Attachment D

CITY OF PALM BAY

SOUTH REGIONAL WATER RECLAMATION FACILITY DESIGN

TECHNICAL SPECIFICATIONS
100% BID SET

The City of Palm Bay Florida
A Perfect Place to Grow

JUNE 2019

WADE TRIM

3790 DIXIE HIGHWAY NE, SUITE D
PALM BAY, FL 32905

CITY OF PALM BAY
SOUTH REGIONAL WATER RECLAMATION FACILITY

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PROFESSIONAL CERTIFICATIONS PAGE

PALM BAY UTILITIES DEPARTMENT
SOUTH REGIONAL WATER RECLAMATION FACILITY DESIGN

This Technical Manual is certified as follows:

Civil / Process Engineer

Divisions 1, 2, 11, 15

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Palm Bay, FL 32905
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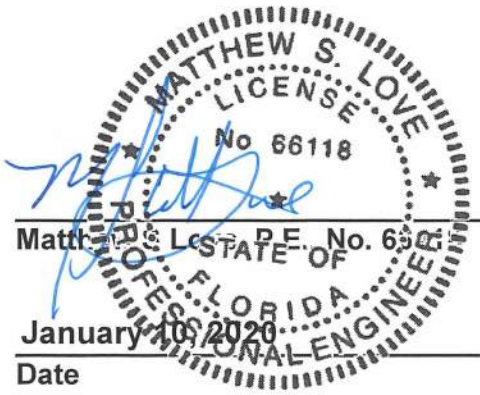
Certificate of Authorization No. 3952



Matthew S. Love, P.E. No. 66118

January 10, 2020
Date

PROFESSIONAL CERTIFICATIONS PAGE

PALM BAY UTILITIES DEPARTMENT
SOUTH REGIONAL WATER RECLAMATION FACILITY DESIGN

Structural Engineer

Divisions 3 - 10

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James K. White, P.E., No. 71068

5-13-2020

Date

PROFESSIONAL CERTIFICATIONS PAGE

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Alan M. Schwab, P.E., No. 61313

1-10-2020
Date

PROFESSIONAL CERTIFICATIONS PAGE

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SOUTH REGIONAL WATER RECLAMATION FACILITY DESIGN

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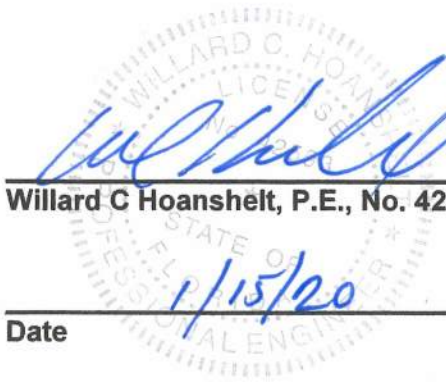

Willard C Hoanshelt, P.E., No. 42593

1/15/20

Date

SECTION 01010
SUMMARY OF WORK

PART I – GENERAL

1.01 REQUIREMENTS INCLUDED

The Work to be performed under this Contract shall consist of furnishing all tools, equipment, materials, supplies, and furnishing all transportation and services, including fuel, power, water, and essential communications, and performance of all labor, work or other operations required for the fulfillment of the Contract in strict accordance with the specifications, schedules, drawings, and other Contract Documents as herein defined, all which are made a part hereof, and including such detail sketches as may be furnished by the ENGINEER from time to time during construction in clarification of said Contract Documents. The Work shall be completed and all work, materials, and services not expressly shown or called for in Contract Documents which may be necessary for the complete and proper construction of the Work in good faith shall be performed, furnished, and installed by the CONTRACTOR as though originally so specified or shown, at no increase in cost to the OWNER.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

The City of Palm Bay Utilities Department has developed their Utilities Administration Building and South Regional Water Treatment Plant (SRWTP) as part of the South Regional Utilities campus on Osmosis Drive in the Bayside Lakes development located in south Palm Bay. This Contract is for the construction of the City of Palm Bay South Regional Water Reclamation Facility on the South Regional Utilities Campus site as shown on the Drawings and specified herein.

The project is being constructed in multiple phases. The initial phases of the project (1A and 1B) will have a total treatment capacity of 2 million gallons per day (MGD) with each phase providing 1 MGD of treatment utilizing the membrane biological reactor (MBR) biological treatment process. Equipment will only be installed in phase 1B for this Work. The effluent will be disposed of via an existing deep injection well and a future public access reuse system.

The work under this contract may include construction of the facilities consisting of, but not limited to, the following:

1. A treatment building consisting of all electrical equipment and motor control center facilities
   including blower rooms, pipe gallery, and housing equipment related to the membrane biological reactor wastewater treatment process, including permeate pumps, waste sludge pumps, clean-in-place system, and related equipment.

2. A headworks/sludge storage structure housing fine screens, grit removal system including grit pumps, isolation gates, telescopic valves, sludge storage coarse bubble diffusers and blowers, and sludge transfer pumps.

3. A biological treatment structure housing equipment related to the membrane biological reactor wastewater treatment process, including anaerobic and anoxic submersible mixers, submersible feed forward pumps/piping, fine bubble aeration diffusers and blowers, isolation gates, telescopic valves, submersible membrane units, and related equipment.

4. An odor control system and associated equipment.

5. A chlorine contact tank with sodium hypochlorite bulk storage and feed system.

6. An effluent pumping system for both deep well injection and ground reclaim water storage.

7. An on-site lift station.

8. Instrumentation and controls for process control and monitoring utilizing a SCADA system.

9. A 3 MG ground storage tank

10. A standby diesel power generator set, fuel storage tank, and fuel system.

11. All associated on-site yard piping and below grade utilities.

12. All associated site work, paving, drainage, and grading.

13. Any necessary dewatering or associated construction requirements.

14. Survey of all underground piping related to this project and AutoCad record drawing preparation.

1.03 CONTRACT METHOD

The Work hereunder will be constructed under a LUMP SUM contract, itemized as set forth in the Bid Schedule and defined in Section 01025 - Measurement and Payment.

The CONTRACTOR shall include the General Conditions and Supplemental Conditions of the Contract as part of all Subcontract Agreements.

1.04 JURISDICTION

Agencies having jurisdiction over construction of this project include but are not limited to:

- Florida Department of Environmental Protection
- St. John's River Water Management District
- Melbourne-Tillman Water Control District
- City of Palm Bay
- Army Corps of Engineers

The CONTRACTOR shall secure any permits associated with construction as required by the agency(s) having jurisdiction, shall abide by all rules and regulations of each and shall pay all costs in connection with the permits. The CONTRACTOR shall pay for such permits and inspection fees to ensure compliance with their requirements.

1.05 NOTICES TO OWNERS, AUTHORITIES, AND ENGINEER

A. The CONTRACTOR shall, as provided in General Conditions, notify OWNERS of adjacent property and utilities when performance of the Work may affect them.

B. The CONTRACTOR shall contact the OWNER, Fire Department, Police Department, Emergency Medical Services, U.S. Postal Department, and ENGINEER, at least 48 hours prior to closing any street.

C. Utilities and other concerned agencies shall be contacted at least 48 hours prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.

D. The CONTRACTOR shall review with the various utility companies the construction methods and Work to be done in the vicinity of utilities. When temporary relocation is necessary sufficient advance notice shall be given by the CONTRACTOR to the utility involved.

1.06 COORDINATION

It shall be responsibility of the CONTRACTOR to coordinate his operations and those of his subcontractors in such a manner so as to avoid interference or delays and ensure the orderly progress of Work in the areas of common or interdependent construction activities. The limits of the Contract are indicated on the Plans and specified herein. However, these limits may be altered by mutual agreement of the CONTRACTOR with the OWNER, with the written Agreement of the ENGINEER, in order to facilitate the work operations.

The Work of this Contract may involve coordination with other utility companies or agencies, either performing connection repair or maintenance service on their own facilities. The CONTRACTOR shall coordinate and cooperate with all utility companies and other contractors working in the same area that this Contract entails. This shall include, but not be limited to, the telephone company; the electric power company; the cable television company; the gas company; all subcontractors; and any other contractors who are performing Work within the area of this Contract.

This effort to coordinate and cooperate with all utility companies and other CONTRACTORS shall be toward, but not be limited to, maintaining public access to the various cross streets, residences, commercial establishments, and other institutions within the limits of construction and adjoining streets, and maintaining the area's electric, telephone, cable television, gas, water, and sewer services.

1.07 REFERENCE STANDARDS

Reference to the standards of any technical society, organization, or association or to codes of local or state authorities shall mean the latest effective standard, code, specification, or standard adopted and published at the date of receipt of bids, unless specifically stated otherwise.

In addition to these technical standards, the CONTRACTOR shall abide by the City of Palm Bay Utilities Department standards set out in the *Policies, Procedures and Standards Handbook*. Work performed by the CONTRACTOR shall conform to the most stringent specifications.

1.08 AVAILABILITY OF LAND

Work is located within the property lines of the OWNER at the existing plant site. In areas where work will extend beyond right-of-ways or the property lines, the OWNER will secure a construction easement to facilitate the Work.

Nothing in this Contract shall imply that the CONTRACTOR has exclusive use of roadways or public and/or private land employed to perform the Work.

1.09 CONTRACTOR'S USE OF PREMISES

The CONTRACTOR shall maintain his construction operations within the property limits and areas designated by the OWNER. In the event that the CONTRACTOR deems it necessary or advisable to operate beyond the limits as provided by the OWNER, he shall be responsible for coordinating such efforts with the OWNER.

The project site is adjacent to homeowners to the north and west. The CONTRACTOR shall maintain adequate dust control measures during the project to mitigate impact to the neighboring community.

1.10 SALVAGE OF MATERIAL AND EQUIPMENT

No items shall be salvaged and reused without permission from the OWNER or the ENGINEER unless specifically stated otherwise in the bid form.

The OWNER reserves the right of first refusal to salvage any item from the project site. If so directed by the ENGINEER, the CONTRACTOR shall deliver to a location any items to be salvaged by the OWNER.

1.11 STORAGE OF MATERIALS

Storage conditions shall be acceptable to the OWNER for all materials and equipment not incorporated into the Work but included in applications for payment. Such storage arrangements and conditions shall be presented in writing and shall afford adequate and satisfactory security and protection. Off-site storage facilities shall be accessible to the ENGINEER. The stored materials shall be insured for full value. Certificates of Insurance coverage must be submitted to the OWNER or ENGINEER with the request for payment by the CONTRACTOR. All arrangements and costs for storage facilities shall be paid by the CONTRACTOR, unless specifically designated in the Contract Documents to be furnished by the OWNER.

1.12 OWNER DIRECT PURCHASED ITEMS

The OWNER reserves the right to directly purchase materials for the project. Should the OWNER exercise this right, the CONTRACTOR shall follow the requirements detailed in Section 01625.

1.13 FIELD OFFICE

The CONTRACTOR shall provide two on-site field office trailers located within the limits of the project and are to be installed upon the CONTRACTOR's mobilization. One trailer will be for use by the CONTRACTOR during the Work and one trailer shall be for the ENGINEER. Both trailers are to be removed upon conclusion of the WORK. The Contractor's field office trailer shall house the working as-built drawings and will be made available for the ENGINEER's and OWNER's review as requested. The Contractor's on-site field office shall contain a conference room complete with table and chairs to accommodate at least 10 meeting attendees. All project meetings shall be held in the Contractor's field office unless noted otherwise.

The ENGINEER's field office trailer shall be as described in SECTION 01500, paragraph 1.04.

1.14 RECORD OF UNDERGROUND PIPING

As part of the documentation of record drawings, the CONTRACTOR shall provide the ENGINEER with surveyed horizontal and vertical data of all underground piping (process, stormwater, utility, and electrical conduits), underground valves, and underground fittings. Surveyed coordinates are required at changes in direction of all underground piping and major underground piping components. The AutoCAD file will clearly identify the name, diameter, and material of construction of all piping and correctly locate all underground piping based on

surveyed coordinates. Vertical data shall consist of top of pipe elevation. Record drawing updates will be required with each payment application during the course of field construction.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01025
MEASUREMENT AND PAYMENT

PART I – GENERAL

1.01 SCOPE OF PAYMENT

Payment to the CONTRACTOR will be made for actual quantities and work completed and accepted in accordance with the Contract.

The CONTRACTOR shall accept in compensation provided herein full payment for furnishing all materials, labor, tools, equipment, and incidentals necessary to complete all work included in the Contract; also for all loss or damage arising from the nature of the work or from action of the elements or from any unforeseen difficulties which may be encountered during the execution of the work except as provided herein. The OWNER will make no allowances for Items not included in the proposal.

The payment of any progress payment shall not relieve the CONTRACTOR of his obligation to repair any defective work or of his responsibility for all damage due to such defects.

1.02 PROCEDURE FOR MEASUREMENT

A. For lump sum items, payment shall be based on the lump sum prices set forth in the Bid Proposal and based on the amount of completed work as determined by the accepted Schedule of Values.

B. For field measured unit-price items; payment shall be based on the actual amount of work accepted and the actual amount of materials in place, as will be determined by the final measurements.

1. All units of measurement shall be standard United States convention as it applies to the specific items of work by tradition and as interpreted by the ENGINEER.

2. Once each month the ENGINEER will prepare two "Monthly Progress Summation" forms from the month's accumulation of "Daily Progress Reports".

3. The completed forms will provide the basis of the ENGINEER'S monthly quantity estimate upon which payment will be made. Items not appearing on both the Daily Progress Reports and the Monthly Progress Summations will not be included for payment. Items appearing on forms not properly signed by the CONTRACTOR will not be included for payment.

4. After the work is completed and before final payment is made, the OWNER will make final field measurements to determine the quantities of various items of work accepted as the basis for final settlement.

1.03 PROGRESS PAYMENT

Progress payments shall be made monthly as work progresses in accordance with the provisions of the General Conditions based on an accepted Progress Schedule; Schedule of Values and field measured unit quantities.

1.04 ESTIMATED QUANTITIES

All estimated field measured quantities stipulated in the Bid Form or other Contract Documents are approximate and are to be used only (a) as a basis for estimating the probable cost of the WORK and (b) for purpose of comparing the bids submitted for the WORK. The actual amounts of WORK done under field measured unit price items may differ from the estimated quantities. The basis of payment for WORK will be the actual amount of WORK done and field measured unless it exceeds the estimated quantities in which case a change order must be approved prior to payment for quantities exceeding the estimated quantity.

PAYMENT FOR INCREASED OR DECREASED QUANTITIES

A. When alterations in the quantities of work not requiring supplemental agreements, as herein provided for, are ordered and performed and alteration does not exceed 15% of the quantity stated in the Bid Schedule, the Contractor shall accept payment in full at the Contract price for the actual quantities of work done. No allowance will be made for anticipated profits.

B. When alterations in quantities exceed 25% of the quantities stated in the bid schedule, unit prices may be renegotiated if changes are warranted and justified. Increased or decreased work involving supplemental agreements will be paid for as stipulated in such agreements.

1.05 INCIDENTAL WORK

All work shown on the plans and referenced in the specifications as being part of the contract for which no separate pay item is provided is considered incidental to the contract. Incidental items are to be incorporated into the pay items provided. Claims for separate payment of incidental items will not be considered. Incidental items include:

A. Clearing and grubbing.
B. Trench excavation, including necessary pavement and rock removal, except as otherwise specified.
C. Dewatering and disposal of surplus water.
D. Structural fill, backfill, grading, and related transport costs.
E. Replacement of unpaved roadways, grass (sod) and shrubbery plots.
F. Cleanup.
G. Foundation and borrow materials, except as hereinafter specified.
H. Testing and placing system in operation.
I. Any material and equipment required to be installed and utilized for tests.
J. Pipe, structures, pavement replacement, restoration and/or appurtenances included within the limits of lump sum work, unless otherwise shown.
K. Maintaining the existing quality of service during construction, including any required bypass pumping.
L. Appurtenant work as required for a complete and operable system.
M. Repair of damaged irrigation piping and sprinkler heads.
N. Maintaining access to treatment plant structures with barriers, lights, signage etc.

1.06 FINAL PAYMENT

The OWNER shall make final payment upon final acceptance of the work as set forth in the General Conditions.

1.07 BID ITEMS

Bid Item No. 1 - Mobilization/Demobilization

A. Mobilization shall be 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 temporary Contractor's field trailer, temporary Resident Engineer's field trailer, site cleaning, storage buildings, safety equipment and first aid supplies, sanitary and other facilities, as required by the Contract Documents and applicable laws and regulations. The costs of bonds, required insurance, permits and any other preconstruction expense necessary for the start of the work, excluding the cost of construction materials, shall also be included in this item. Demobilization shall be the work of removing temporary facilities from the site.

B. Payment for mobilization/demobilization shall not exceed 5 percent (5%) of the Bid Price. Partial payments for this item will be made in accordance with the following schedule:

Percent of Original Contract Amount Earned	Allowable Percent of the Lump Sum Price for the Item
After Contract Execution	25
10	35
20	45
30	55
40	65
50	70
60	75
70	80
80	85
90	90
Substantial Completion	95
Final Payment	100

C. These payments will be subject to the standard retainage provided in the agreement. Payment of the retainage will be made after completion of the work and demobilization.

Bid Item No. 2 - Demolition

A. Payment of the applicable lump sum price shall be full compensation for furnishing, but is not limited to, all labor, materials and equipment necessary for the removal, demolition and disposal of structures, equipment, piping, valves, vegetation and soil materials for installation of new facilities. Demolition shall include clearing and grubbing; tree removal; miscellaneous pipe and utility removal; and all other appurtenant work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 3 – Sitework

A. Payment of the applicable lump sum price shall be full compensation for furnishing and installing, but is not limited to, all labor, materials and equipment necessary to provide excavation; grading; sodding; asphalt paving; signage; borrow; fencing; yard piping;

permanent modular operations trailer; curbing; and all other appurtenant work related to this lump sum pay item as presented in the Contract Documents. This bid item includes the survey by the CONTRACTOR of ALL new underground piping, valving, and fittings as described in the Summary of Work.

Bid Item No. 4 – Chlorine Contact Tank

A. Payment of the applicable lump sum price shall be full compensation for furnishing and installing, but is not limited to, all labor, materials and equipment necessary to construct the effluent transfer pump station; install vertical turbine pumps; plant water pumps; tanks; dewatering; concrete structure; steel structure; chemical pumps and appurtenances, valves, hatches; piping; air release valve; flow meters; pressure gages; concrete structure; including all site preparation, clearing, grading, drainage, paving, grassing; borrow; demolition; excavation; signage and all other appurtenant work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 5 – Chlorine Feed System

A. Payment for the Chemical Feed System will be made at the lump sum price and shall constitute full compensation for furnishing and installing, but is not limited to, all labor, materials and equipment necessary to construct building, concrete, meters, chlorine analyzer, pumps, piping, equipment, fittings, valves, and all other appurtenant work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 6 – High Service Pump Station

A. Payment of the applicable lump sum price shall be full compensation for furnishing, but is not limited to, all plant, labor, materials and equipment necessary to provide and install a High Service Pump Station, including dewatering; excavation; grading; crushed stone base; backfill; sod; precast items; concrete encasement; concrete pad; vertical turbine pumps; piping; valves; air release valves; flowmeter; pipe supports; pressure gauges; control panel; variable frequency drives; electrical work; instrumentation and SCADA; and all other appurtenant work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 7 – Ground Storage Tank

A. Payment of the applicable lump sum price shall be full compensation for furnishing, but is not limited to, all plant, labor, materials and equipment necessary to provide and install a 3 MG Ground Storage Tank, including dewatering; excavation grading; crushed stone base; backfill; asphalt paving; sod; concrete pad; 1 ground storage tank; aluminum walkway, stairs and railings; piping; valves; pipe supports; control panels; electrical work; instrumentation and SCADA; and all other appurtenant work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 8 – Electrical Work and Instrumentation

A. Payment of the applicable lump sum price shall be full compensation for furnishing, but is not limited to, all plant, labor, materials and equipment necessary to construct a complete power and control system including switches, panels, switchgear, VFDs, MCC, control panels, duct banks, lighting, power circuitry; and install, set-up, calibrate, program, integrate, and coordinate a complete instrumentation package as specified including all

instruments, PLC's, software and programming, fiber optic cable, transmitters, interface panels, programming terminal, and all appurtenances as shown on the plans and specifications.

Bid Item No. 9 – MBR Treatment Facility

A. Payment of the applicable lump sum price shall be full compensation for furnishing and installing, but is not limited to, all labor, materials and equipment necessary to construct the MBR treatment facility, including: pumps; blowers; tanks; dewatering; concrete structures; steel structures; membranes; valves, hatches; piping; air release valves; flow meters; pressure gauges including all site preparation, clearing, grading, drainage, paving, grassing; borrow; demolition; excavation; signage and all other appurtenant work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 10 – Discretionary Work

A. This payment item is for the OWNER's requested changes in the work pertaining to the South Regional Water Reclamation Facility that requires authorization of the OWNER prior to the work being performed. This item is not to cover WORK outlined in the plans and/or specifications or for work incidental to the completion of the project as outlined herein, and shall only be used when directed by the OWNER.

B. Payment shall be made based on written authorization of the additional work. The authorization shall reflect the actual amounts agreed to by the CONTRACTOR and the OWNER.

C. Payment of the applicable lump sum price shall be full compensation for furnishing, but is not limited to, all labor; materials and equipment necessary to perform work not covered under previous Bid Items and is considered outside of the original scope of WORK.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

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END OF SECTION

SECTION 01041
PROJECT COORDINATION

PART I – GENERAL

1.01 WORK INCLUDED

The CONTRACTOR shall furnish personnel and equipment that will be efficient, appropriate and large enough to secure a satisfactory quality of work and a rate of progress that will ensure the completion of the work within the Contract time. If at any time, such personnel appears to the ENGINEER to be inefficient, inappropriate or insufficient for securing the quality of work aforementioned, he may order the CONTRACTOR to increase the efficiency, change the character or increase the personnel and equipment, and the Contractor shall conform to such order. Failure of the ENGINEER to give such order shall in no way relieve the CONTRACTOR or his obligations to secure the quality of the work and rate of progress.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 PIPE LOCATIONS

All pipes shall be located substantially as indicated on the Drawings, but the OWNER and ENGINEER reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings are noted on the Drawings, such notation is for the CONTRACTOR'S convenience and does not relieve him from laying and jointing different or additional items where required.

3.02 OPEN EXCAVATIONS

The CONTRACTOR shall adequately safeguard all open excavations by providing temporary barricades, caution signs, lights, and other means to prevent accidents to persons, and damage to property. The CONTRACTOR shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by workmen. All open excavations shall comply with applicable OSHA Standards.

3.03 TEST PITS

Test pits for the purpose of locating underground pipelines or structures in advance of the construction shall be excavated and backfilled by the CONTRACTOR. Test pits shall be backfilled immediately after their purpose has been satisfied and maintained in a manner satisfactory to the ENGINEER. The costs for such test pits shall be borne by the CONTRACTOR.

3.04 CARE AND PROTECTION OF PROPERTY

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

3.05 PROTECTION OF CONSTRUCTION AND EQUIPMENT

A. All newly constructed work shall be carefully protected from damage in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions damaged shall be reconstructed by the CONTRACTOR at no additional expense to the OWNER.

B. All structures shall be protected in a suitable manner to prevent damage. Should any part of a structure become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the CONTRACTOR at his own expense and to the satisfaction of the ENGINEER. If, in the final inspection of the work, any defects, faults or omissions are found, the CONTRACTOR shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the CONTRACTOR shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the warranty period described in the Contract.

C. Further, the CONTRACTOR shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the OWNER.

3.06 MAINTENANCE OF TRAFFIC

A. If the CONTRACTOR'S operations cause traffic hazards, he shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the ENGINEER.

B. Detours around construction will be subject to the approval of the OWNER and the ENGINEER. Where detours are permitted, the CONTRACTOR shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured, the CONTRACTOR shall expedite construction operations and periods when traffic is being detoured will be strictly controlled by the OWNER.

C. The CONTRACTOR shall take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist. The CONTRACTOR shall be fully responsible for damage or injuries whether or not night watchman has been provided.

3.07 PRIVATE LAND

The CONTRACTOR shall not enter or occupy private land outside the site, except by written permission of the appropriate Owners. CONTRACTOR shall provide OWNER a copy of such written permission prior to entering private land.

3.08 COOPERATION WITHIN THIS CONTRACT

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

B. Operation of the existing water and wastewater facilities to be tied into as required for the

performance of this Contract shall be maintained as operational during construction.

END OF SECTION

SECTION 01045
CUTTING AND PATCHING

PART I – GENERAL

1.01 DEFINITION

"Cutting and Patching" is defined to include the cutting and patching of nominally completed and previously existing concrete, steel, wood, miscellaneous metal structures, piping and pavement, in order to accommodate the coordination of Work, or the installation of other facilities or structures or to uncover other facilities and structures for access or inspection, or to obtain samples for testing, or for similar purposes.

1.02 REQUIREMENTS OF STRUCTURAL WORK

A. Structural Work shall not be cut and patched in a manner that results in a reduction of load-carrying capacity or load/defection ratio.

B. Prior to cutting and patching the following categories of Work, the CONTRACTOR shall obtain the ENGINEER'S approval to proceed.

1. Structural steel
2. Miscellaneous structural metals, including equipment supports, stair systems, tank cover systems and similar categories of Work
3. Structural concrete
4. Foundation construction
5. Timber and primary wood framing
6. Bearing and retaining walls
7. Structural decking
8. Exterior curtain wall construction
9. Pressurized piping, vessels and equipment
10. Asphalt pavement, concrete or asphalt curb/gutter, and concrete sidewalk.

1.03 OPERATIONAL AND SAFETY LIMITATIONS

A. The CONTRACTOR shall not cut and patch operational elements and safety-related components in a manner resulting in a reduction of capacities to perform in the manner intended or resulting in decreased operational life, increased maintenance or decreased safety.

B. Before cutting and patching the following categories of Work, the CONTRACTOR shall obtain the ENGINEER'S approval to proceed.

1. Sheeting, shoring and cross bracing
2. Operating systems and equipment
3. Water, moisture, vapor, air, smoke barriers, membranes and flashing
4. Noise and vibration control elements and systems
5. Control, communication, conveying and electrical wiring systems.

1.04 VISUAL REQUIREMENTS

The CONTRACTOR shall not cut and patch Work which is exposed on the exterior or exposed in occupied spaces, in a manner resulting in a reduction of visual qualities or resulting in substantial evidence of the cut and patch Work, both as judged solely by the ENGINEER. The CONTRACTOR shall remove and replace Work judged by the ENGINEER to have been cut and patched in a visually unsatisfactory manner.

1.05 APPROVALS

When prior approval for cutting and patching is required, the CONTRACTOR shall submit the request and obtain approval of the ENGINEER prior to performing the Work. The request should include a description of why cutting and patching cannot reasonably be avoided; how it will be performed; how structural elements (if any) will be reinforced; products to be used; firms and tradespeople who will perform the Work; approximate dates of the Work; and anticipated results in terms of structural, operational, and visual variations from the original Work.

PART 2 – PRODUCTS

2.01 MATERIALS USED IN CUTTING AND PATCHING

A. Unless otherwise indicated, the CONTRACTOR shall provide materials for cutting and patching which will result in an equal-or-better product than the material being cut and patched, in terms of performance characteristics and including visual effects where applicable. The CONTRACTOR shall use material identical with the original materials where feasible.

B. Materials shall comply with the requirements of the Technical Specifications wherever applicable.

PART 3 – EXECUTION

3.01 PREPARATION

A. The CONTRACTOR shall provide adequate temporary support for Work to be cut to prevent failure.

B. The CONTRACTOR shall provide adequate protection of other Work during cutting and patching.

3.02 INSTALLATION

A. The CONTRACTOR shall employ skilled tradespeople to perform cutting and patching. Except as otherwise indicated, the CONTRACTOR shall proceed with cutting and patching at the earliest feasible time and perform the Work promptly.

B. The CONTRACTOR shall use methods least likely to damage Work to be retained and Work adjoining.

1. In general, where physical cutting action is required, the CONTRACTOR shall cut Work with sawing and grinding tools, not with hammering and chopping tools. Openings through concrete Work shall be core-drilled.

2. Comply with the requirements of Technical Specifications wherever applicable.

3. Comply with the requirements of applicable sections of Division 2 where cutting and patching requires excavation and backfill.

C. The CONTRACTOR shall patch with seams which are as invisible as possible and comply with specified tolerance for the Work.

D. The CONTRACTOR shall restore exposed seams of patched area and, where necessary, extend finish restoration onto retained Work adjoining, in a manner, which will eliminate evidence of patching.

END OF SECTION

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SECTION 01060
REGULATORY REQUIREMENTS & PERMITS

PART I – GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall comply with the most stringent of all Federal, State, and local (Palm Bay) building codes, laws and/or ordinances appropriate to the project, including those of the:

1. National Electric Code
2. Florida Building Code
3. Chapter 556, Florida Statutes, Underground Facility Damage Prevention and Safety Act
4. Americans with Disabilities Act (ADA)
5. Others as noted in the Section 01010: Summary of Work

B. The CONTRACTOR shall comply with these codes, laws, regulations, rules, directives of all agencies, boards, districts, and governmental bodies having jurisdiction.

C. The CONTRACTOR shall obtain and pay the cost of all permits, fees, tie-in or connection charges associated with the project.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. All applicable sections of the Specifications

B. General Conditions

1.03 PERMITS BY OWNER

A. The OWNER prior to the advertisement of the project has applied for or has obtained permits from the following agencies:

1. Florida Department of Environmental Protection: Wastewater Treatment Facility Operating Permit Renewal.
2. St. Johns River Water Management District: Environmental Resources Permit.
3. City of Palm Bay: Site Plan Permit.
4. Melbourne-Tillman Water Control District

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 MEASUREMENT AND PAYMENT

A. The CONTRACTOR shall be reimbursed for permit fees as described in the Section entitled “Measurement and Payment”.

B. There shall be no special measurement or payment for work in this section, it shall be included in the lump sum price bid item 1 – mobilization, except as noted in Article 3.01 A above.

END OF SECTION

SECTION 01061
STORMWATER POLLUTION PREVENTION / NPDES REQUIREMENTS

PART I – GENERAL

1.01 SECTION INCLUDES

Stormwater Pollution Prevention Plan requirements and recommendations under the NPDES program

1.02 PURPOSE

The purpose of this section is to outline minimum requirements for stormwater pollution prevention as required under the NPDES program. There may be more stringent local government or OWNER requirements for Erosion and Sediment Control, which would be located in the Specifications or on the Drawings. The more stringent requirement governs.

1.03 RELATED SECTIONS

A. Section 01060: Regulatory Requirements and Permits
B. Section 02370: Erosion and Sedimentation Control

1.04 ABBREVIATIONS

- NPDES - National Pollution Discharge Elimination System
- SWPPP - Stormwater Pollution Prevention Plan
- NOI - Notice of Intent
- NOT - Notice of Termination

1.05 CONSTRUCTION PROJECTS REQUIRING COMPLIANCE WITH NPDES GENERAL PERMIT

All projects 1 or more acres in size that discharge to offsite areas.

1.06 GENERAL REQUIREMENTS

A. The CONTRACTOR and all subcontractors involved with a construction activity that disturbs site soil or who implement a pollutant control measure identified herein must comply with the following requirements of the NPDES General Permit and any local governing agency having jurisdiction concerning erosion and sedimentation control.

B. The Contractor is responsible for preparing a SWPPP and for completing and submitting the required NOI and NOT forms, and paying all associated fees. NOI and NOT forms, and permit application fee information are available for download at:

1. Projects located in Florida: www.dep.state.fl.us/water/stormwater/npdes/

C. The SWPPP shall include the elements necessary to comply with the national baseline general permit for construction activities administered by the U.S. Environmental Protection Agency (EPA) or states designated to administer the EPA NPDES program, and shall also include all local governing agency and OWNER requirements. There may be more stringent local government or OWNER requirements for Erosion and Sediment Control, which would be located in the Specifications or on the Drawings.

D. A copy of the NOI and a description of the project must be posted in a prominent place for public viewing at the construction site.

E. The SWPPP must be implemented at the start of construction. A complete copy of the SWPPP, including copies of all inspection reports, plan revisions, etc., must be retained at the project site at all times during working hours and kept in the permanent project records for at least three years following submission of the NOT.

F. The CONTRACTOR must provide names and addresses of all subcontractors working on this project who will be involved with the major construction activities that disturb site soil. That information must be part of the SWPPP.

G. The CONTRACTOR and all subcontractors involved with the major construction activities that disturb site soil must sign a copy of the appropriate certification statement included herein.

H. Regular inspections by the CONTRACTOR must be made to determine effectiveness of the SWPPP. The inspector must be a person familiar with the site, the nature of the major construction activities, and qualified to evaluate both overall system performance and individual component performance.

I. The SWPPP must be updated each time there are significant modifications to the pollutant prevention system or a change of contractors working on the project who disturb site soil. The CONTRACTOR must notify EPA or the local state agency administering the NPDES program as soon as these modifications are implemented.

J. Discharge of oil or other hazardous substances into the storm water is subject to reporting and cleanup requirements. Refer to Part III.B of the NPDES General Permit for additional information. Copies of the NPDES General Permit are available for download at the sites listed in item B.

K. Once the site reaches final stabilization, the general contractor must complete and submit the NOT to the required NPDES agency and the OWNER.

L. The SWPPP must be amended as necessary during the course of construction in order to keep it current with the pollutant control measures utilized at the site.

M. A record of the dates when major grading activities occur, when construction activities temporarily or permanently cease on a portion of the site, and when stabilization measures are initiated must be maintained until the NOT is filed. Provide copies of these records to the OWNER.

N. The SWPPP must be implemented before construction begins on the site. The primary purpose of the SWPPP is to address the impact of storm rainfall and runoff on areas of the ground surface disturbed during the construction process. In addition, it shall include recommendations for controlling other sources of pollution that could accompany the major construction activities. The SWPPP will terminate when disturbed areas are stabilized, construction activities are completed, and the NOT has been filed.

1.07 ALLOWABLE NON STORMWATER DISCHARGES DURING CONSTRUCTION

A. The national baseline General Permit for Storm Water Discharges from Construction Activities prohibits most non-storm water discharges during the construction phase. Allowable non-storm water discharges that could occur during construction on this project, which would therefore be covered by the General Permit, include:

1. Discharges from fire fighting activities

2. Fire hydrant flushing

3. Water used to wash vehicles or control dust

4. Water flowing from potable sources and water line flushing

5. Irrigation drainage

6. Runoff from pavement wash down where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents have not been used

7. Springs and uncontaminated groundwater

1.08 MINIMUM SWPPP CONSTRUCTION GUIDELINES

A. Construct rock pads for construction entrance/exit.

B. Install sediment barriers down slope from construction activities that disturb site soil.

C. Construct rock surface for temporary parking.

D. Install sediment barriers on the down slope prior to clearing and grubbing.

E. Install sediment barriers on the down slope side of utility construction and soil stockpiles.

F. Install sediment barriers on the down slope from disturbed soil during grading activities.

1.09 SWPPP SITE DATA

Site Location (General Description and Longitude and Latitude): The project is located in Section 30, Township 29S, Range 37E in Brevard County Florida. More specifically, it is located on Osmosis Drive between Cogan Drive and Melbourne Tillman Water Control District Canal No. 37 (27°56’ 02.5”, -80°40’12.7”).

A. Site Topography: The topography varies from approximately Elevation 14.2 to Elevation 23.9 NGVD 29.

B. Rainfall Information: Mean Annual Precipitation is 65.2 inches per year.

C. Site Soils: Information is contained in the geotechnical report as Appendix A.

D. Total Area: 24.78 Acres

E. Receiving Surface Waters: Melbourne-Tillman Water Control District Canal No. 37.

1.10 MINIMUM EROSION AND SEDIMENT CONTROL

A. The primary technique to be used at this project for stabilizing site soil will be to provide a protective cover of turf grass or pavement.

B. Within 14 days after construction activity ceases on any particular area, all disturbed ground where there will not be construction for longer than 21 days must be seeded with fast-germinating temporary seed and protected with mulch.

C. All areas at final grade must be sodded or permanently seeded and mulched (as required by the Drawings) within 14 days after completion of the major construction activity. Final site stabilization is achieved when turf grass cover provides permanent stabilization for at least 70 percent of the disturbed soil surface, exclusive of areas that have been paved.

D. Construction traffic must enter and exit the site at the stabilized construction entrance. The purpose is to trap dust and mud that would otherwise be carried off-site by construction traffic.

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

F. No solid materials, including building materials, are allowed to be discharged from the site with storm water. All solid waste, including disposable materials incidental to the major construction activities, must be collected and placed in containers. The containers shall be emptied periodically by a contract trash disposal service and hauled away from the site.

G. Substances that have the potential for polluting surface and/or groundwater must be controlled by whatever means necessary in order to ensure that they do not discharge from the site. As an example, special care must be exercised during equipment fueling and servicing operations. If a spill occurs, it must be contained and disposed so that it will not flow from the site or enter groundwater, even if this requires removal, treatment, and disposal of soil. In this regard, potentially polluting substances should be handled in a manner consistent with the impact they represent.

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

I. Non-storm water components of site discharge must be clean water. Water used for construction, which discharges from the site, must originate from a public water supply or private well approved by the State Health Department. Water used for construction that does not originate from an approved public supply must not discharge from the site.

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

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

L. Sediment barriers must be inspected and, if necessary, they must be enlarged or cleaned in order to provide additional capacity. All material excavated from behind sediment barriers shall be stockpiled on the up slope side. Additional sediment barriers shall be constructed as needed.

M. All discharge points must be inspected to determine whether erosion control measures are effective in preventing significant impacts to receiving waters.

N. Based on inspection results, any modification necessary to increase effectiveness of this SWPPP to an acceptable level must be made within seven calendar days of the inspection. The inspection reports must be completed entirely and additional remarks should be included if needed to fully describe a situation. An important aspect of the inspection report is the description of additional measures that need to be taken to enhance plan effectiveness. The inspection report must identify whether the site was in compliance with the SWPPP at the time of inspection and specifically identify all incidents of non-compliance.

O. Inspection reports must be kept on file by the CONTRACTOR as an integral part of this SWPPP for at least three years from the date of completion of the project.

P. It is the responsibility of the CONTRACTOR to assure the adequacy of site pollutant discharge controls.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

3.01 MEASUREMENT AND PAYMENT

A. The CONTRACTOR shall not be reimbursed for permit fees as described in the Section entitled “Measurement and Payment”.

B. There shall be no special measurement or payment for the work under this section, it shall be included in the lump sum price bid for item 1 – mobilization, except as noted in Article 3.01 A above.

END OF SECTION

CONTRACTOR
CERTIFICATION

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

Contractor implementing the SWPPP:

_____

Business Name

_____

Business Address

_____

_____

_____

Business Telephone Number

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

> ***"I certify under penalty of law that I understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification."***

_____

Signature Date

_____

Printed Name

SECTION 01070
ABBREVIATIONS

PART I – GENERAL

1.01 SUMMARY

Wherever in these Specifications references are made to the standards, specifications, or other published data of the various international, national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of these Specifications, the following acronyms or abbreviations which may appear in these Specifications shall have the meanings indicated herein.

1.02 ABBREVIATIONS

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturer's Association
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
ACOE	Army Corps of Engineers
AFBMA	Anti-Friction Bearing Manufacturer's Association, Inc.
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHAM	Association of Home Appliance Manufacturers
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANS	American Nuclear Society
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association

API	American Petroleum Institute
APWA	American Public Works Association
ASA	American Standards Association
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASLE	American Society of Lubricating Engineers
ASME	American Society of Mechanical Engineers
ASQC	American Society for Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators International
BHMA	Builders Hardware Manufacturer's Association
CBM	Certified Ballast Manufacturers
CEMA	Conveyors Equipment Manufacturer's Association
CGA	Compressed Gas Association
CLFMI	Chain Link Fence Manufacturer's Institute
CMA	Concrete Masonry Association
CRSI	Concrete Reinforcing Steel Institute
DIPRA	Ductile Iron Pipe Research Association
DOH	Department of Health
EIA	Electronic Industries Association
ETL	Electrical Test Laboratories
EPA	Environmental Protection Agency

FBC	Florida Building Code
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FM	Factory Mutual System
FS	Federal Specifications
HI	Hydronics Institute
HRS	Department of Health and Rehabilitative Services
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IME	Institute of Makers of Explosives
IP	Institute of Petroleum (London)
IPC	Institute of Printed Circuits
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
MBMA	Metal Building Manufacturer's Association
MPTA	Mechanical Power Transmission Association
MSS	Manufacturers Standardization Society
MTI	Marine Testing Institute
MTWCD	Melbourne-Tillman Water Control District
NAAMM	National Association of Architectural Metal Manufacturer's
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NCCLS	National Committee for Clinical Laboratory Standards
NEC	National Electrical Code

NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NLGI	National Lubricating Grease Institute
NMA	National Microfilm Association
NRWRF	Palm Bay North Regional Water Reclamation Facility
NRWWTP	Palm Bay North Regional Wastewater Treatment Plant
NSF	National Sanitation Foundation
NWMA	National Woodwork Manufacturers Association
OSHA	Occupational Safety and Health Administration
PBUD	Palm Bay Utilities Department
PCA	Portland Cement Association
PPI	Plastics Pipe Institute
RCRA	Resource Conservation and Recovery Act
RIS	Redwood Inspection Service
RVIA	Recreational Vehicle Industry Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SAMA	Scientific Apparatus Makers Association
SJRWMD	St. Johns River Water Management District
SMA	Screen Manufacturers Association
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
SPI	Society of the Plastics Industry, Inc.
SPIB	Southern Pine Inspection Bureau
SPR	Simplified Practice Recommendation
SRWRF	South Regional Water Reclamation Facility
SRWTP	South Regional Water Treatment Plant
SSA	Swedish Standards Association

SSPC	Society of Protective Coatings
SSPWC	Standard Specifications for Public Works Construction
SWPPP	Storm Water Pollution Prevention Plan
TAPPI	Technical Association of the Pulp and Paper Industry
TFI	The Fertilizer Institute
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau
WCRSI	Western Concrete Reinforcing Steel Institute
WEF	Water Environment Federation
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

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SECTION 01090
REFERENCE STANDARDS

PART I – GENERAL

1.01 REQUIREMENTS

A. Titles of Sections and Paragraphs: Captions accompanying specification sections and paragraphs are for convenience of reference only, and do not form a part of the Specifications.

B. 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 which 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.

C. Specialists, Assignments: In certain instances, specification text requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that 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 codes and similar regulations governing the work; also 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 applicable codes and the applicable requirements of the following documents.

B. References herein to "Building Code" shall mean "Florida Building Code". Reference to "Uniform Building Code" shall mean Uniform Building Code of the International Conference of Building Officials (ICBO). Similarly, references to "Mechanical Code" or "Uniform Mechanical Code," "Plumbing Code" or "Uniform Plumbing Code," "Fire Code" or "Uniform Fire Code," shall mean Uniform Mechanical Code, Uniform Plumbing Code and Uniform Fire Code of the International Conference of the Building Officials (ICBO). "Electric Code" or "National Electric Code (NEC)" shall mean the National Electric Code of the National Fire Protection Association (NFPA). The latest edition of the codes as approved by the Municipal Code and used by the local agency as of the date that the WORK is advertised for bids, as adopted by the agency having jurisdiction, 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 furnishing labor. The CONTRACTOR shall bid to the most stringent requirements.

D. 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 herein.

E. Applicable Standard Specifications: References in the Contract Documents to "Standard Specifications" or SSPWC shall mean the Standard Specifications for Public Works Construction, latest edition.

F. References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations, including all changes and amendments thereto.

G. References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

H. Reference the section entitled “Summary of Work” for additional requirements.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01120
DEMOLITION AND ALTERATION PROJECT PROCEDURES

PART I – GENERAL

1.01 RELATED DOCUMENTS

Drawing and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.02 DESCRIPTION OF REQUIREMENTS

A. Coordinate work of trades and schedule elements of demolition and alteration work by procedures and methods to expedite completion of the Work.

B. In addition to demolition work specifically shown, cut, move or remove items as required to provide access or to allow alterations and new work to proceed.

C. Patch, repair and refinish existing items to remain, to the specified condition for each material, with a workmanlike transition to adjacent new items of construction.

1.03 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Conform to the applicable Federal, State and local requirements of the following with the modifications and additional requirements specified in this Section, except as superseded and added to by authorities having jurisdiction:

1. ANSI A10.6, "Safety Requirements for Demolition".

B. Operation of Existing Facilities: Existing areas and facilities to remain are in normal use or operation, which shall remain in operation, unless otherwise indicated or specified, and shall be protected from cessation of operation and damage. Avoid interference with the use of adjacent areas and facilities, and interruption of free passage to and from such areas, unless otherwise approved by the OWNER.

C. Structural Integrity: Maintain the structural integrity of the existing building or parts thereof at all times.

1.04 SEQUENCE AND SCHEDULES

A. Schedule Work in the sequences and within times approved by the OWNER, and as indicated by the Contract Documents.

B. Submit two (2) copies of proposed methods and operations of demolition to the ENGINEER for review prior to the start of work. Provide a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the OWNER'S operations. No demolition shall commence until after schedule of demolition has been approved by the OWNER. Perform demolition work in an orderly sequence in accordance with approved schedule.

1.05 ALTERATIONS, CUTTING, AND PROTECTIONS

A. Assign the work of moving, removal, cutting and patching, to trades qualified to perform

the work in a manner to cause least damage to each type of work, and provide means of returning surfaces to appearance of new work.

B. Perform cutting and removal work to remove minimum necessary, and in a manner to avoid damage to adjacent work.

C. Perform cutting and patching as specified in Section 01045.

D. Protect existing finishes, equipment, and adjacent work, which are scheduled to remain, from damage.

E. Provide temporary plywood barricades or fencing as required to protect Patrons and other existing facility users from construction and demolition operations. Where temporary barricades are required to provide a thermal barrier, provide insulated walls and seal ends and tops of walls to existing structure remaining.

1.06 EXISTING CONSTRUCTION

Accuracy of Existing Details: Details showing existing construction that is to be demolished or altered are furnished for CONTRACTOR'S convenience and are representative of what the ENGINEER believes to be the existing conditions. It is the responsibility of the CONTRACTOR to fully verify all existing conditions and related details.

PART 2 – PRODUCTS

2.01 PRODUCTS FOR PATCHING, EXTENDING AND MATCHING

A. General Requirements that Work be Complete:

1. Provide same products or types of construction as that in existing structure, as needed to patch, extend or match existing work.
   a. Generally, Contract Documents will not define products or standards of workmanship present in existing construction. Contractor shall determine products by inspection and any necessary testing, and workmanship by use of the existing as a sample of comparison.

2. Presence of a product, finish, or type of construction, requires that patching, extending or matching shall be performed as necessary to make work complete and consistent to identical standards of quality.

PART 3 – EXECUTION

3.01 PERFORMANCE

Patch and extend existing work using skilled mechanics that are capable of matching existing quality of workmanship. Quality of patched or extended work shall be not less than that specified for new work.

3.02 DAMAGED SURFACES

A. Patch and replace any portion of an existing finished surface which is found to be damaged, lifted, discolored, or shows other imperfections, with matching material.

1. Provide adequate support of substrate prior to patching the finish.

2. Refinish patched portions of painted or coated surfaces in a manner to produce uniform color and texture over entire surface.

3. When existing surface finish cannot be matched, refinish entire surface to nearest intersections.

B. Within four (4) hours of notification, CONTRACTOR shall make repairs required to stop leaks in building resulting from CONTRACTOR'S operations. If leaks are not stopped within this time period, OWNER may take steps as required to have leaks repaired and shall subsequently bill CONTRACTOR for cost of repairs.

C. Within 72 hours of notification, CONTRACTOR shall make repairs or cause to be repaired any damage (either interior or exterior) to the building resulting from CONTRACTOR'S operations. If repairs are not made within this time period, OWNER may take steps as required to have damage repaired and shall subsequently bill CONTRACTOR for cost of repairs. Repairs shall be made to match original condition or better.

3.03 TRANSITION FROM EXISTING TO NEW WORK

A. When new work abuts or finishes flush with existing work, make a smooth and workmanlike transition. Patched work shall match existing adjacent work in texture and appearance so that the patch or transition is invisible at a distance of five feet.

1. When finished surfaces are cut in such a way that a smooth transition with new work is not possible, terminate existing surface in a neat manner along a straight line at a natural line of division, and provide trim appropriate to finished surface.

2. Match existing finishes and align new work with existing structure where new work abuts existing structure or where indicated by the Contract Documents.

3.04 CLEANING

A. Perform periodic and final cleaning as directed by OWNER and in Section 01710.

1. Clean Owner-occupied areas daily where debris and dust occur resultant from Construction Activities.

2. Clean spillage, overspray, and collection of dust in Patron-occupied areas immediately.

B. At completion of work of each trade, clean area and make surfaces ready for work of successive trades.

C. As completion of alterations work in each area, provide final cleaning and return area to a condition suitable for use by OWNER.

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END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART I – GENERAL

1.01 PRECONSTRUCTION MEETING

Prior to the delivery of materials or the start of any construction, the CONTRACTOR shall request a Preconstruction Meeting from the ENGINEER. A minimum two (2) weeks notice shall be required.

A. Schedule

The ENGINEER will establish the meeting place, time and date, distribute agenda, notify participants, and administer the meeting. The CONTRACTOR shall notify major Subcontractors.

B. Attendance

1. OWNER

2. ENGINEER

3. CONTRACTOR

4. GOVERNMENTAL AGENCIES
   a. Major Subcontractors
   b. Utility Companies
   c. Safety Representatives

5. AS APPLICABLE

C. Agenda

1. Distribution by CONTRACTOR and discussion of:
   a. List of names and telephone numbers for superintendent, foreman and other key personnel.
   b. List of major subcontractors and suppliers.
   c. Projected Construction Schedules.
   d. Hurricane Preparedness Plan (SECTION 01540)
   e. Erosion and Sedimentation Control Plan (SECTION 01568)

2. Critical Work sequencing.

3. Major equipment deliveries and priorities.

4. Project coordination.

5. Responsibilities of OWNER, ENGINEER, CONTRACTOR and other agencies.

6. Procedures and processing of:
   a. Field decisions.
   b. Proposal requests.
   c. Submittals.

d. Field Directives.
e. Change Orders.
f. Applications for Payment.

7. Adequacy of distribution of Contract Documents.

8. Procedures for maintaining Record Documents.

9. Use of premises.

10. Construction Facilities, Controls and Construction bids.

11. Temporary utilities.

12. Safety and first aid procedures.

13. Security procedures.

14. Housekeeping procedures.

15. Testing

D. Minutes

The ENGINEER will prepare and distribute copies to participants within seven (7) days of meeting. Participants shall report corrections and comments within ten (10) days of receipt of minutes.

1.02 PROGRESS MEETINGS

Progress Meetings will be held twice a month or as required by the progress of the Work.

A. Schedule

The ENGINEER will establish the meeting place, time and date, distribute agenda, notify participants and administer the meeting. The CONTRACTOR shall notify major Subcontractors. The Contractor shall bring an updated schedule to each progress meeting.

B. Attendance

1. ENGINEER
2. CONTRACTOR
3. Subcontractor as appropriate to the agenda.
4. Suppliers as appropriate to the agenda.
5. Others

C. Agenda

1. Review minutes of previous meeting.

2. Review of work progress since previous meeting.

3. Review field observations, problems, conflicts.

4. Review problems which impede Construction Schedules.

5. Review of offsite fabrication, delivery schedules.

6. Review corrective measures and procedures to regain projected schedule.

7. Review revisions to Construction Schedules.

8. Review plan progress, schedule, during succeeding Work period.

9. Review coordination of schedules.

10. Review submittal schedules; expedite as required.

11. Review maintenance of quality standards.

12. Review proposed changes for:
    a. Effect on Construction Schedule and on completion date.
    b. Effect on other Contracts of the Project.

13. Other business.

D. Minutes

The ENGINEER will prepare and distribute copies to participants and OWNER within seven (7) days of meeting for review at the next meeting.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

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SECTION 01300
SUBMITTALS

PART I – GENERAL

1.01 CONSTRUCTION SCHEDULES

A. Progress Schedules

The CONTRACTOR shall submit Progress Schedules in accordance with the General Conditions and Section 01311 of the specifications.

B. Submittals Schedule

The CONTRACTOR shall submit two (2) copies of the Submittals Schedule indicating the individual items and submission dates to the ENGINEER within ten (10) working days after the Effective Date of the Agreement. Copies of this Schedule shall be made available by the CONTRACTOR for discussion during the preconstruction meeting.

C. Schedule of Values

The CONTRACTOR shall submit two (2) copies of Schedule of Values for the Work to the ENGINEER within ten (10) calendar days after the Effective Date of the Agreement. The Schedule of Values shall be submitted by the CONTRACTOR for discussion during the preconstruction meeting. The Schedule of Values shall be in accordance with the General Conditions and presented in sufficient detail to serve as the basis for payments during construction.

D. Staking Schedule

The CONTRACTOR shall submit two (2) copies of the Staking Schedule, in accordance with Section 01330 to the ENGINEER prior to mobilization. This Staking Schedule should be updated by the CONTRACTOR and submitted to the ENGINEER on a periodic basis.

1.02 APPLICATIONS FOR PAYMENT

The CONTRACTOR shall submit Applications for Payment to the ENGINEER in accordance with the provisions of the General Conditions. Sample forms for this purpose are included in the Contract Documents. Applications for payment shall be made on these forms or forms of similar format. The CONTRACTOR shall submit a completed Application for Payment and Progress Schedule to the ENGINEER not more often than once per month. The ENGINEER will certify payments with the use of ENGINEER's Certificate for Payment.

1.03 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. General

The CONTRACTOR shall submit all shop drawings in electronic PDF format. The shop drawing submittals shall be directed to the ENGINEER for review in accordance with the provisions of the General Conditions. Correspondence method (either via email or FTP site) of shop drawings shall be coordinated during the pre-construction meeting.

B. Shop Drawings

The shop drawings shall be presented in a clear and thorough manner. Details shall be identified by reference to Contract Drawing Number and Detail, and Contract Specification Section and Page Number. Shop drawings which are not properly and clearly labeled shall be returned to the Contractor.

C. Product Data

The product data shall be presented in a clear and thorough manner, identified the same as the shop drawings. Included with the information shall be performance characteristics and capacities depicting dimensions and clearances required. The manufacturers' standard schematic drawings and diagrams shall be modified to delete information which is not applicable to the Work. Manufacturers' standard information shall be supplemented to provide information specifically applicable to the Work.

D. Samples

The samples shall be of sufficient size and quantity to clearly illustrate functional characteristics of the product with integrally related parts and attachment devices depicting full range of color, texture and pattern. Mark all samples with labels that include project name, date and description.

E. Submission Requirements

The CONTRACTOR shall make submittals in accordance with the approved schedule, and in such sequence as to cause no delay in the Work or in the Work of any other CONTRACTOR. No damages will be awarded or extension of time granted due to the shop drawing and product data review process.

The CONTRACTOR shall submit an entire package of shop drawings and product data information for major items of Work so that the ENGINEER can review the package as a unit.

Electronic submittals shall contain the following information:

- Title, Submittal Dates, Contractor's signature and review stamp.
- Field dimensions, clearly identified as such.
- Relation to adjacent or critical features of the Work or materials.
- Applicable standards, such as ASTM or Federal Specification Numbers.
- Identification of deviations from Contract Documents.
- Identification of revisions on resubmittals.

The CONTRACTOR'S stamp indicating as a minimum the Project Title, Date of Submission, Date of Previous Submission, and Contract Specification Section Reference shall be initialed or signed, certifying the review and approval of submittal per General Conditions, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents.

The ENGINEER shall affix a stamp and initials or signature and indicate confirmation or requirements for resubmittal. The ENGINEER shall return to the CONTRACTOR one (1) of the reproducibles and three (3) copies of the product data information for distribution or for resubmission.

F. Resubmission Requirements

The CONTRACTOR shall make all corrections or changes in the submittals required by the ENGINEER and resubmit. The CONTRACTOR shall indicate any changes which have been made other than those requested by the ENGINEER.

1.04 SPECIFICATION SECTION REQUIREMENTS

Miscellaneous schedules, field reports, test reports, affidavits, certificates, permits, agreements and other items identified in the Technical Specification Sections, or as requested by the ENGINEER shall be submitted to the ENGINEER in duplicate. As a minimum, these submittals should be identified with the Project Title, Date of Submission, and Contract Specification Section Reference.

1.05 MANUFACTURERS OPERATION AND MAINTENANCE DATA

The CONTRACTOR shall furnish an electronic PDF and four (4) copies of all operation and maintenance data required per the various Technical Specification Sections and as according to the requirements of the General Conditions. Prior to 50% completion of the Project, the CONTRACTOR shall have submitted one (1) acceptable copy to the ENGINEER for review.

The operation and maintenance data shall be bound in a suitable number of 3-inch or 4-inch, 3-ring hard cover binders. Permanently imprinted on the cover and side shall be the words Manufacturers Operation and Maintenance Data, Project Title, Location of the Project, and the Date. A Table of Contents shall be provided in the front of each binder to list the various sections of the Manual.

The information to be provided in each section for each piece of equipment and project component shall include, but not be limited to, detailed equipment drawings; sections cut through all of the major equipment and subassemblies; installation and operational procedures; complete wiring and piping schematics; lubrication materials and procedures; maintenance procedures; and parts lists complete enough to permit identification of parts by nomenclature, number and use.

At the front of each section a maintenance schedule shall be provided for each piece of equipment or system in the section. The schedule shall display the daily, weekly, monthly, semi-annual, annual or fraction thereof, lubrication and preventative maintenance required in order to meet warranty conditions and the manufacturers recommendations for optimum performance and life of the unit or system. A common schedule format is to be developed and used for all of the sections. Photocopies or reproductions of the manufacturers literature will not be accepted.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

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SECTION 01311
CONSTRUCTION SCHEDULE AND REPORTS

PART I – GENERAL

1.01 GENERAL REQUIREMENTS AND SCOPE

A. Pursuant to the General Conditions of this contract, the following additional scheduling requirements are a part of this Contract.

B. Work under this Section shall consist of furnishing a Construction Schedule showing in detail how the CONTRACTOR plans to execute and coordinate the Work. The Contract Schedule shall be based on and incorporate the Contract Milestone and Completion Dates specified in the Owner-Contractor Agreement and shall show the order in which the CONTRACTOR shall perform the Work, projected dates for the start and completion of separable portions of the work, and any other information concerning the CONTRACTOR'S Work scheduling as OWNER may request. The proposed Construction Schedule and related Schedule of Values must be submitted to the ENGINEER and the OWNER prior to mobilization of the site.

C. The Construction Schedule shall be in the form of a bar chart and shall consist of horizontal lines, or bars, plotted along a daily time scale. Each pay item designed in the CONTRACTOR'S Schedule of Values shall be denominated as a separate activity and represented by a horizontal bar or bars on the chart. The time-scale shall indicate all required Milestone and Completion Dates as set forth in the Owner-Contractor Agreement. The horizontal bar(s) shall indicate the start and finish dates as well as the total time period of performance for each pay item activity. The CONTRACTOR shall arrange the chart so as to show the pay item activities, the allotted timeline to fulfill each, and every Milestone and Completion Date requirement. This Schedule must be submitted by the CONTRACTOR prior to commencement of work and award of contract.

D. Each Work item on the bar chart, as well as being correlated to the payment document, shall be broken into reasonable work segments/activities (where practicable) with individual starting and stopping dates. As a minimum, work shall be segmented to demonstrate its relationship to the various Milestone Dates, if any. The segmented Work activities shall be cost loaded to show their dollar value as part of the entire pay item. Activity titles shall be self-explanatory; abbreviations shall be shown in the legend.

E. If the CONTRACTOR should desire or intend to complete the work earlier than any required Milestone or Completion date, the OWNER or the ENGINEER shall not be liable to the CONTRACTOR for any costs or other damages should the CONTRACTOR be unable to complete the Work before such Milestone or Completion date. The duties, obligations and warranties of the OWNER to the CONTRACTOR shall be consistent with and applicable only to the completion of the Work on the Milestone and completion dates required in the Owner-Contractor Agreement, unless the OWNER, ENGINEER and CONTRACTOR otherwise agree in a written Change Order.

1.02 UPDATES AND REVISIONS

A. The chart shall be updated to show actual progress and the effect of modifications, delays and other events. A second bar for each work item, in a contrasting color or pattern, shall be drawn parallel to the proposed schedule to show actual progress and to forecast future progress. The actual start and stop dates shall be entered, as well as the actual dates of the Milestone events. Updates are to be submitted monthly to the ENGINEER with, and

as part of, each payment request.

B. The updated Construction Schedule submitted by the CONTRACTOR shall not show a completion date later than the Contract Time, subject to any time extensions approved by the Owner; provided, however, that if the CONTRACTOR believes he is entitled to an extension of the Contract under the Contract Documents, the CONTRACTOR shall submit to the ENGINEER, the appropriate requests pursuant to General Conditions, including with each update, a separate schedule analysis (entitled "Requested Time Adjustment Schedule") indicating suggested adjustments in the Contract Time which should, in the opinion of the CONTRACTOR, be made by time extension, due to changes, delays or conditions occurring during the past month or previously, or which are expected or contemplated by the CONTRACTOR (whether such conditions are excusable under the Contract or are allegedly due to CONTRACTOR or OWNER fault); this separate schedule, if submitted, shall be accompanied or preceded by a formal time extension request as required by the Contract Documents and a detailed narrative justifying the time extension requested. To the extent any time extension requests are pending at the time of any update in the Construction Schedule, the "Requested Time Adjustment Schedule" shall be updated also each month, to reflect any adjustments made by the CONTRACTOR in the Construction Schedule, or any time extensions previously granted by the OWNER, and to reflect actual or expected progress. Neither the ENGINEER nor the OWNER shall have any obligation to consider any time extension request unless the requirements of the Contract Documents, and specifically, but not limited to, the requirements set forth in this paragraph, are complied with; and neither the ENGINEER nor the OWNER shall be responsible to the CONTRACTOR for any constructive acceleration due to failure of OWNER to grant time extensions under the Contract Documents should the CONTRACTOR fail to substantially comply with the submission requirements and the justification requirements of this CONTRACTOR for time extension requests. CONTRACTOR'S failure to perform in accordance with the Construction Schedule shall not be excused, nor be chargeable to the OWNER, nor the ENGINEER, because the CONTRACTOR has submitted time extension requests or the "Requested Time Adjustment Schedule."

C. Neither the updating of the CONTRACTOR'S work schedule nor the submission, updating, change or revision of any other report or schedule submitted to the OWNER by the CONTRACTOR nor review or nonobjection of the OWNER or ENGINEER of any such report or schedule shall have the effect of amending or modifying, in any way, the Contract Completion Date, Milestone Dates or of modifying or limiting, in any way, the CONTRACTOR'S obligations under this Contract.

D. All of the CONTRACTOR'S detailed calculations and documents supporting all schedules, reports, and forecasts shall be available to the OWNER and ENGINEER on request.

E. Each updated Construction Schedule submitted by the CONTRACTOR to the ENGINEER shall be accompanied by a narrative report which reflects the following:

1. Description of Work accomplished since submission of previous progress schedule;

2. Comparison of the actual status of the Work with the CONTRACTOR'S project schedule;

3. Status of equipment and material deliveries;

4. Personnel staffing schedule;

5. Causes of any delays;

6. Revision of schedules; and

7. Action proposed to restore schedule.

F. Pursuant to the General Conditions, should any of the conditions exist such that certain activities shown on the CONTRACTOR'S Construction Schedule fall behind schedule to the extent that any of the mandatory specific or milestone dates or completion dates are in jeopardy, the CONTRACTOR shall be required to, at no extra cost to the OWNER, prepare and submit, to the ENGINEER, a supplementary Recovery Schedule, in a form and detail appropriate to the need, to explain and display how he intends to reschedule those activities to regain compliance with the Construction Schedule during the immediate subsequent pay period.

1.03 SCHEDULE OF OFF-SITE ACTIVITIES

A. The CONTRACTOR shall include in his Construction Schedule all procurements related activities which lead to the delivery of materials to the site in a timely manner. Upon written approval by the OWNER, these activities may be submitted as a separate Off-Site Activities Schedule, properly correlated to the Construction Schedule. The schedule of off-site activities shall include, but is not limited to, the following:

1. Dates for submittals, ordering, manufacturing, or fabricating and delivery of equipment and materials. Long lead items requiring more than one month between ordering and delivery to site shall be clearly noted;

2. All significant activities to be performed by the CONTRACTOR during the fabrication and erection/ installation in a CONTRACTOR'S plant or on a job site, including materials/equipment purchasing, delivery; and

3. CONTRACTOR'S drawings and submittals to be prepared and submitted through the ENGINEER to the Owner for approval.

B. The CONTRACTOR shall be solely responsible for expediting the delivery of all materials to be furnished by him so that the construction progress shall be maintained according to the current schedule for the Work as approved by the ENGINEER.

C. The ENGINEER shall be advised in writing by the CONTRACTOR wherever it is anticipated or determined by the CONTRACTOR that the delivery date of any material and/or equipment furnished by the CONTRACTOR for installation will be later than the delivery dates shown on the schedule, subject to schedule updates.

D. Submittals, equipment orders and similar items are to be treated as schedule activities.

1.04 FLOAT TIME

A. Float or slack time is defined as the amount of time between the earliest start date and the latest start date or between the earliest finish date and the latest finish date of an activity on the Construction. Float or slack time is for the exclusive use and benefit of the OWNER. The CONTRACTOR acknowledges and agrees that actual delays, affecting activities containing float time, will not have any effect upon contract completion times, providing that the actual delay does not exceed the float time associated with those activities.

B. Extensions of time for performance as described in the Contract Documents will be granted only to the extent that time adjustment for the activity or activities affected by any condition or event which entitles the CONTRACTOR to a time extension exceed the total float or slack of the affected activity at the time of issuance of a Change Order or the commencement of any delay or condition for which an adjustment is warranted under the Contract Documents.

1.05 COORDINATION

A. The CONTRACTOR shall coordinate his work with that of other contractors and shall cooperate fully with the ENGINEER in maintaining orderly progress toward completion of the work as scheduled. The ENGINEER'S decisions regarding priority between the CONTRACTOR'S work and the work of other contractors at the site shall be final and shall not be cause for extra compensation or extension of time, except where extension of time is granted because of a delay for which CONTRACTOR is otherwise entitled to an extension of time under the Contract Documents.

B. The milestone dates referred to in the Contract Documents for delivery of OWNER direct-purchased equipment and materials and interface activities of other contractors on the site are based on dates set forth in separate contracts with the OWNER and represent the information available at this time.

C. Failure of OWNER direct-purchased equipment and materials to arrive as scheduled, or failure of other construction contractors to meet their schedule, shall not be justification for an extension of time, except where such failure causes, in the opinion of the ENGINEER, an unreasonable delay in the CONTRACTOR'S work, in which case the provisions of the General Conditions regarding extensions of time and extra work shall apply.

D. The CONTRACTOR shall keep himself, and his subcontractors, advised at all times during the course of the Work regarding delivery status of OWNER direct purchased equipment and materials and of the progress of construction work being performed under separate contracts.

1.06 CONTRACTOR COVENANTS AND GUARANTEES

A. The CONTRACTOR covenants and guarantees that the CONTRACTOR will not:

1. Misrepresent to the OWNER or ENGINEER its planning scheduling or execution of the Work;

2. Utilize schedules materially different from those provided by the CONTRACTOR to the OWNER or ENGINEER.

3. Prepare schedules, updates, revisions or reports for the work which do not accurately reflect the actual intent or reasonable and actual expectations of the CONTRACTOR and Subcontractors as to:
   a. The sequences of activities
   b. The duration of activities
   c. The responsibility of activities
   d. Resources availability

e. Labor availability or efficiency
f. Foreseeable weather conditions
g. The value associated with the activity
h. The percentage complete of any activity
i. Completion of any item of work or activity
j. Project milestone completion
k. Delays, slippages, or problems encountered or expected
l. Subcontractor requests for time extensions or delay claims of subcontractors
m. If applicable, the float time available

B. CONTRACTOR'S failure to substantially comply with the foregoing covenant and guarantee shall be a substantial and material breach of contract which will permit the OWNER to terminate Contract for default, or withhold payments under the Contract Documents, and shall entitle the OWNER to the damages afforded for misrepresentation or fraud by these Contract documents or applicable law.

C. Should the CONTRACTOR fail to substantially comply with the provisions of the Contract documents relating to planning, scheduling and execution of the Work by the overall project schedule, the OWNER and ENGINEER shall have the right, at their option, to retain the services of scheduling consultants or experts (including attorneys if necessary in their opinion) to prepare a schedule in accordance with the Contract Documents and to review and analyze the same, in order to allow the OWNER and ENGINEER to evaluate the program of the Work by the CONTRACTOR, to determine whether the CONTRACTOR is substantially complying with the contract Documents, and to direct such action on the part of the contractor, as permitted by the Contract Documents, as required to ensure, under the owner's schedule prepared hereunder, that Contractor will comply with such schedule. All costs (including attorneys' fees) incurred by the OWNER or ENGINEER in preparing the schedule hereunder shall be charged to the CONTRACTOR'S account or deducted from retainage. If the CONTRACTOR fails to substantially comply with the scheduling and execution of the work requirements of the Contract Documents, the CONTRACTOR hereby agrees, in such instance, to comply with such schedules, as the ENGINEER develops or directs and activity sequences and durations as the ENGINEER may reasonably require, without additional cost to the OWNER (subject only to cost adjustments for such changes in the Work as the OWNER may direct by written change order), to ensure completion within the Contract Time.

1.07 DEFAULT

Failure of the CONTRACTOR to substantially comply with the requirements of this Section shall constitute reason that the CONTRACTOR is failing to prosecute the Work with such diligence as will insure its completion within the Contract times and shall be considered grounds for termination by the OWNER, pursuant to the General Conditions.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

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SECTION 01330
CONSTRUCTION STAKING

PART I – GENERAL

1.01 GENERAL REQUIREMENTS

A. Responsibility for Staking

The CONTRACTOR will set stakes and markers showing the locations of various parts of the Work as outlined herein. It shall be the responsibility of the CONTRACTOR to transfer surface line and grade for any other than normal surface open cut operations which the CONTRACTOR may conduct, and also for any operations where ordinary surface line and grade is not feasible.

1.02 RELOCATION AND RE-ESTABLISHMENT

A. Survey Control Points

The CONTRACTOR shall bear all expense involved in re-establishing and/or resetting any survey control point, land survey point or monument lost or disturbed during his construction operation. Such Work shall be done under the direct supervision of a State of Florida licensed land surveyor.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

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SECTION 01380
CONSTRUCTION PHOTOGRAPHS

PART I – GENERAL

1.01 SCOPE OF WORK

A. The CONTRACTOR shall employ a competent photographer to take construction record photographs prior to start of work and periodically during the course of the Work.

B. Related Requirements Described Elsewhere:

1. Section 01010: Summary of Work
2. Section 01300: Submittals

1.02 PHOTOGRAPHY REQUIRED

A. Photographs shall be taken at each of the major stages of construction and as directed by the ENGINEER.

B. Photographs may be taken by the CONTRACTOR's personnel but must be of professional quality as herein specified. Photographs which are deemed unsatisfactory will be rejected and retakes will be required.

C. Views Required

1. One (1) view of each activity as directed by the ENGINEER, up to a limit of thirty (30) activities photographed per month.

2. Five (5) views of overall Project site monthly, as directed by the ENGINEER.

3. Each side of each structure on site, if applicable, where construction activities are present monthly.

D. Reproduction

1. All photographs shall be provided in digital format on CD or DVD.

2. The photographer shall agree to furnish hard-copy prints to OWNER and the ENGINEER at commercial rates applicable at time of purchase.

1.03 COST OF PHOTOGRAPHY

The CONTRACTOR shall pay costs for specified photography and storage media. Parties requiring additional photography or prints will pay the photographer directly.

PART 2 – PRODUCTS

2.01 DIGITAL PRINTS

A. Photographs taken in accordance with this Section shall be furnished to the ENGINEER on two (2) sets of CDs or DVDs, cumulative of all photos to date, and attached with each pay request.

B. Each photograph shall be high resolution in JPEG file format.

C. Each photograph shall bear a date and time stamp.

D. A log, prepared in Microsoft Excel, shall be included on the CD or DVD. The log shall state the digital file name, name of project, date of photograph and orientation of view, and name of photographer. Additional, pertinent comments may be placed on the log at the discretion of the CONTRACTOR.

2.02 HARD-COPY PRINTS

A. General

1. Hard-copy prints will not be provided unless specifically requested by the OWNER. The print requests shall be made as outlined in Article 1.02.E.2 of this Section.

B. Type of Print

1. Paper: Single weight, color print paper.
2. Finish: Smooth surface, glossy.
3. Size: 8 inch x 10 inch

C. Identify each print on back, listing

1. Name of project
2. Orientation of view
3. Date and time of exposure
4. Name and address of photographer
5. Photographer's numbered identification of exposure

PART 3 – EXECUTION

3.01 TECHNIQUE

A. Factual Presentation.

B. Correct exposure and focus.

1. High resolution and sharpness
2. Maximum depth-of-field
3. Minimum distortion

3.02 VIEWS REQUIRED

A. Photograph from locations to adequately illustrate condition of construction and state of progress.

1. At successive periods of photography, take at least one photograph from the same overall view as previously photographed.

2. Consult with the ENGINEER at each period of photography for instructions concerning views required.

B. The photographer shall be escorted on the construction site at all times by the ENGINEER. The photographer shall comply with all directions given by the ENGINEER.

3.03 DELIVERY OF PRINTS

A. Deliver digital photographs on two (2) sets of CDs or DVDs to the ENGINEER to accompany each Application for Payment.

B. The CONTRACTOR shall store all photographs electronically for the project record file until the end of the project. A final, comprehensive CD or DVD of all photographs shall be delivered with Project Record Documents as specified in Section 01700.

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SECTION 01400
QUALITY CONTROL SERVICES

PART I – GENERAL

1.01 RELATED DOCUMENTS

Drawing and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for quality control services.

B. Quality control services include inspections, tests and related actions including reports, performed by independent agencies, governing authorities, and the CONTRACTOR. They do not include Contract enforcement activities performed by the ENGINEER or the OWNER.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the CONTRACTOR of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.

1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.

2. Inspections, test and related actions specified are not intended to limit the CONTRACTOR'S quality control procedures that facilitate compliance with Contract Document requirements.

3. Requirements for the CONTRACTOR to provide quality control services required by the ENGINEER, OWNER, the Specifications, or the Contract, or authorities having jurisdiction are not limited by provisions of this Section.

1.03 RESPONSIBILITIES

A. CONTRACTOR Responsibilities: The CONTRACTOR shall provide inspections, tests and similar quality control services as summarized below or specified in individual Specification Sections and required by governing authorities, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the CONTRACTOR. Costs for these services shall be included in the Contract Sum. The testing agency shall be subject to the approval of the OWNER.

1. The OWNER may elect to engage and pay for the services of an independent agency to perform inspections and tests specified as the OWNER'S responsibility, or at the discretion of the OWNER.

2. Where the OWNER has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the CONTRACTOR is also required to engage an entity for the same or related element, the CONTRACTOR shall not employ the entity engaged by the OWNER, unless otherwise agreed in writing with the OWNER.

B. Retesting: The CONTRACTOR is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the CONTRACTOR'S responsibility.

1. Cost of retesting construction revised or replaced by the CONTRACTOR is the CONTRACTOR'S responsibility, where required tests were performed on original construction.

C. Associated Services: The CONTRACTOR shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:

1. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.

2. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.

3. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.

4. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.

5. Security and protection of samples and test equipment at the Project Site.

D. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, samplings and testing of materials and construction specified in individual Specification Sections shall cooperate with the ENGINEER and CONTRACTOR in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the ENGINEER and CONTRACTOR promptly if irregularities or deficiencies observed in the Work during performance of its activities.

2. The agency is not authorized to release, alter or enlarge requirements of the Contract Documents, or approved or accept any portion of the Work.

3. The agency shall not perform any duties of the CONTRACTOR.

E. Coordination: The CONTRACTOR and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, the CONTRACTOR and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The CONTRACTOR is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.04 SUBMITTALS

A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the ENGINEER, in triplicate, and a copy of each inspection shall be sent to the OWNER.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
   a. Date of issue.
   b. Project title and number.
   c. Name, address and telephone number of testing agency.
   d. Dates and locations of samples and tests or inspections.
   e. Names of individuals making the inspection or test.
   f. Designation of the Work and test method.
   g. Identification of product and Specification Section.
   h. Complete inspection or test data.
   i. Test results and an interpretation of test results.
   j. Ambient conditions at the time of sample-taking and testing.
   k. Comments or professional opinion as to whether inspection or testing Work complies with Contract Document requirements.
   l. Name and signature of laboratory inspector.
   m. Recommendations on retesting.

3. Data that is not in compliance with the Contract Document shall be printed on “yellow” colored paper. Retests shall be printed on “blue” colored paper.

1.05 QUALITY ASSURANCE

A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 INSPECTION OF CONDITIONS

A. Installer's Inspection of Conditions: Require the installer of each major unit of work to inspect the substrate to receive work and conditions under which the work is to be performed. The installer shall report all unsatisfactory conditions in writing to the

CONTRACTOR. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Manufacturer's Instructions: Where installations include manufactured products, comply with the manufacturer's applicable instructions and recommendations for installation, to the extent that these instructions and recommendations are more explicit or more stringent than requirements indicated in the Contract Documents.

C. Inspect each item of materials or equipment immediately prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods for securing work. Secure work true to line and level, and within recognized industry tolerances. Allow for expansion and building movement. Provide uniform joint width in exposed work. Arrange joints in exposed work to obtain the best visual effect to the satisfaction and approval of the ENGINEER and the OWNER. Refer questionable visual-effect choices to the ENGINEER and the OWNER for final decision.

E. Recheck measurements and dimensions of the Work, as an integral step of starting each installation.

F. Install each unit-of-work during weather conditions and project status that will insure the best possible results in coordination with the entire Work. Isolate each unit of work from incompatible work as necessary to prevent deterioration.

G. Coordinate enclosure of the Work with required inspections and tests, so as to minimize the necessity of uncovering work for that purpose.

H. Mounting Heights: Where mounting heights are not indicated, mount individual units of work at industry recognized standard mounting heights for the particular application indicated. Refer questionable mounting height choices to the Architect for final decision.

3.02 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching" as found in Section 01045

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is the CONTRACTOR'S responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION

SECTION 01500
CONSTRUCTION FACILITIES AND TEMPORARY CONTROL

PART I – GENERAL

1.01 LAND FOR CONTRACTOR'S USE

A. Site Access and Parking

The CONTRACTOR shall locate roads, drives, walks and parking facilities to provide uninterrupted access to construction offices, mobilization, work, storage areas, and other areas required for execution of the Contract.

The CONTRACTOR shall maintain driveways a minimum of 15 feet wide between and around combustible materials in storage and mobilization areas.

The CONTRACTOR shall maintain traffic areas as free as possible of excavated materials, construction equipment, products, and debris.

The CONTRACTOR shall not utilize existing parking facilities for construction personnel or for CONTRACTOR'S vehicles or equipment, unless written permission from OWNER of parking facility is obtained.

B. Trucking Route and Public Road Maintenance

Prior to the start of construction, the CONTRACTOR shall submit for review a schedule and list indicating the streets and roads within the municipality that his equipment will use off the Project site.

The CONTRACTOR shall comply with all safety requirements, weight restrictions and speed limits.

All gravel and dirt roads or streets used shall be maintained by grading, placing dust palliatives and maintenance gravel in sufficient quantities to eliminate dust and maintain traffic.

Paved streets shall be maintained in a reasonable state of cleanliness and the CONTRACTOR shall remove accumulations of debris, dirt or mud caused by his operations. This shall be done at the close of each days operation or when requested by the ENGINEER.

In order to insure adequate street maintenance as outlined above, the CONTRACTOR may be required to deposit with the Agency having jurisdiction a cash Road Protection Bond. This Bond, if required, will be held in escrow until final release is given by the Agency having jurisdiction. In the event the CONTRACTOR fails or neglects to maintain the streets to the satisfaction of the Agency having jurisdiction, the Agency having jurisdiction shall have the required maintenance work done and the cost incurred shall be deducted from the Road Protection Bond. At the completion of the Project, the Agency having jurisdiction shall return the Road Protection Bond less any monies expended by the Agency having jurisdiction and shall render to the CONTRACTOR an accounting of all monies so expended.

C. Private or Public Roads, Sidewalks and Parking Areas

The CONTRACTOR shall at all times provide emergency access to property in the vicinity of the construction for police and fire equipment, ambulances or other emergency vehicles to protect life, health and property.

Where public roads, driveways, parking areas and sidewalks are encountered throughout the community, the CONTRACTOR shall maintain those portions affected by the construction operations in a passable condition until such time as final restoration of these improvements can be made as herein specified. If, in the opinion of the ENGINEER, the public safety is in danger or the necessity exists for maintaining traffic, he may direct that backfilling be completed immediately. In the event that the necessary backfill material and equipment are not available when direction is given for immediate backfill, the trench shall be backfilled with native material to provide for the necessary maintenance of traffic and safety; however, the native material shall be removed within 48 hours and the trench properly backfilled as herein specified.

Where private roads are encountered throughout the community, the CONTRACTOR shall maintain those portions affected by its construction operations in a passable condition. These roads shall be maintained by the use of crushed shell, crushed stone, slag or compacted earth as required. Upon completion of the construction activities, the CONTRACTOR shall shape and regrade these roads leaving them in a condition adequate for normal travel.

1.02 TRAFFIC MAINTENANCE AND CONTROL

A. Road Closing

No street, road or section thereof shall be closed to through traffic unless otherwise provided for on the Plans, Specifications, or authorized by the agency with jurisdiction over the roads. Prior to closing a street, road, or section thereof, the CONTRACTOR shall provide the ENGINEER with a copy of a detour Plan approved by the agency having jurisdiction over the roads.

In the event roads or streets are to be closed, the CONTRACTOR shall notify the local fire department, police department, local road authority, ambulance and emergency services, Department of Public Works, U.S. Postal Department, public transit authority and public school system daily as to what streets will be partly blocked or closed, the length of time the streets will be blocked or closed and estimated when the streets will be reopened to traffic. The CONTRACTOR shall designate one responsible employee to carry out the requirements of this condition.

B. Maintaining Traffic

The CONTRACTOR shall provide access for local traffic to property along the Project by means of temporary roads, drives, culverts or other means approved by the ENGINEER. The CONTRACTOR shall grade, add surfacing materials, and dust palliatives to such temporary roads and drives as necessary for the proper maintenance of traffic.

Where the shoulder is used to maintain traffic, the shoulder shall be graded, surfaced, treated for dust, constructed, or reconstructed, as specified herein or as shown on the Plans. If the construction work is suspended due to weather conditions or for any other reason, sufficient labor, materials and equipment shall be ready for immediate use at all

times for the proper maintenance of traffic. Surfacing materials and dust palliatives shall be applied at such times and locations and in such amounts as directed by the ENGINEER.
Where shoulders are low, high, soft or rough, adequate provisions shall be taken to inform and protect the traveling public by means such as construction warning signs, barricades, lighted devices, etc. Such shoulder hazards shall be eliminated as soon as practicable.

The CONTRACTOR shall furnish, erect and maintain all signs, barricades, lights, traffic regulators, in accordance with the requirements of the current Manual of Uniform Traffic Control Devices, and all flagmen and watchmen or uniformed officers as are necessary to maintain and safeguard traffic along the entire Project. Failure to comply with these requirements may be cause to issue a stop Work order, which shall remain in effect until all necessary devices are in place and operational. The issuance of a stop Work order shall not be reason for granting additional compensation or an extension to the Contract time.

C. Existing Signs

No stop sign, traffic control or warning device shall be taken down until the agency having jurisdiction over the roads has been notified and arrangements for the immediate reinstallation has been made. The CONTRACTOR shall provide temporary signs, traffic control devices, warning devices, or watchmen continuously from the time the item is removed until it is reinstalled. All signs removed shall be replaced with signs meeting requirements of the agency having jurisdiction over the roads.

1.03 TEMPORARY UTILITY SERVICES

A. Electricity and Lighting

The CONTRACTOR shall be responsible for and pay all costs for the installation and removal of circuit and branch wiring, with area distribution boxes located so that power and lighting is available throughout the construction by the use of construction-type power cords and shall pay all costs of electrical power used.

Electrical wiring and distribution shall conform to the National Electrical Code as adopted by the State of Florida and the local building official.

B. Telephone

The CONTRACTOR shall pay all costs for installation, maintenance and removal, and service charges for local calls to provide service for his construction site office as well as for the ENGINEER’s field office. Toll charges for calls relating to Project business shall be at the CONTRACTOR's expense.

C. Water

1. The CONTRACTOR shall acquire any and all permits, post any bonds and pay all fees required by the local agency having jurisdiction prior to using any hydrant as the source of water, and reimburse the local utility for all water consumed during course of the Contract at the current municipal rate.

2. The CONTRACTOR shall be responsible for installation, maintenance and removal of potable water and ice machines for use of construction personnel and ENGINEER

D. Sanitary Provisions

The CONTRACTOR shall be responsible for installation, maintenance and removal of temporary sanitary facilities for use of construction personnel and ENGINEER. All rules and regulations of the State and local health officials shall be observed, with precautions taken to avoid creating unsanitary conditions.

1.04 FIELD OFFICE

The CONTRACTOR shall furnish and maintain an approved weatherproof trailer as a field office for use by the ENGINEER. The trailer shall be located at a site convenient to the construction operations as approved by the ENGINEER.

The trailer shall have a tight board floor and is to be provided with at least five (5) single sash windows and two (2) standard size doors having adequate locking facilities. The floor space shall be not less than 300 square feet and the ceiling not less than eight (8) feet in height. The trailer shall be furnished with a wooden locker or closet large enough for the storing of implements and testing equipment, with one (1) bracketed wall table at least 3' x 6' feet in dimension, three (3) desk with drawers at least 3' x 4' in dimension, a four drawer file cabinet with lock, three (3) desk chairs, one (1) long folding table with six (6) folding chairs, one (1) bracketed wall shelf, a fire extinguisher, and a wastebasket.

The CONTRACTOR shall furnish and maintain in the trailer telephone service, a fax machine, heat, air conditioning, light, and shall provide water, as required, etc., for the purpose of making field tests and for drinking. The heating/cooling equipment shall be capable of maintaining a temperature of not less than 70 degrees F and not more than 75 degrees F during working hours. The field trailer shall be adequately anchored to meet City of Palm Bay Building Department requirements.

The cost and maintenance of the field office and facilities will not be paid for separately but shall be included in the price bid for mobilization under the Contract. The building shall be removed by the CONTRACTOR upon completion of the Contract and shall become his property.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01505
MOBILIZATION

PART I – GENERAL

1.01 DEFINITION AND SCOPE

A. Mobilization shall include the costs of obtaining all permits, insurance and bonds, moving onto the site of all plant and equipment; furnishing and erecting plants, temporary buildings, and other construction facilities; all as required for the proper performance and completion of the Work. Mobilization shall include, but not be limited to, the following principal items.

1. Move onto the site all CONTRACTOR's plant and equipment required for first month operations.

2. Install temporary construction power, wiring, and lighting facilities.

3. Establish fire protection plan and safety program.

4. Secure construction water supply.

5. Provide field office trailers for CONTRACTOR and as may be specified for OWNER and ENGINEER.

6. Provide on-site sanitary facilities and potable water facilities as specified.

7. Arrange for and erect CONTRACTOR's work and storage yard and employee's parking facilities.

8. Submit all required insurance certificates and bonds.

9. Obtain all required permits.

10. Post all OSHA, EPA, Department of Labor, and all other required notices.

11. Have CONTRACTOR's superintendent at the job site full time.

12. Submit a detailed construction CPM schedule acceptable to the ENGINEER as specified.

13. Submit a schedule of values of the Work.

14. Submit a schedule of submittals.

1.02 DEMOBILIZATION

Demobilization is the timely and proper removal of all CONTRACTOR-owned material, equipment or plant, from the job site and the proper restoration or completion of work necessary to bring the site into full compliance with the contract documents.

1.03 PAYMENT FOR MOBILIZATION/DEMOBILIZATION

The CONTRACTOR's attention is directed to the condition that payment for mobilization or any

part thereof, shall in accordance with Bid Item No. 1 in Section 01025, Measurement and Payment, Paragraph 1.07.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01525
CONSTRUCTION AIDS

PART I – GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish, install and maintain required construction aids, remove on completion of Work.

B. Related Requirements Described Elsewhere:

1. Section 01010: Summary of Work

C. Comply with applicable requirements specified in Sections of Divisions 2 through 16.

PART 2 – PRODUCTS

2.01 MATERIALS

Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.

2.02 CONSTRUCTION AIDS

A. Provide construction aids and equipment required by personnel and to facilitate execution of the Work: scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other such facilities and equipment such as temporary valves and fittings. Refer to respective Sections for particular requirements for each trade.

B. When permanent stair framing is in place, provide temporary treads, platforms and railings, for use by construction personnel.

C. Maintain facilities and equipment in first-class condition.

PART 3 – EXECUTION

3.01 PREPARATION

Consult with the ENGINEER, review site conditions and factors which affect construction procedures and construction aids, which may be affected by execution of the Work.

3.02 GENERAL

A. Comply with applicable requirements specified in sections of Divisions 2 through 16.

B. Relocate construction aids as required by progress of construction, by storage of work requirements and to accommodate legitimate requirements of OWNER and other contractors employed at the site.

3.03 REMOVAL

A. Completely remove temporary materials, equipment and services:

1. When construction needs can be met by use of permanent construction.

2. At completion of work.

B. Clean and restore areas damaged by installation by use of temporary facilities.

1. Remove foundations and underground installations for construction aids.

2. Grade and grass areas of site affected by temporary installations to required elevations, slopes, ground cover and clean the area.

C. Restore permanent facilities used for temporary purposes to specified condition or in kind if not specified.

END OF SECTION

SECTION 01540
HURRICANE PREPAREDNESS

PART I – GENERAL

1.01 REQUIREMENTS

A. The CONTRACTOR is responsible for having plans for protection of the work site during hurricanes and shall prepare and submit a Hurricane Preparedness Plan prior to any construction activity and mobilization.

B. The Hurricane Preparedness Plan shall be submitted at the Preconstruction Meeting for approval and shall include the following:

1. Items and equipment that must be removed from the work site.

2. Methods and materials that will be utilized to secure the materials and work site.

3. Methods and materials that will be utilized to protect uncompleted work items.

4. Plans for evacuation of staff from the work site.

5. Plans for monitoring local weather conditions, National Weather Service weather reports, and local emergency management instructions.

6. Items that must commence at the time of hurricane water in order to be completed and their anticipated duration.

C. The CONTRACTOR shall immediately mobilize his work forces when a Hurricane Watch is issued and they shall commence with those items in the Hurricane Preparedness Plan required to provide hurricane evacuation before a Hurricane Warning is issues.

D. When the National Weather Service issues a Hurricane Watch for Brevard County or adjoining counties, the Contractor shall immediately implement the Hurricane Preparedness plan.

E. The Cost of preparing and implementing the Hurricane Preparedness Plan shall be the responsibility of the CONTRACTOR.

F. The CONTRACTOR shall follow all instructions from local emergency management officials regarding evacuation of the work site.

1.02 SUBMITTALS

Submittal of the Hurricane Preparedness Plan shall be in accordance with Section 01300.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 01568
TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART I – GENERAL

1.01 DESCRIPTION

A. General

1. At the Preconstruction Meeting, provide the OWNER with the CONTRACTOR'S plan to prevent, control, and reduce erosion and water pollution, meeting the requirements and special conditions or any required permits authorizing project construction.

2. If a National Pollutant Discharge Elimination System (NPDES) permit is issued or approved by the Florida Department of Environmental Protection, the CONTRACTOR'S plan shall be prepared as a part of the Approved Stormwater Pollution Prevention plan (SWPPP) as described in Section 01061.

B. Scope of Work:

1. The Work specified in this Section consists of planning, designing, providing, maintaining and removing temporary erosion and sedimentation controls as required by Rules and Regulations and permit conditions.

2. Temporary erosion controls include, but are not limited to, grassing, mulching, setting, watering and reseeding on-site surfaces and soil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the OWNER.

3. 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 OWNER.

4. The CONTRACTOR is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

C. Related Work Described Elsewhere:

1. Section 02200: General Earthwork
2. Section 01060: Regulatory Requirements and Permits
2. Section 01061: SWPPP and NPDES Requirements

PART 2 – PRODUCTS

2.01 SEDIMENTATION CONTROL

A. Bales shall be clean, seed-free cereal hay type.

B. Netting shall be fabricated of material acceptable to the OWNER.

C. Filter stone shall be crushed stone which conforms to Florida Department of Transportation (FDOT) specifications.

D. Concrete block shall be hollow, non-load bearing type.

E. Concrete shall be exterior grade not less than 1-inch thick.

PART 3 – EXECUTION

3.01 POLLUTION PREVENTION PLAN

A. The SWPPP will include this erosion control plan and all additional measure that will be employed to dispose of, control, or prevent the discharge of solid, hazardous, and sanitary wastes to waters of the U.S.

B. The OWNER and ENGINEER will review and approve the CONTRACTOR'S part of the SWPPP, including required signed certification statements, before construction activities begin.

C. Failure of the CONTRACTOR to sign any required documents or certification statements will be considered a default of the Contract.

D. Any earth disturbing activities performed without the required signed documents or certification statements may be considered a violation of the Clean Water Act by the EPA.

E. When a SWPPP is required, prepare the erosion control plan in accordance with the sequence of operations and present in the NPDES Stormwater Pollution Prevention Plan required format provided by the FDEP. The erosion control plan shall describe, but not be limited to the following items or activities:

1. For each phase of construction operations or activities, supply the following information:
   a. Locations of all erosion control devices
   b. Types of all erosion control devices
   c. Estimated time erosion control devices will be in operation
   d. Monitoring schedules for maintenance of erosion control devices
   e. Methods of maintaining erosion control devices
   f. Containment or removal methods for pollutants or hazardous wastes

2. The name and telephone number of the person responsible for monitoring and maintaining the erosion control devices.

3.02 SEDIMENTATION CONTROL

Install and maintain silt dams, traps, barriers, and appurtenances as shown on the approved descriptions and working drawings. Hay bales which deteriorate and filter stone which is dislodged shall be replaced.

3.03 PERFORMANCE

A. Should any of the temporary erosion and sediment control measures employed by the CONTRACTOR fail to produce results which comply with the requirements of the State of Florida, the OWNER or ENGINEER, the CONTRACTOR shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

B. The CONTRACTOR shall comply with the Stormwater Pollution Prevention Plan provided in this section and all NPDES records shall be kept on-site and available for inspection if required.

END OF SECTION

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SECTION 01580
PROJECT IDENTIFICATION AND SIGNS

PART I – GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish, install and maintain project signs.

2. Remove signs on completion of construction.

3. Allow no other signs to be displayed.

B. Related Requirements Described Elsewhere:

1. Section 01010: Summary of Work
2. Section 09900: Painting and Special Coatings

1.02 PROJECT SIGNS

A. One (1) painted sign with lettering, size, color and construction in accordance with the local requirements.

B. Erect on the plant site at a location of high public visibility, as approved by the ENGINEER and the OWNER.

C. Information:

1. Project Sign:
   a. OWNER title and logo.
   b. Project name.
   c. CONTRACTOR.
   d. ENGINEER.

1.03 INFORMATIONAL SIGNS

A. Painted signs with painted lettering, or standard products.

1. Size of signs and lettering: As required by the OWNER, or as appropriate to usage.

2. Color: As required by the OWNER, otherwise of uniform colors throughout Project.

B. Erect at appropriate locations to provide required information.

C. Information:

1. CONTRACTOR's name and home office address.

2. List of subcontractors and type of subcontract work.

1.04 QUALITY ASSURANCE

A. Sign Painter: Professional experience in type of work required.

B. Finishes, Painting: Adequate to resist weathering and fading for scheduled construction period.

1.05 SUBMITTALS

An 11 inch by 17 inch sketch of the project sign shall be submitted to the ENGINEER for approval prior to final preparation of the project sign.

PART 2 – PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: May be new or used, wood or metal, in sound condition, structurally adequate and suitable for specified finish.

B. Sign Surfaces: Exterior softwood plywood with medium density overlay, 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.

C. Rough Hardware: Galvanized.

D. Paint: Exterior quality, as specified in Section 09900: Painting and Special Coatings

PART 3 – EXECUTION

3.01 PROJECT IDENTIFICATION SIGNS

A. Paint exposed surface of supports, framing and surface material; one coat of primer and one coat of exterior paint.

B. Paint graphics in styles, sizes, and colors selected.

3.02 MAINTENANCE

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

3.03 REMOVAL

Remove signs, framing, supports and foundations at completion of project.

END OF SECTION

SECTION 01600
MATERIAL AND EQUIPMENT

PART I – GENERAL

1.01 TRANSPORTATION AND HANDLING

A. Transportation

The CONTRACTOR shall provide for expeditious transportation and delivery of materials and equipment to the Project site in an undamaged condition and on a schedule to avoid delay of the Work. Materials and equipment shall be delivered in original containers or packaging with identifying labels intact and legible.

B. Handling

The CONTRACTOR shall provide equipment and personnel at the site to unload and handle materials and equipment in a manner to avoid damage. Materials and equipment shall be handled only at designated lifting points by methods to prevent bending or over stressing.

1.02 STORAGE AND PROTECTION

The CONTRACTOR shall store materials and equipment immediately on delivery, and protect it until installed in the Work.

Materials shall not be stored in preserve areas of existing vegetation to remain.

Products subject to damage by elements shall be stored in weather tight enclosures with temperature and humidity ranges as required by manufacturers instructions.

Loose granular materials shall be stored on solid surfaces to prevent mixing with foreign matter.

The place of storage shall be located so as to minimize interference with traffic and to provide easy access for inspection. No material shall be stored closer than five (5) feet to the edge of a pavement or traveled way open to the public.

Materials that have been stored shall be subject to retest and shall meet the requirements of their respective specifications at the time they are to be used in the Work.

1.03 MANUFACTURER'S INSTRUCTIONS

When Contract Documents require that installation of Work shall comply with manufacturer's instructions, the CONTRACTOR shall obtain and distribute copies of such instructions to parties involved in the installation including two copies to the ENGINEER. The CONTRACTOR shall handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with ENGINEER for further instructions.

1.04 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Products List

Within four (4) days of request, the CONTRACTOR shall submit a complete list of major products proposed to be used, with the name of the manufacturer and the installing subcontractor, if applicable, to the ENGINEER.

B. CONTRACTOR'S Product Options

1. For products specified only by reference standard, the CONTRACTOR may, with OWNER approval, select any product meeting that standard. An item may be considered equal to the item so named or described if, in the opinion of the OWNER and ENGINEER:
   a. It is at least equal in quality, durability, appearance, strength, and design.
   b. It will perform at least equally the specific function imposed by the general design for the work being contracted for or the material being purchased.
   c. It conforms substantially, even with deviations, to the referenced standards.

   Approval by the OWNER and the ENGINEER will be granted based upon considerations of quality, workmanship, economy of operation, suitability for the purpose intended, and acceptability for use on the Project.

2. For products specified by naming several products or manufacturers the CONTRACTOR shall select any one (1) of the products or manufacturers named, which complies with the specifications.

3. For products specified by naming one (1) or more products or manufacturers and or equal, the CONTRACTOR must submit a Substitution Request Form for any product or manufacturer not specifically named, in accordance with the General Conditions.

4. For products specified by naming only one (1) product and manufacturer, there is no option.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01625
OWNER DIRECT PURCHASE PROGRAM

PART 1 – GENERAL

1.01 GENERAL

A. This section applies for purchases with anticipated long lead times. Because the OWNER holds a current Florida Consumer's Certificate Revenue, construction materials and equipment purchased by the OWNER for and incorporated into this Project are eligible for exemption from Florida State sales tax. The CONTRACTOR shall implement the following procedures for the OWNER to take advantage of its sales tax exempt status.

The OWNER has identified certain pieces of equipment shown in the table below that it may be interested in directly purchasing to exercise its eligibility for exemption from Florida state sales tax and to expedite equipment arrival on site. Should the OWNER decide to direct purchase this equipment, the CONTRACTOR shall follow the process outlined in this specification Section 01625.

OWNER DIRECT PURCHASE EQUIPMENT
1) Any materials or equipment with a Purchase Order value greater than $100,000 to a single vendor or supplier.

1.02 DEFINITIONS

A. Direct-Purchase Items: Material purchased directly by the OWNER through execution and delivery of a Purchase Order.

B. Purchase Order: The OWNER'S request for materials from a particular vendor or supplier and the OWNER'S promise to pay for the materials specified upon delivery and acceptance at the project site, and presentation of proper documentation by the CONTRACTOR to the OWNER certifying payment of same.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 PROCEDURES

A. The CONTRACTOR shall include the cost of construction materials and equipment in the Bid Form section of the Bid Price. The Bid Price will also include all Florida State sales taxes normally applicable to such materials and equipment directly from the supplier. In the event the OWNER elects to make direct purchases, as referred to in this Section as "Direct-Purchase Items", the responsibilities of both the OWNER and the CONTRACTOR relative to Direct-Purchase Items shall be governed by the terms and conditions of this Section. This Section shall take precedence over any conflicting conditions and terms of other Contract Documents. All clerical, administrative, management, supervisory inspection handling, storage, and other costs necessary for the CONTRACTOR to comply with this Section are included in the Bid Price.

B. The CONTRACTOR shall select the supplier or suppliers from whom it wishes to purchase materials or equipment.

C. The CONTRACTOR shall require major Subcontractors to comply with these procedures.

D. The CONTRACTOR shall furnish OWNER with an agreed to Purchase Order signed by the equipment or material supplier. The Purchase Order shall be between the Supplier of the equipment listed in Article 1.01.A herein and the OWNER, identifying each item of material or equipment to be purchased by the OWNER for the Project. The Purchase Order shall include:

1. The name, address, telephone number and contact person for the supplier

2. Manufacturer or brand, model or specification number of the item.

3. Quantity needed as estimated by the CONTRACTOR or its Subcontractors and Suppliers.

4. The price quoted by the Supplier for the material or equipment in question. The CONTRACTOR shall submit the supplier quotation to justify the price for the item of material or equipment to be purchased.

5. Any sales tax associated with such quote.

6. Shipping, handling and insurance costs.

7. Delivery date as established by the CONTRACTOR or its Subcontractors and Suppliers.

8. Special terms and condition which have been negotiated with the supplier relative to payment terms, discounts, rebates, warranty, credits or other terms and conditions which will revert to the OWNER.

9. Statement with the submittal control number that materials have been reviewed and approved by ENGINEER during the Shop Drawing submittal process.

E. Promptly upon receipt of CONTRACTOR'S Notice of Award, the OWNER will endorse and process a Purchase Order for that material or equipment which the OWNER chooses to purchase. The Purchase Order shall require that the supplier provide the required shipping and handling insurance. The Purchase Order shall also require the delivery of the Direct-Purchase Items on the delivery dates provided by the CONTRACTOR. A copy of each Purchase Order will be sent to the CONTRACTOR to verify that items ordered are in accordance with the terms and delivery dates required.

F. The CONTRACTOR shall prepare and the OWNER shall execute deductive Change Orders to reflect purchases made by the Owner. The amount of the deduction shall be based on the Requisition amount plus sales tax avoided. These Change Orders shall be executed before the related Purchase Order will be paid.

G. Upon receipt of a fully endorsed Purchase Order, the Supplier shall submit to the OWNER and CONTRACTOR completed Shop Drawings and Submittals for the Direct-Purchase Items for approval. The OWNER shall review the Shop Drawings for approval and respond directly to the Supplier, copying the CONTRACTOR on all correspondence. Nothing in this Section shall alter or modify the procedures for submission of Shop Drawings and other submittals by the CONTRACTOR.

H. The CONTRACTOR shall be fully responsible for all matters relating to the receipt, protection and risk of loss of Direct-Purchase Items the same as if such items were purchased by the CONTRACTOR. At a minimum, the CONTRACTOR shall verify correct quantities, verify documentation, coordinate and expedite delivery, obtain and verify warranties required by the Contract Documents, inspect and accept each item at the time of delivery, unload, handle and store the item. Direct purchase of materials by the OWNER in no way relieves the CONTRACTOR of any responsibilities regarding the compliance with specification requirements, coordination, protection, scheduling or warranty.

I. As Direct-Purchase Items are delivered to the job-site, CONTRACTOR shall visually inspect all shipments, and approve the supplier's shipping documents and invoice. The CONTRACTOR shall ensure that each delivery of Direct-Purchase Items is accomplished by documentation adequate to identify the Purchase Order against which the purchase is made. The CONTRACTOR shall forward approved invoices to the ENGINEER for payment. The OWNER will process these completed invoices as they are received with their associated paperwork.

J. The CONTRACTOR shall inspect to determine that Direct-Purchase Items conform to the Purchase Order, and determine prior to incorporation into the Project if such materials are defective. If the CONTRACTOR discovers defective or nonconforming items it shall not utilize such items in the Project and shall promptly notify the OWNER of the defect or nonconformity and assist the OWNER in obtaining repair or replacement of the item. The CONTRACTOR shall be fully responsible and liable to the OWNER if it fails to perform such inspection or otherwise permits defective or non-conforming material or equipment to be incorporated into the Project. The CONTRACTOR shall not be relieved of its obligation to ensure that materials requested for purchase have been reviewed by the ENGINEER and are released for purchase complying with the Shop Drawing and submittal procedures.

K. The CONTRACTOR warrants Direct-Purchase Items the same as all other materials and equipment furnished by the CONTRACTOR and nothing in this Section shall alter or modify the CONTRACTOR obligations under the Contract relative to warranties.

L. The CONTRACTOR will purchase and maintain Builder's Risk insurance sufficient to protect against any loss of or damage to Direct-Purchase items. Such insurance shall cover the full value of Direct-Purchase Items not yet incorporated into the Project starting from the moment of material delivery to the project site. The CONTRACTOR shall be solely responsible for any deductible or any loss not covered by Builder's Risk Insurance.

M. The CONTRACTOR shall be liable for any interruption or delay in connection with Direct-Purchase Items.

N. The CONTRACTOR shall on a monthly basis, provide the OWNER or ENGINEERS with documentation establishing the amount and nature of the material and equipment delivered by suppliers and accepted by the CONTRACTOR during that reporting period. The CONTRACTOR shall match all material and equipment to purchase orders, invoices, delivery tickets, and inspection and acceptance reports. The CONTRACTOR shall also obtain lien waivers and other releases from suppliers. Upon receipt of appropriate documentation from the CONTRACTOR, the ENGINEER shall request payment from the OWNER. Payments will be made directly by the OWNER to the appropriate supplier in accordance to the terms and conditions of the Contract Documents.

O. The CONTRACTOR shall maintain records of all Owner Direct-Purchase Items incorporated into the Work. These records shall be available for inspection by the

OWNER upon request.

END OF SECTION

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SECTION 01631
PRODUCT SUBSTITUTIONS

PART I – GENERAL

1.01 RELATED DOCUMENTS

Drawing and general provisions of contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. The Contractor's Project Schedule and the Schedule of Submittals are included under Section 01300: Submittals.

C. Procedural requirements governing the Contractor's selection of products and product options are included under Section 01600: Materials and Equipment.

1.03 DEFINITIONS

A. Definitions used in the Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the CONTRACTOR after award of the Contract are considered requests for "Substitutions". The following are not considered substitutions:

1. Substitutions requested by Bidders during the bidding period, and accepted by the OWNER prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.

2. Revisions to Contract Documents requested by the ENGINEER and approved by the OWNER.

3. Specified options of products and construction methods included in Contract Documents.

4. The CONTRACTOR'S determination of and compliance with governing regulations and orders issued by governing authorities do not constitute "substitutions" and do not constitute a basis for Change Orders, except as provided for in Contract Documents.

1.04 QUALITY ASSURANCE

A. Source Limitations: To the greatest extent possible for each unit of work, provide products, materials or equipment of a singular generic kind from a single source.

1.05 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if received within 15 days after commencement of the Work or otherwise as approved by the OWNER. Requests received more than 15 days after Notice of Commencement of the Work may be considered or rejected at the discretion of the ENGINEER or the OWNER.

1. Submit three (3) copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
   a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
   b. Samples, where applicable or requested.
   c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such a size, weight, durability, performance and visual effect.
   d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the OWNER and separate Contractors that will become necessary to accommodate the proposed substitution.
   e. A statement indicating the substitution's effect on the CONTRACTOR'S construction to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
   f. Cost information, including a proposal of the net change, in any, in the Contract Sum.
   g. Certification by the CONTRACTOR and subcontractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the CONTRACTOR'S waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

3. ENGINEER'S Action: Within one week of receipt of the request for substitution, the ENGINEER and/or the OWNER will request additional information or documentation necessary for evaluation of the request. Within two (2) weeks of receipt of the request, or one (1) week of receipt of the additional information or documentation, whichever is later, the ENGINEER will notify the Contractor of acceptance or rejection by the ENGINEER and/or the OWNER of the proposed substitution. If a decision of use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance will be in the form of a Change Order.

PART 2 – PRODUCTS

2.01 SUBSTITUTIONS

A. After Bidding: The CONTRACTOR shall submit all substitution requests with a copy of the attached “Substitution Request Form.” The CONTRACTOR'S substitution request will be received and considered by the ENGINEER and the OWNER when one or more of the following conditions are satisfied, as determined by the ENGINEER and the OWNER; otherwise requests will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of Contract Documents.
3. The request is timely, fully documented and properly submitted.
4. The request is directly related to an "or equal" clause of similar language in the Contract Documents.
5. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
7. A substantial advantage is offered the OWNER, in terms of cost, time, energy conservation or other considerations or merit, after deducting offsetting responsibilities the OWNER may be required to bear. Additional responsibilities for the OWNER may include additional compensation to the ENGINEER for redesign and evaluation services, increased cost of other construction by the OWNER or separate Contractors, and similar considerations. These shall be identified within the request for substitution.
8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor and/or subcontractor certifies that the substitution will overcome the incompatibility.
9. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor and/or subcontractor certifies that the proposed substitution can be coordinated.
10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor and/or subcontractor certifies that the proposed substitution can provide the required warranty.

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

Substitution Request Form

SECTION #	PARA #	SPECIFIED PRODUCT	PROPOSED SUBSTITUTION
_____	_____	_____	_____

A. Does specified product exceed, in any respect, proposed substitution? ___ Y __ N

B. Does substitution affect dimensions shown on drawings? ___ Y __ N

C. Does substitution affect other trades more than original product? ___ Y __ N

D. Does warranty differ from that specified? ___ Y __ N

E. Does substitution affect cost to Owner? ___ Y __ N

F. Does substitution result in any license fee or royalty? ___ Y __ N

If you indicated a Yes to any of the items above, attach thorough explanation on your Company letterhead, as follows:

1. Explain any differences between proposed substitution and specified product.
2. Summarize experience with product and manufacturer in Project area.
3. Attach complete technical data and literature.

The undersigned states that the function, appearance, and quality of the proposed substitution is equivalent or superior to the specified item, and that all information above and attached is true and correct.

For use by ENGINEER

Submitted by: _____

Position: _____

Company: _____

Address: _____

_____

_____

Date: _____

Telephone: _____

Signature: _____

SECTION 01650
STARTING AND PLACING EQUIPMENT INTO OPERATION

PART I – GENERAL

1.01 SCOPE

CONTRACTOR shall initially start-up and place all mechanical and electrical equipment and systems installed by him into successful operation according to manufacturers written instructions and as instructed by manufacturer's field representative. Provide all material, labor tools, equipment, and expendables required. Starting and placing equipment in operation shall include the following steps: physical checkout, initial start-up, systems testing and performance testing.

1.02 RELATED REQUIREMENTS

A. General Conditions of the Contract

B. Specifications:

1. Section 01010: Summary of Work
2. Section 01300: Submittals
3. Section 01400: Quality Control
4. Section 01600: Material and Equipment
5. Section 01700: Contract Closeout
6. Section 01730: O & M Manual
7. Section 01800: Training
8. Individual section: Specific requirements for startup.

1.03 QUALITY CONTROL

A. When specified, individual Sections require manufacturer to provide authorized manufacturer’s representative to be present at site to inspect, check, and approve equipment installation prior to startup; to supervise placing equipment in operation; and to provide a written report that equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting lines or anchor bolts, and had been satisfactorily operated under full load condition. A manufacturer’s representative shall be defined as an employee of the equipment manufacturer who is completely knowledgeable of the construction, installation, operation, and maintenance of the equipment. A sales representative does not qualify.

B. See Section 01600, Material and Equipment for additional requirements.

1.04 SUBMITTALS

A. Submittals shall be made in accordance with Section 01300, Submittals.

B. Submit preliminary schedule listing times and dates for startup of each item of equipment in sequence 90 days prior to proposed dates.

C. Submit manufacturer’s representative reports within 7 days after startup, listing satisfactory startup dates.

D. Submit a detailed draft start-up plan 180 days after Notice to Proceed. The start-up plan shall include detailed start-up procedures for each equipment item, each system, and the total facility. The ENGINEER may recommend changes to the start-up procedures as necessary.

E. Warranty for all major pieces of equipment must be submitted to OWNER before

acceptance of the equipment. Refer to SECTION 01740.

1.05 PHYSICAL CHECKOUT

A. CONTRACTOR shall conduct a physical checkout of all new equipment to insure that installation is proper and complete. The manufacturer's authorized representative shall perform checkout where required.

B. General activities of the physical checkout may include but is not limited to the following:

1. Cleaning

2. Removing temporary protective coatings

3. Flushing and replacing greases and lubricants, where required by manufacturer

4. Lubrication

5. Check shaft and coupling alignments and reset where needed.

6. Check and set motor, pump and other equipment rotation, safety interlocks, and belt tensions.

7. Check and correct if necessary leveling plates, grout, bearing plates, anchor bolts, fasteners, and alignment of piping which may put stress on pumping equipment connected to it.

8. All adjustments required

9. Provide initial filling of lubricants and all other required operating fluids

1.06 INITIAL EQUIPMENT START-UP

A. Preparation

1. Have an approved detailed start-up plan available forty-five (45) days prior to start-up.

2. Coordinate sequence for start-up of various items of equipment.

3. Notify ENGINEER fourteen (14) days prior to startup of each item of equipment.

4. Have on hand during start-up the following documents: Contract documents, shop drawings, product data, approved operation and maintenance data, and approved training manuals. (NOTE: Start-up of equipment shall not begin until all approved training materials and O&M Manual information has been provided in accordance with Sections 01730 and 01800 of these specifications.)

B. CONTRACTOR shall perform initial start-up of component equipment, under the supervision of the manufacturer's representative for the equipment as listed in the technical specification section. The manufacturer's representative shall inspect, test and adjust the equipment in preparation for placing the equipment into operation. The inspection shall include, but not be limited to, the following equipment checks as applicable:

1. Soundness (no damaged parts)

2. Completeness in all details, as specified

3. Correctness of setting, alignment, and relative arrangement of various parts

4. Adequacy and correctness of packing, sealing, and lubrication

C. Upon completion of the start-up, the equipment shall be left in the proper conditions for satisfactory operation.

D. CONTRACTOR shall provide fuel, electricity, water, filters, wastewater biosolids, and other expendables required for initial start-up of equipment unless otherwise specified.

E. The prime responsibility for proper mechanical operation will belong to CONTRACTOR. Manufacturer's representatives shall be present during initial start-up and operation unless otherwise acceptable to ENGINEER.

F. Start-up of either the heating or air conditioning systems is dependent upon the time of year that the system start-up is initiated. CONTRACTOR will be required to return at the beginning of the next heating or air conditioning season (whichever is applicable) to start the appropriate system.

G. CONTRACTOR may be required to provide simulated control signals to operate equipment in automatic mode.

H. All equipment initial start-ups are to be witnessed by the OWNER AND ENGINEER.

1.07 MINIMUM EQUIPMENT START-UP PROCEDURES

A. Equipment start-up procedures will follow manufacturer's recommendations.

B. General activities of the equipment start-up shall include but not limited to the following:

1. Bearings and Shafting:
   a. Inspect for cleanliness, clean and remove foreign materials.
   b. Verify alignment.
   c. Replace defective bearings, and those that run rough or noisy.
   d. Grease as necessary, and in accord with manufacturer's recommendations.

2. Drives:
   a. Adjust tension in V-belt drives, and adjust variable pitch sheaves and drives for proper equipment speed.
   b. Adjust drives for alignment of sheaves and V-belts.
   c. Clean and remove foreign materials before starting operation.
   d. Verify proper lubrication including grease and oil levels.

3. Motors:
   a. Check each motor for comparison to amperage nameplate value.
   b. Check rotation.
   c. Correct conditions which produce excessive current flow, and which exist due to equipment malfunction.

4. Pumps:

a. Check glands and seals for cleanliness and adjustment before running pump.
b. Inspect shaft sleeves for scoring.
c. Inspect mechanical faces, chambers, and seal rings, and replace if defective.
d. Verify that piping system is free of dirt and scale before circulating liquid through the pump.

5. Valves:
   a. Inspect hand and automatic control valves, clean bonnets and stems.
   b. Tighten packing glands to assure no leakage, but permit valve stems to operate without galling.
   c. Replace packing in valves to retain maximum adjustment after system is judged complete.
   d. Replace packing on any valve which continues to leak.
   e. Remove and repair bonnets which leak.
   f. Coat packing gland threads and valve stems with a surface preparation of "Moly-Cote" or "Fel-Pro", after cleaning.

6. Verify that control valve seats are free from foreign material, and are properly positioned for intended service.

7. Tighten flanges and all other pipe joints after system has been placed in operation. Replace gaskets which show any sign of leakage after tightening.

8. Inspect all joints for leakage.
   a. Promptly remake each joint which appears to be faulty; do not wait for rust to form.
   b. Clean threads on both parts, apply compound and remake joints.

9. After system has been placed in operation, clean strainers, drives, pockets, orifices, valve seats and headers in fluid system, to assure freedom from foreign materials.

10. Open steam traps and air vents where used, remove operating elements. Clean thoroughly, replace internal parts and put back into operation.

11. Remove rust, scale and foreign materials from equipment and renew defaced surfaces.

12. Set and calibrate draft gages of air filters and other equipment.

13. Inspect fan wheels for clearance and balance. Provide factory-authorized personnel for adjustment when needed.

14. Check each electrical control circuit to assure that operation complies with specifications and requirements to provide desired performance.

15. Inspect each pressure gage and thermometer for calibration. Replace items which are defaced, broken, or which read incorrectly.

16. Repair damaged insulation.

17. Vent gasses trapped in any part of systems. Verify that liquids are drained from all parts of gas or air systems.

1.08 SYSTEM START-UP PROCEDURES

A. After all component pieces of equipment have been successfully checked out and started, a functional or system start-up test will be required for all process equipment, HVAC systems, and electrical systems. The purpose of the systems testing is to demonstrate to the satisfaction of the ENGINEER that the equipment can operate without vibration or overheating and deliver the rate capacity or service under specified conditions. Field conditions shall be made equivalent to anticipated service conditions and accepted by the ENGINEER prior to testing.

The ENGINEER will review all start-up documentation submitted by the CONTRACTOR and shall provide the OWNER with a recommendation regarding the adequacy and completeness of the Systems Testing.

B. The CONTRACTOR shall coordinate the system start-up test with the requirements contained in Division 13 specifications for the start-up, commissioning, and field testing of the instrumentation and control system.

C. Systems requiring system start-up testing shall include the following:

- Influent Screen
- Grit Removal System
- Membrane Biological Reactor System
- Aeration Blowers
- Feed Forward Pumps
- Disinfection System
- Effluent Transfer Pump System
- Chemical Feed System
- Odor Control System
- Sludge Transfer Pumps
- On-Site Lift Station
- Packaged Emergency Generator Set
- Instrumentation & Control System

D. Specific systems tests shall be performed by the CONTRACTOR in addition to the requirements of shop, field and other tests called for in the technical specifications. Such tests shall demonstrate that the component equipment functions as an entire system in accordance with the design requirements. Testing shall be performed with clean water wherever possible. Systems testing shall be coordinated and performed by the CONTRACTOR and SubContractors/Suppliers and shall include the following:

1. Provide 60 days written notice indicating the anticipated date and time during which the systems test is proposed. Submit with this notice the following for review and approval of the ENGINEER:
   a. Description of the tests specifically outlining how the test will conform to the requirements of the technical specifications. At a minimum, the test shall include the operation of all equipment in all modes of operation for a minimum of 10 minutes or until the satisfaction of the ENGINEER. All interlocks and/or equipment safety features shall be tested.
   b. Testing devices that will be used in the tests: Description must state what portion of the tests that the device will perform or measure and device accuracy.
   c. Personnel used to perform the tests: Submit resumes and qualifications.

As a minimum, personnel must have three years experience with the operation of the equipment and/or system to be tested and have participated in five similar tests during this period of experience.

d. Schedule for testing: Schedule shall include frequency of measurements, required personnel to be present for the test, and contingency plans for equipment and/or system test in the event of failure.

e. Test forms: Review and comment on all forms provided by the ENGINEER.

f. Provide material and equipment required for the test. Water, Power and all consumables will be supplied by the CONTRACTOR for testing purposes only.

g. Operational requirements: Include valve positions, set-ups and gate positions that are required to run the tests in a written description so that the ENGINEER can anticipate and plan the testing. Provide all temporary piping connections or other temporary requirements related to performance of the functional tests, including simulated control signals where necessary.

h. Provide 14 days written notice to the ENGINEER prior to the actual start of any testing. This will include a statement by the CONTRACTOR that the equipment and facilities to be tested have been thoroughly inspected and cleaned of construction debris and other extraneous materials and all lubrication, materials and preparations are complete.

2. All systems testing are to be witnessed by the OWNER and ENGINEER.

3. Approval of the systems testing procedures by the ENGINEER must be made within two weeks of the test date. Incorporate minor comments on the procedures, equipment, and personnel, as required, prior to testing. Major comments by the ENGINEER will require a resubmission of the systems testing procedures and test data.

E. Systems tests shall be suited to the equipment being tested. As a minimum, the following items shall be evaluated:

1. Equipment vibration
2. Overheating
3. Jamming/Bending
4. “Wire to Water” efficiency
5. Head (Suction and Discharge)
6. Capacity
7. Motor RPM
8. Motor Input
9. Ability to handle rated loads
10. Ability to operate equipment in all operating modes

F. The CONTRACTOR shall provide all necessary supervision and labor, materials, tools, testing instruments, or other equipment or services required to test, adjust, set and calibrate all equipment.

G. The CONTRACTOR shall correct, or replace promptly, defects or defective equipment revealed by or noted during the test and repeat tests as necessary until testing results acceptable to the ENGINEER are obtained at no expense to the OWNER.

H. In the event the CONTRACTOR is unable to demonstrate to the satisfaction of the ENGINEER that the equipment item satisfactorily performs the services required and that

it will operate free form vibration and overheating, the equipment item will be rejected. The CONTRACTOR shall then remove and replace the item and repeat all equipment start-up and systems testing on the replacement equipment at no cost to the OWNER.

I. Submit within one week after completion of the tests, the following to the ENGINEER for approval:

1. Completed test forms for each device or system tested on forms approved prior to the test.

2. Completed certification, the content of which was approved prior to the tests.

3. A written summary of testing, reporting on the results and summarizing the entire procedure.

4. A schedule for retesting, if necessary, including changes to procedures, testing devices, or personnel. Any retesting required to fulfill the intent of the test requirements due to negligence, poor workmanship, or products that fail to meet the Contract requirements shall be at no additional cost to the OWNER.

1.09 ACCEPTANCE OF INSTALLATION

A. The ENGINEER may accept an equipment system installation as substantially complete when:

1. All components of a system are installed

2. All factory test(s) have been approved by the ENGINEER.

3. All shop performance test(s) have been approved by the ENGINEER.

4. Equipment Start-up, and Systems Testing activities have been completed and approved by the ENGINEER.

5. The required equipment has met the performance requirements.

6. All required training of OWNER'S personnel have been completed.

7. The O&M Manuals have been approved by the ENGINEER.

8. CONTRACTOR has provided ENGINEER with manufacturer written warranty per SECTION 01740.

1.10 PERFORMANCE TESTING

A. Prior to Final Acceptance, the CONTRACTOR shall provide the services of a start-up coordinator to oversee the performance testing. During the performance test the completed facility shall be operated by OWNER staff and shall continuously meet all performance requirements established by the Contract Documents and shall operate without fault, failure or defect for a minimum period of 60 consecutive calendar days.

B. In the event of an equipment breakdown or unsatisfactory performance the CONTRACTOR shall make all necessary repairs and the performance testing shall be restarted again. Individual equipment failures that are corrected within 48 hours and do not prevent the entire Project from continuously satisfying the established performance

requirements shall not require the performance testing to be re-started unless the failure recurs. Any failure of the complete Project construction to meet all performance requirement, or any individual equipment failure that (a) requires more than 48 hours to correct, (b) recurs during the 48 hour correction period requiring further correction, or (c) occurs more than once during the test period, shall require the performance testing period to be restarted. In the event that the performance test is not successful and accepted by the ENGINEER, all expenses incurred during all consecutive performance testing until the performance testing is acceptable shall be borne by the CONTRACTOR at no additional cost to the OWNER.

C. CONTRACTOR Responsibility during Performance Testing

1. Review performance test requirements and procedure as prepared by the ENGINEER.

2. Correct any outstanding punchlist items prior to or during the test.

3. Provide specified start-up materials and operating supplies for the duration of the performance testing.

4. Provide Supplier's authorized representative to supervise placing equipment or systems in operation and provide guidance during performance testing.

5. Provide to the ENGINEER a list of 24 hour "on call" representative supervisory persons who will monitor the performance testing and serve as liaison for the ENGINEER and OWNER.

6. Provide the necessary craft or labor assistance, in the event of an emergency equipment failure requiring immediate attention (emergency is defined as a failure of function which precludes the further operation of a critical segment of; or the whole of the work) with a response time of not more than four hours from the time of notification.

7. Provide necessary Supplier's representatives and operating supplies for retesting systems that fail to pass the initial performance tests due to deficiencies in products or workmanship at no additional cost to the OWNER.

D. General Requirements of Performance Testing

1. All checkout and functional testing of the systems or equipment being tested shall be successfully completed prior to commencing the performance testing.

2. All installed instrumentation and controls systems shall be available for all systems or equipment being tested during the entire testing period.

3. The equipment and process control devices shall be operated by the OWNER'S certified operations staff under the guidance of the ENGINEER. The performance testing will be carried out by the OWNER'S staff and monitored by the ENGINEER and CONTRACTOR.

4. Systems or equipment failing to perform as specified shall be retested at the direction of the ENGINEER.

5. The CONTRACTOR shall be available at all times during the performance tests to repair, correct, adjust or replace faulty equipment and instrumentation at no

cost to the OWNER.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

PART I – GENERAL

1.01 CLEANING

The CONTRACTOR shall perform periodic cleaning to keep the Work, the site and adjacent properties free from accumulations of waste materials, rubbish and wind-blown debris, resulting from construction operations. Waste material, debris and rubbish shall be periodically removed from the Site and disposed of at legal disposal areas away from the Site. Prior to OWNER acceptance the CONTRACTOR shall conduct an inspection of sight-exposed interior and exterior surfaces, and all Work areas, to verify that the entire Work is clean. The CONTRACTOR shall broom clean exterior paved surfaces and rake clean other exterior surfaces of the site.

1.02 PROJECT RECORD DOCUMENTS

The CONTRACTOR shall deliver one (1) copy of all Specifications, Addenda, Shop Drawings and Samples, annotated to show all changes made during the construction process, to the ENGINEER upon completion of the Work. Submittal of the Record Documents shall be made with a transmittal letter containing:

- Date
- Project Title and Number
- CONTRACTOR'S Name and Address
- Title and Number of each Record Document
- Certification that each Document as submitted is complete and accurate
- Documents shall be submitted in good order and in a legible condition.

1.03 RECORD DRAWINGS

Upon completion of the project, the CONTRACTOR shall provide the ENGINEER with a complete set of record drawings. Any changes shall be clearly marked in ink on reproducibles provided by the ENGINEER. The CONTRACTOR shall additionally provide the ENGINEER with an AutoCAD survey file(s) containing the horizontal (coordinate points) and vertical (top of pipe) as-built location of all underground yard piping (including valves, reducers, etc.) compiled throughout the project, inclusive but not limited to all process, stormwater, utility, and electrical conduits. This is the responsibility of the CONTRACTOR and shall not be construed to be the responsibility of any other party.

1.04 OPERATION AND MAINTENANCE DATA

Prior to final inspection or acceptance, the CONTRACTOR shall fully instruct the OWNER'S designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment and systems specified. Operation and maintenance data required by the individual Specification sections and the manufacturers operation and maintenance data required in Section 01300, Submittals, shall constitute the basis of such instruction.

1.05 SCHEDULING

The CONTRACTOR shall coordinate efforts between the ENGINEER, any equipment manufacturers, subcontractors and governing agencies in the scheduling of required close-out procedures.

1.06 START UP

The CONTRACTOR shall coordinate efforts between the OWNER and ENGINEER, any equipment manufacturers, subcontractors and governing agencies in the start up of applicable portions of the Work.

1.07 SUBSTANTIAL COMPLETION

Certification that the Work is substantially complete shall be in accordance with the General Conditions.

1.08 FINAL PAYMENT AND ACCEPTANCE

The final inspection, final application for payment and acceptance shall be in accordance with the General Conditions.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01710
CLEANING

PART I – GENERAL

1.01 REQUIREMENTS

The CONTRACTOR shall execute cleaning, during progress of the Work, and at completion of the Work, as required by the General Conditions and these specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. All applicable sections of the Specifications

B. General Conditions

1.03 DISPOSAL REQUIREMENTS

The CONTRACTOR shall conduct its cleaning and disposal operations to comply with all applicable codes, ordinances, regulations, and anti-pollution laws.

PART 2 – PRODUCTS

2.01 MATERIALS

The CONTRACTOR shall use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

PART 3 – EXECUTION

3.01 DURING CONSTRUCTION

A. The CONTRACTOR shall execute cleaning as determined necessary by the ENGINEER OR OWNER to keep the WORK, the site and adjacent properties free from accumulation of waste material, rubbish and windblown debris, resulting from Construction Work. Site cleaning shall be performed not less than weekly.

B. The CONTRACTOR shall provide on-site containers for the collection of waste materials, debris and rubbish.

C. The CONTRACTOR shall remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL

A. Perform operations so that dust and other contaminants resulting from Construction Work operations will not cause any damages or maintenance problems to adjacent properties.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.

3.03 FINAL CLEANING

A. Employ skilled workmen for final cleaning.

B. Power brush clean paved roadways.

C. Remove all trash and debris in roadways, sidewalk, and landscape areas

D. Broom clean sidewalk surfaces, power clean if determined necessary by ENGINEER; rake clean other surfaces of the grounds.

E. Thoroughly clean the interior of buildings including washing windows, clean floors, dust surfaces, and polish surfaces.

F. Prior to final completion, or OWNER occupancy, CONTRACTOR shall conduct an inspection of sight-exposed interior and exterior surfaces, and all work areas, to verify the entire work is clean.

G. All storage and staging areas shall be cleaned and returned to prior conditions or better as per requirements of this Section.

3.04 MEASUREMENT AND PAYMENT

There shall be no special measurement or payment for the work under this section. It shall be included in the lump sum price bid for Item 1 - Mobilization.

END OF SECTION

SECTION 01730
OPERATIONS AND MAINTENANCE MANUAL

PART I – GENERAL

1.01 REQUIREMENTS

A. Compile product data and related information appropriate for OWNER'S maintenance and operation of products furnished under this Contract.

B. Prepare operating and maintenance data as specified in this section and as referenced in other pertinent sections of specifications.

C. The CONTRACTOR shall furnish all labor, equipment, material, and all other items to supply and deliver to the ENGINEER equipment manuals for the work in accordance with the requirements of this section. An exact electronic PDF of each manual must accompany the hardcopy submittal.

D. The format of the manuals shall be that acceptable to City of Palm Bay Utilities Department. Existing manuals showing the format desired by the OWNER will be provided to the CONTRACTOR upon request.

E. Compile and submit equipment name plate data and manufacturer's recommended preventative maintenance activities/schedule to the ENGINEER. Refer to the requirements in Section 11005.

1.02 RELATED REQUIREMENTS

A. Specifications

1. Section 01010: Summary of Work
2. Section 01300: Submittals
3. Section 01700: Contract Closeout
4. Section 01800: Training
5. Section 11005: General Mechanical Equipment
6. Individual Equipment Sections

1.03 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel meeting the following qualifications:

1. Trained and experienced in maintenance and operation of described products.

2. Familiar with requirements of this section.

3. Skilled as a technical writer to extent required to communicate the essential data.

4. Skilled as a draftsman competent to prepare required drawings.

1.04 FORM OF SUBMITTALS

A. In general, the manuals shall have two (2) levels: systems level and individual component level.

1. The system level shall:
   a. Describe the system, including sequence of operation, automatic control strategy, manual operating procedure and process flow diagrams.
   b. Explain start-up, shutdown, normal operations, and malfunction of the system.
   c. Tabulate a lubrication schedule for the system.
   d. Describe preventive maintenance checking procedures for the system.
   e. Include a cross reference to all individual components manuals.

2. The individual component level shall contain:
   a. Storage requirements
   b. Installation instructions.
   c. Alignment instructions and tolerances.
   d. Operating instructions
   e. Troubleshooting instructions.
   f. Lubrication requirements.
   g. Maintenance instructions.
   h. Parts list.
   i. Recommended spare parts list and how to obtain the required spare parts.

B. Format:

1. Size 8-1/2 inch x 11-inch

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 11-inch x 17-inch.

5. Provide flyleaf for each separate product, or each piece of operating equipment.
   a. Provide typed description of product, and major component parts of equipment.
   b. Provide indexed tabs.

6. Cover: Identify each volume with typed or printed title, "OPERATIONS AND MAINTENANCE INSTRUCTIONS" and list:
   a. Title of project.
   b. Identify separate structure as applicable.
   c. Identify general subject matter covered in the manual.

7. Binders:
   a. Filled to not more than 75 percent capacity.
   b. When multiple binders are used, arrange the date into related consistent groupings.

8. Electronic
   a. An exact copy of each document submitted shall be provided in electronic PDF format.

1.05 CONTENT OF O&M MANUAL

A. Neatly word processed 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 or installer.
   b. A list of each product required to be included, indexed to content of the volume.
   c. Identify area of responsibility of each subcontractor or installer.
   d. Local source of supply for parts and replacement.

4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

B. Product date:

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 identity data applicable to installation.
   c. Delete references to inapplicable information.

C. 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.

D. Written text, 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 instructions of each procedure.

3. Describe how complete system is to operate.

E. Copy of each warranty, bond, and service contract issued:

1. Provide the following information sheet for Owner's personnel:
   a. Proper procedures in event of failure.
   b. Instances that might affect validity of warranties or bonds.

F. Any training manuals and documents used will become part of this manual.

1.06 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 re-ordering special-manufactured 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 that are detrimental to product.
   c. Recommend schedule for cleaning and maintenance.

B. Content for moisture-protected 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 as required by other sections of the specifications.

1.07 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Content, for each unit of equipment and system, as appropriate:

1. Description of system:
   a. Design and performance criteria.
   b. Sequence of operation.
   c. Automatic control strategy.
   d. Manual operating procedures.
   e. Single-line Process flow diagram showing each component of the treatment plant.

2. 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. Model number and name plate data for each piece of equipment.

3. 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.
   e. Control setting and ranges.

4. Maintenance Schedules and Procedures:
   a. Identify type and frequency of preventive maintenance activities required

for each piece of equipment. Identify preventive maintenance activities requirements for daily, weekly, monthly, semi-annually, and annually intervals.

b. Guide to “trouble-shooting.”
c. Disassembly, repair and reassembly.
d. Alignment, adjusting, and checking.

5. Servicing and lubrication schedule:
   a. List of lubricants required.
   b. Period between lubrication.

6. Manufacturer’s printed operating and maintenance instructions. (This is not to be a generalized catalog of the entire product line unless the specific equipment item provided or installed is highlighted.)

7. Description of sequence of operation by control manufacturer.

8. 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.

9. As-installed control diagrams by controls manufacturer.

10. Each Contractor’s coordination drawings.

11. Charts of valve tag numbers, with location and function of each valve:
    a. Reference drawing valves are on.
    b. Manufacturer model and serial numbers.
    c. Operation of valve (manual, hydraulic, electric or pneumatic).

12. List of original manufacturer’s spare parts, manufacturer’s current prices and recommended quantities to be maintained in storage.

13. Other data as required under pertinent sections of specifications.

14. Local services (process water, drains, HVAC, natural gas, steam, and process air).

B. Content, for each electric and electronic system, as appropriate:

1. Make a table identifying each piece of equipment, each associated control or instrument, the location of the control or instrument and the junction of the control or instrument.

2. Description of system and components parts:
   a. Function, normal operating characteristics and limiting conditions for both the system and the component parts.
   b. Performance curves, engineering data and tests.
   c. Complete nomenclature and commercial number of replaceable parts.

3. Circuit directories of panel boards:
   a. Electrical service.

b. Controls.
c. Communications.

4. As-installed, color-coded wiring diagrams.

5. Instrument loop diagrams showing the path that a control or instrumentation signal takes from its origin to the action it takes:
   a. An electrical schematic for each item.

   b. A chart listing the controls/instruments in a loop identifying the equipment abbreviated symbol, a description of the symbol, design criteria, process flow, quantity supplied and manufacturer's model and serial number.

6. Operating procedures:
   a. Routine and normal operating instructions.
   b. Sequences required.
   c. Special operating instructions.

7. Maintenance procedures:
   a. Routine operations.
   b. Guide to "trouble-shooting."
   c. Disassembly, repair, and reassembly.
   d. Adjustment and checking.

8. Manufacturer's printed operating and maintenance instructions.

9. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

10. Other data as required under pertinent sections of specifications.

11. Abnormal and emergency operation:
    a. Potential overloads.
    b. Procedures for equipment breakdown.
    c. Action to be taken in a power outage.
    d. Identify alarms by equipment location and action to correct.
    e. Equipment safety features, requirements and potential hazards.

C. Prepare and include additional data when the need for such data becomes apparent during instructions of OWNER'S personnel.

D. Additional requirements for operating and maintenance data required by sections of specifications.

1.08 SUBMITTAL SCHEDULE

A. The OWNER requires timely receipt of Equipment Operation and Maintenance (O&M) Manuals. The required time frames for these submittals are at the fifty (50) percent and ninety (90) percent completion of the construction. To have the OWNER meet this requirement, the CONTRACTOR shall submit the following:

1. Equipment Manuals. Five (5) copies of the O&M Instruction Manual for each piece of equipment, shall be submitted to the ENGINEER no later than thirty (30) days after ordering such equipment.

2. Preliminary O&M Manuals. Five (5) copies of the Preliminary Equipment shall be bound, indexed, and submitted to the ENGINEER for approval prior to fifty (50) percent completion of equipment fabrication under this Contract.

3. Final O&M Manuals. Five (5) copies of the Final Equipment O&M Manuals shall be bound, indexed, and submitted to the ENGINEER for approval prior to ninety (90) percent completion of equipment fabrication under this Contract.

4. The cost of these manual submitted shall be included in the lump sum Contract Price.

B. The Final Equipment O&M Manuals shall be submitted prior to the equipment being placed into service. Any modifications required after that submission shall be made to the manuals by issuance of addenda to the manual. The addenda will identify where the new data is to be inserted, what data is to be removed, and new index sheets as necessary.

PART 2 – PRODUCTS

2.01 O&M Submittals shall consist of hardcopy binders and electronic PDF files.

2.02 BINDERS

The manuals shall be supplied in binders that are:

A. Commercial quality, three-post binders with durable and cleanable plastic covers.

B. Maximum post width: two inches.

2.03 ELECTRONIC

CONTRACTOR is responsible for providing an exact copy of every O&M submitted in PDF format.

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 01740
WARRANTIES AND BONDS

PART I – GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Compile specified warranties and bonds, as in the General Conditions and as specified in these Specifications.

2. Co-execute submittals when so specified.

3. Review submittals to verify compliance with Contract Documents.

4. Submit to the ENGINEER for review and transmittal to OWNER.

B. Related to Work Described Elsewhere:

1. Section 01010: Summary of Work
2. Section 01700: Contract Closeout
3. Conditions of the Contract: Performance Bond, Payment Bond, Material and Workmanship Bond.

1.02 SUBMITTAL REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.

B. Number of original signed copies required: Two (2) each

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product of work item

2. Firm, with name of principal, address and telephone number

3. Scope

4. Date of beginning of warranty, bond or service and maintenance contract

5. Duration of warranty, bond or service maintenance contract

6. Provide information for OWNER's personnel:
   a. Proper procedure in case of failure.
   b. Instances which might affect the validity or warranty or bond.

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

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size eight and one half inches (8-1/2”) x eleven inches (11), punch sheets for standard three (3)-post binder
   a. Title of Project
   b. Name of CONTRACTOR

C. Binders: Commercial quality, three (3)-post binder, with durable and cleanable plastic covers and maximum post width of two inches (2”).

1.04 WARRANTY SUBMITTALS REQUIREMENTS

A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer's warranty period shall be concurrent with the CONTRACTOR's for two (2) year plus time equipment is not functional to the OWNER unless otherwise specified, commencing at the time of final acceptance by the OWNER.

B. The CONTRACTOR shall be responsible for obtaining certificates for equipment warranty for all major equipment specified in the specifications and which has at least a one (1) horsepower motor or which lists for more than $500.00. The OWNER reserves the right to request warranties for equipment not classified as major. The CONTRACTOR shall still warrant equipment not considered to be "major" in the CONTRACTOR's two-year warranty period even though certificates of warranty shall not be required.

C. In the event that the equipment manufacturer or supplier is unwilling to provide the warranty described above commencing at the date of substantial completion, the CONTRACTOR shall obtain from the manufacturer a two (2) year warranty commencing at the time of equipment delivery to the job site. This two (2) year warranty from the manufacturer shall not relieve the CONTRACTOR of the two (2) year warranty starting at the time of OWNER acceptance of the equipment.

D. The OWNER shall incur no labor or equipment cost during the warranty period.

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

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01750
SPARE PARTS, MAINTENANCE ITEMS AND TOOLS

PART I – GENERAL

1.01 REQUIREMENTS INCLUDED

A. The CONTRACTOR shall furnish all spare parts, maintenance items, tools, and special test equipment required in these Specifications.

B. The Work includes:

1. The spare parts and maintenance items noted in the Contract Documents.

2. Any special tools required shall be grouped into a “set of special tools”. The Contractor shall provide three [3] sets of such special tools.

3. Spare parts shall be identical to installed components. Any modifications required of the installed components shall also be provided at no extra cost.

1.02 RELATED REQUIREMENTS

A. Section 01400: Quality Control
B. Section 01700: Contract Closeout
C. Section 01730: Operations and Maintenance Manual
D. Individual Specification Sections - Specific spare parts and materials required.

1.03 STORAGE AND MAINTENANCE

A. Store spare parts with products to be installed in the Work.

B. After delivery of products to site, maintain spare products in same space and condition as products to be installed in the Work.

1.04 PACKAGING AND DELIVERY

The CONTRACTOR shall package, deliver and handle the Work of this Section in accordance with the requirements of the General Conditions and other Division 1 sections of these Specifications.

PART 2 – PRODUCTS

2.01 MATERIALS

A. The spare parts, maintenance items, or tools to be furnished by the CONTRACTOR shall be manufactured or fabricated in accordance with the requirements of the section in which they are specified.

B. Spare parts shall be identical to the installed components. Any modifications required of the installed components shall also be provided on the spare parts at no extra cost.

PART 3 – EXECUTION

3.01 GENERAL

Prior to delivery of spare parts to the OWNER, the CONTRACTOR shall complete all forms required by the OWNER in order to receive spare parts deliveries from the CONTRACTOR. The CONTRACTOR shall request the required forms directly from the ENGINEER at least sixty (60) calendar days prior to the planned spare parts delivery date.

END OF SECTION

SECTION 01760
PACKAGING, DELIVERY AND ACCEPTANCE OF SPARE PARTS, SPECIAL TOOLS, MAINTENANCE ITEMS AND EQUIPMENT

PART I – GENERAL

1.01 SCOPE

A. The CONTRACTOR shall furnish all labor, equipment, materials and all other items to package, and handle spare parts, special tools, maintenance items and equipment as specified in this section, and in accordance with the requirements in other portions of these specifications.

B. Unless otherwise provided for in the detailed specifications, this section shall govern the packaging, delivery of equipment and acceptance of spare parts, special tools, and maintenance items. The CONTRACTOR shall refer and adhere to the applicable requirements of Sections 01750 of the Specifications.

1.02 SUBMITTALS

The CONTRACTOR shall submit to the ENGINEER for his review and acceptance the Items as required by other sections in accordance with the requirements of Sections 01300, 01750 and the detailed specifications.

1.03 PACKAGING

A. Packaging shall be in accordance with the best practices of the industry for the shipment and long-term storage of parts and equipment. A letter from the manufacturer through the CONTRACTOR to the ENGINEER shall be sent well before shipment, stating his recommended packaging, for approval by the ENGINEER. This approval shall not relieve the CONTRACTOR of full responsibility for proper packaging. Packaging shall be such that no stresses are imposed on the contents. The container and the filler material shall thoroughly insulate the contents against any reasonable shock or other abuses inherent in shipping, handling and unloading. Packaging shall protect the contents from external dirt, dust and moisture and damage from other causes. Contents susceptible to the effects of atmospheric corrosion shall be protected by means of sealed plastic wraps with desiccant agents, grease coatings or other proper means.

B. The outside of each shipping container shall have the following information firmly fastened and legibly posted:

1. Contract Number, Contract Title and Specification Item Number, and Storage Identification Number.

2. The words "SPARE PARTS SUPPLIES," etc.

3. Complete equipment description if a single unit or item; if multiple contents, a list of contents (name and equipment) and description and number of each spare item in an attached envelope with bill of lading.

4. Name and address of manufacturer and other identifiable information regarding the contents.

5. Special instructions as to correct lifting, moving and storage of the container and any other precautionary notes.

6. The gross shipping weight of the container.

1.04 EQUIPMENT AND MATERIALS LIST

A. As one of the items of Work under the Contract, the CONTRACTOR shall furnish to the ENGINEER ten (10) copies of a "Spare Parts List". This list shall give Job Title, Contract Number and a numerical list, including quantity and description of all spare parts and equipment to be delivered under the Contract. Subsequently, as new information becomes available for each item, the CONTRACTOR shall, by written notification and reference to "Spare Parts List," supplement the list with information such as expected date of shipment and delivery (not less than four (4) weeks notice so that storage identification number can be assigned by the OWNER), approximate number of containers, their dimensions, and gross weights, and furnish copies of actual invoices for each item so substantiate the delivered cost of each item.

B. Spare parts and equipment are intended solely for the purpose of replacing worn parts and equipment in due course of time to minimize equipment down time. If equipment or parts prove inherently defective in operation or workmanship during the period of the Contract and the warranty period, then spares for such items shall also be suspected of like defects and shall likewise be replaced by the CONTRACTOR if there is sufficient justification to suspect each item to be defective based on the performance of installed equipment. Spare parts are for the OWNER'S use and are not to be used by the CONTRACTOR for achieving compliance with the operational requirements of the Contract.

1.05 DELIVERY AND ACCEPTANCE

A. All deliveries of spare parts and equipment at the site shall be made in the following sequence

1. The carrier shall report to the CONTRACTOR'S superintendent on duty at the site. Thereafter, the packages shall be delivered, with the ENGINEER present before unloading, at the location identified by the CONTRACTOR and approved by the ENGINEER.

2. The CONTRACTOR shall inspect the container contents and correctly repack the container after inspection according to the instructions of the manufacturer for long-term storage.

B. Spare parts and equipment should only be accepted by the CONTRACTOR if:

1. The container has no visible signs of extensive damages, mutilation or contamination.

2. Inspection indicates that contents are all present, packed and labeled correctly in excellent condition and properly prepared for long-term storage.

3. The components shall be so packaged to allow ready access for the required "in storage" maintenance procedures as noted in the manufacturer's storage instruction.

4. Written manufacturer's instructions on recommended long-term storage, preparation, and installation of the spare units accompany or have preceded the shipment. This requirement may be waived by the ENGINEER if no particular care of special instructions are deemed necessary or if such information already appears in the previously approved submittals.

C. Spare parts and equipment will only be accepted by the ENGINEER at the completion of all construction and if:

1. The material has been properly stored since the CONTRACTOR's receipt and acceptance.

2. Inspection indicates that contents are all present, packed and labeled correctly in excellent condition and properly prepared for long-term storage.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 01800
TRAINING

PART I – GENERAL

1.01 REQUIREMENTS INCLUDED

A. Instruct and train the OWNER'S personnel in maintenance and operation of equipment and system supplied and installed under this Contract.

B. Incorporate the following maintenance and operation data and training services into the training program.

1. Shop Drawings.
2. Equipment manuals.
3. Training as specified in detailed specification sections.

C. Prepare instructor materials and student notes/guides required for complete factory, field, classroom and hands-on-training.

D. Include in Contract Price the cost for preparing training manuals; conducting classroom instructions; performing field, factory and hands-on training; and all other activities required to provide a comprehensive training program as specified herein.

1.02 RELATED REQUIREMENTS

A. General Conditions of the Contract

B. Specifications:

1. Section 01010: Summary of Work
2. Section 01300: Submittals
3. Section 01311: Construction Schedule and Reports
4. Section 01600: Material and Equipment
5. Section 01650: Starting and Placing Equipment into Operation

1.03 QUALITY ASSURANCE

A. Preparations of training materials and instructions to be provided shall be performed by personnel who have trained and experienced in the maintenance and operation of equipment and systems installed under this contract.

B. Furnish resumes, including three outside references for each instructor to be used in the training program.

C. The ENGINEER shall review the resumes. Based upon a review of resumes and contracts with referenced, the ENGINEER shall approve, request additional information, or reject proposed instructors for the training program. If the proposed instructor is rejected, the CONTRACTOR shall submit a resume and references on an alternate instructor for acceptance by the ENGINEER.

1.04 FORM OF TRAINING MANUALS

A. Prepare training packages in form of an instruction manual for use by Owner's personnel. Submit training packages for approval to the ENGINEER 60 days prior to starting training program.

B. Format

1. Size: 8-1/2” x 11”

2. Paper: 20 pound minimum, white, for type pages.

3. Text: Manufacturer’s printed data, or neatly typewritten, including:
   a. Table of contents.
   b. Pretest
   c. Learning objectives.
   d. General operations, theory, specific equipment information.

4. Drawings:
   a. Provide reinforced, punched binder tab, bind in with text.
   b. Reduce larger drawings and fold to size of text pages, not larger than 11”x 17”

5. Cover: Identify each volume with typed or printed title “City of Palm Bay Utilities Department. South Regional Water Reclamation Facility. Training Manual.” and volume number.
   a. Title of project.
   b. Identify separate structure or system as applicable.
   c. Identify general subject matter covered in the manual.

C. Binders:

1. Commercial quality, three-post binders with durable and cleanable plastic covers. Binders shall title pockets for holding notes.

2. Maximum post width: 2-inch.

3. When multiple binders are used, correlate the information into related consistent groupings.

1.05 TRAINING SCHEDULE

A. All factory training programs, if required, shall be completed between 15 and 30 days prior to initial equipment start-up and shall use equipment similar to the OWNER'S equipment.

B. The field training programs shall be completed no sooner than 15 days before systems testing begins.

C. Up to ten (10) individuals will require training, both for operating and maintenance functions. For each training program, the CONTRACTOR shall provide two (2) training sessions if so requested by the OWNER such that these individuals shall be trained in small groups Monday through Friday, during the day shift.

1.06 VIDEOTAPED TRAINING MATERIAL

A. Produce or provide video-taped training material, subject to approval of the OWNER for all equipment.

B. Furnish DVDs compatible for use with the OWNER'S viewing equipment.

C. All cost associated with production and provision of the DVDs, shall be borne by the CONTRACTOR.

D. Include factory or studio-produced material and/or DVDs of on-site training as appropriate and as acceptable to the ENGINEER.

E. Label DVDs with the following information:

1. Name and number of construction contract.

2. Name of Contractor.

3. Subject matter of type:
   a. Equipment item or system.
   b. Manufacturer of equipment or system.

4. Date of production

F. Prepare and submit an index of all DVDs, with a numbering system categorized according to subject matter.

1.07 TRAINING FOR MAINTENANCE OF CONTROL AND INSTRUMENTATION SYSTEM

A. Train the OWNER'S maintenance personnel as follows:

1. Describe the overall function of each instrument and control loop installed under this Contract.

2. Locating the probable source of a malfunction in the instrumentation equipment and control loops, determining the symptoms of the trouble, establishing the probable cause and affecting a solution.

3. Taking appropriate preventive and corrective maintenance procedures necessary to keep the instrumentation system in proper operating condition, including calibration and testing.

B. Course material to be used for training OWNER'S maintenance personnel shall include:

1. Pertinent portions of the submittals specified in the specification such as loop diagrams, calibration data and maintenance instructions.

2. Detailed course outlines and troubleshooting guides for field use. The trouble shooting guides shall include symptoms, probable causes and solutions for all cases of trouble described during the training program.

C. Effectiveness of training maintenance personnel shall be determined through written and in-the-field skills evaluation to the trainees at the completion of each segment of formal instruction and hands-on-training. The performance of each of the personnel shall be classified as “satisfactory” (demonstrates basic knowledge and performance of standard maintenance procedures) or “unsatisfactory” (requires more training to demonstrate basic knowledge and performance of standard maintenance, procedures). All unsatisfactory evaluation shall include recommendation for corrective action. This requirement may be waived by the OWNER.

D. Training program shall not include the time required for initial equipment start-up or systems testing.

1.08 TRAINING FOR MAINTENANCE OF PROCESS EQUIPMENT

A. Train the OWNER'S maintenance personnel as follows:

1. Describe the functions of the equipment installed under this Contract.

2. Component preventive and corrective maintenance activities required to keep unit equipment in good operating condition.

3. The CONTRACTOR shall instruct the trainees in locating the probable source equipment malfunctions, determining the symptoms of the trouble, establishing the probable cause, and affecting a solution

B. Course materials to be used for training OWNER'S operation personnel include:

1. Pertinent portions of the operation and maintenance manuals as well as alignment tolerances, lubrication schedules, vibration analysis instruction and parameters, and special calibration test and procedures.

2. Detailed course outlines and troubleshooting guides for each piece of equipment installed under this Contract. The troubleshooting guides shall include systems, probable causes, and solutions for all cases of trouble described during the training program.

C. Methods of training maintenance personnel shall include the CONTRACTOR using the OWNER'S equipment to demonstrate troubleshooting, preventive and corrective maintenance procedures.

D. Effectiveness of training maintenance personnel shall be assessed through written and skills evaluations on each piece of equipment to the trainees. The performance of each trainee shall be classified as “Satisfactory” (demonstrate basic performance of standard maintenance procedures) or “Unsatisfactory (requires more training to demonstrate basic procedures). All unsatisfactory evaluations shall include recommendations for corrective action. This requirement may be waived by the OWNER.

E. The field training program shall not include the time required for initial equipment startup or the systems testing.

1.09 TRAINING FOR OPERATION OF PROCESS EQUIPMENT

A. Train the OWNER'S operations personnel as follows:

1. Describe the function of the equipment installed under this Contract, including how the components of a system are controlled together and what the effects of the control methods are on the system and on other upstream and downstream processes installed under this Contract.

2. Being able to implement start-up and shutdown procedures for each piece of equipment individually, as well as the start-up and shutdown of the systems comprising the equipment. This instruction shall include normal operation, alternative operation, and emergency operations.

3. Understand the function of the instrumentation installed under this Contract, describing the individual components and how each component is used in monitoring and /or controlling equipment and/or processes installed under this Contract

4. Understand the operating modes possible as a result of the modifications and installations made under this Contract.

5. Locating the probable source of system inefficiency determining the symptoms, establishing the probable cause, and re-stabilizing system efficiency for systems installed under this Contract.

6. In taking necessary precautions for safe operation of the equipment, instrumentation, and control system installed under this contract.

7. Emergency procedure for equipment and system installed under this Contract during pump malfunction, chemical spills, and other extreme conditions.

B. Course materials to be used for training OWNER'S operation personnel include:

1. Pertinent portions of the Operations and Maintenance Manuals, including start-up and shutdown procedures; descriptions of equipment and instrumentation functions and modes of operations, control and monitoring; trouble shooting instructions and process control instructions.

2. Detailed course outlines and operations guides for equipment and processes for field use. The operations guides shall include general operating procedures, start-up and shutdown procedures, optimization procedures and emergency operating procedures.

C. Methods of training OWNER'S operations personnel shall include a field-training program at the OWNER'S site consisting of classrooms and hands-on training using the OWNER'S equipment and systems.

D. Effectiveness of training operations personnel shall be assessed through written and in-the field skills evaluation to the trainees. The evaluations shall be designed to determine the trainees' ability to control the processes, as well as their ability to operate the equipment. The performance of each trainee shall be classified as "satisfactory-operations" (demonstrates basic knowledge and performance of standard operating procedures) or "unsatisfactory-operations" (demonstrates basic knowledge and performance of process control strategies), or "unsatisfactory-process" (requires more training to demonstrate basic knowledge and performance of process control strategies). All unsatisfactory evaluations shall include recommendations for corrective action. This requirement may be waived by the OWNER.

E. The field training program shall not include the time required for initial equipment start-up or systems test.

1.10 SUBMITTALS

A. Submit the preliminary draft detailed outline of proposed training program to the ENGINEER within 180 days after Notice to Start Work.

1. The outline will be reviewed by the ENGINEER and OWNER'S personnel and comments returned to the CONTRACTOR.

2. A revised training program outline shall be submitted to the OWNER'S REPRESENTAITVE within thirty (30) days after receiving the comments from the engineer.

B. After the detailed outline is approved by the ENGINEER and at least thirty (30) days prior to classroom training, submit training manuals, student notes, instructor guides, and methods/ criteria to evaluate effectiveness of training to the ENGINEER for review and approval.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 02100
CLEARING AND GRUBBING

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes all clearing and grubbing Work indicated on the Plans and as required, complete with cutting and removal of trees, shrubs, vegetation, stumps, logs, brush, roots and undergrowth, and disposal of materials.

B. Related Work Specified Elsewhere

1. Section 01025: Measurement and Payment
2. Section 02200: General Earthwork
3. Section 02215: Site Grading
4. Section 02229: Earthwork for Paving

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.01 EXECUTION OF WORK

A. General

1. Areas designated for improvements on the Plans shall be cleared of all trees, shrubs, vegetation, stumps, logs, brush, roots, buildings, pavement other than concrete, and debris.

2. Clearing and Removal

Within areas for roadways, sidewalks, and parking areas where the finished grade is five (5) feet or less in height above the existing ground, trees, stumps, and roots shall be removed to a depth of not less than 12 inches below the existing ground. Within areas for roadways sidewalks, and parking areas, where the finished grade is more than five (5) feet in height above existing ground, trees and stumps shall be cut off flush with the existing ground surface. For embankment areas outside of the roadways, sidewalks, and parking areas, trees and stumps shall be cut off flush with the existing ground surface, or as indicated on the Plans or as directed by the ENGINEER.

Within areas designated for a building pad the trees, stumps, roots, vegetation and other debris shall be removed completely.

3. Removal of Trees, Stumps, and Other Vegetation

Where trees cannot be felled without danger to traffic or injury to other trees, structures or property, they shall be cut down in sections. The removal of stumps and roots may be accomplished by the use of a shredding machine meeting the approval of the ENGINEER.

All logs, stumps, poles, brush, and other unsatisfactory material occurring in the Contract Limits shall be removed and shall be disposed of by the CONTRACTOR. When material is disposed of outside of the Contract Limits, disposal shall be as specified in Section 02200, General Earthwork.

Burial of materials is generally not permitted. The burial of trees, stumps and other vegetation will be permitted, only if disposal areas are indicated on the Plans or directed by the ENGINEER. If trees and stumps are buried in these areas, they shall have a minimum cover of two (2) feet.

4. Holes and Trenches

All holes and trenches remaining after the grubbing operation in embankment areas shall have the sides broken down or leveled, and shall be refilled with acceptable material. The material shall be moistened and properly compacted in layers by tampers or rollers to the density required under roadways, parking areas, and other special areas, as directed by the ENGINEER. The same construction procedure shall be applied to all holes and trenches remaining in excavation areas where the depth of holes exceeds the depth of proposed excavation.

END OF SECTION

SECTION 02140
DEWATERING DURING CONSTRUCTION

PART I – GENERAL

1.01 DESCRIPTION

A. Scope of Work:

The work to be performed under this section shall include the design, permitting and installation of a temporary dewatering system until completion of construction to dewater subsurface waters from structures and piping as required. The CONTRACTOR shall be responsible for all permitting activities, including permit fees, associated with obtaining applicable permits from the State Water Management District and FDEP having jurisdiction over the installation and operation of the dewatering systems.

B. Related Work Described Elsewhere:

1. Section 02226: Trenching, Backfilling and Compaction

C. General Design

1. Storm structures, water pipes, sanitary pipes, sanitary structures, and building foundations may require dewatering. It is the CONTRACTOR'S responsibility to determine extent of dewatering area and requirements for construction.

1.02 QUALITY ASSURANCE

A. Qualifications: The temporary dewatering system shall be designed by a firm who regularly engages in the design of dewatering systems and who is fully experienced, reputable, and qualified in the design of such dewatering systems. The firm shall have a successful record of operation for a minimum of five (5) years prior to bid date. The design firm shall supply the ENGINEER with previous installation details of at least three (3) successful dewatering operations of a similar nature in the State of Florida.

B. In lieu of experience, the dewatering firm shall provide a performance and warranty bond for 1.5 times the total installed cost of the temporary dewatering system. This bond shall be executed prior to award and/or contract execution.

C. Standards: The dewatering of any excavation areas and the disposal of water during construction shall be in strict accordance with all local and state government rules and regulations. If a consumptive use permit is required by local water management district, the CONTRACTOR shall be responsible for obtaining said permit. If an NPDES permit is required by FDEP, the CONTRACTOR shall be responsible for obtaining said permit.

1.03 SUBMITTALS

A. Materials and Shop Drawings: Shop drawings required to establish compliance with the Specifications shall be submitted in accordance with the provisions of Section 01300: Submittals. Submittals shall include at a minimum the following:

1. Design notes and Drawings
2. Descriptive literature of temporary dewatering system
3. Layout of all piping involved

4. Observation well locations
5. Bill of materials

1.04 CRITERIA

A. The dewatering system shall be developed to the point that is capable of dewatering such that the below grade structures can be excavated and constructed with no standing water. Each dewatering system shall be capable of dewatering and maintaining groundwater levels at the respective structures or pipelines. Observation wells shall be constructed for the purpose of testing each system. Observation wells shall be required for the construction of structures, or as determined by the CONTRACTOR's Geotechnical Engineer.

B. Observation Wells:

1. Prior to excavation, the CONTRACTOR shall install groundwater observation wells at locations as directed by the CONTRACTOR'S Geotechnical Engineer, who is registered in the State of Florida and as approved by the ENGINEER adjacent to structures under construction for the purpose of measuring water levels during excavations. The observation well shall consist of screen, casing and cap of approved size and material of construction. The observation well shall be placed in a 2 1/2-inch bore hole which shall be carried to an elevation at least to final bottom grade of structure. The annular space surrounding the intake point and the riser pipe shall be sealed in such a way as to prevent infiltration from surface water. The observation well shall be developed in such a manner as to ensure proper indication of subsurface water levels adjacent to the well.

2. The CONTRACTOR shall be responsible for maintaining the observation wells and for observing and recording the elevation of groundwater in them until adjacent structure of utilities are completed and backfilled. Each observation well shall be observed and recorded daily. Measurements shall be supplied daily to the ENGINEER. The ENGINEER may require that the observation wells reflect true groundwater levels by adding water to the well, recording the drop in the level from the time the water was added. Any plugged observation well shall be redeveloped if necessary to indicate true groundwater levels.

3. Observation wells shall be abandoned when directed by the ENGINEER, and in a manner acceptable to the ENGINEER, and applicable regulatory agencies.

1.05 PUMPING AND DRAINAGE

A. The CONTRACTOR shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. The CONTRACTOR shall submit a plan for dewatering systems to the ENGINEER for review prior to commencing work. The dewatering system installed shall be in conformity with overall construction plan, and certification of this shall be provided by a Geotechnical Engineer. The Geotechnical 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.

B. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation and

to preserve the integrity of adjacent structures. As a minimum, the water level shall be two (2) feet below the trench or structures bottom. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding ground. To minimize consolidation settlement of soils below surrounding existing structures, a recharge system may be required to maintain ground water levels to prevent any consolidation of soils under surrounding structures. Close monitoring of the ground storage tank shall be incorporated into the dewatering plan design and submittal.

C. 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.

D. The CONTRACTOR shall take all additional precautions or prevent uplift of any structure during construction.

E. The conveying of water in open ditches or trenches will not be allowed. Permission to use any storm sewers, or drains, for water disposal purposes shall be obtained from the controlling authority. Any requirements and costs for such use shall be the responsibility of the CONTRACTOR. However, the CONTRACTOR shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and the CONTRACTOR shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored at no cost to the OWNER.

F. Flotation shall be prevented by the CONTRACTOR by maintaining a positive and continuous operation of the dewatering system. The CONTRACTOR shall be fully responsible and liable for all damages which may result from failure of this system.

G. Removal of dewatering equipment shall be accomplished after the CONTRACTOR and the ENGINEER agree that the system is no longer required; the material and equipment constituting the system shall be removed by the CONTRACTOR.

H. This project is within a public wellfield and therefore special consideration should be made to insure that all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on groundwater or receiving water quality.

PART 2 – PRODUCTS

2.01 GENERAL

A. The equipment specified herein shall be standard dewatering equipment of proven ability as designed, manufactured and installed by firms having experience in the design and production of such equipment. The equipment furnished shall be designed, constructed and installed in accordance with the best practices and methods.

B. The CONTRACTOR shall be required to monitor the performance of the dewatering system during the progress of the work and require such modifications as may be required to assure that the systems will perform satisfactorily. The dewatering system shall be designed in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils and to preserve the integrity of adjacent structures.

C. The CONTRACTOR shall engage a Geotechnical Engineer registered in the State of Florida, to design the temporary dewatering system for all structures. The CONTRACTOR shall submit a conceptual plan for the dewatering system prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan and certification of this shall be provided by the Geotechnical Engineer.

The Geotechnical Engineer shall be required to monitor the performance of the dewatering system at the CONTRACTOR'S expense during the progress of the work and require such modifications as may be required to assure that the systems will perform satisfactorily. Dewatering system shall be designed in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the proposed structures or utilities and to preserve the integrity of any adjacent structures.

PART 3 – EXECUTION

3.01 PREPARATION

The CONTRACTOR shall understand where existing utilities exist prior to constructing dewatering system. All necessary precautions should be taken to preserve existing utilities to remain in service during construction.

3.02 INSTALLATION

A. Dewatering: The CONTRACTOR shall design, obtain permits for, and install a temporary dewatering system for the removal of subsurface water encountered during construction of the proposed structures.

3.03 INSPECTION AND TESTING

A. The CONTRACTOR'S Geotechnical Engineer shall be required to assure that the dewatering system is operating properly.

B. The CONTRACTOR'S Geotechnical Engineer shall monitor the performance and instruct any adjustment to the CONTRACTOR during construction.

3.04 PROTECTION AND SITE CLEAN-UP

A. At all times during the progress of the Work the Contractor shall use all reasonable precautions to prevent either tampering with the dewatering system or the entrance of foreign material.

B. Immediately upon completion of the dewatering system, the Contractor shall remove all equipment, materials, and supplies from the site of the work, remove all surplus materials and debris, fill in all holes or excavations, and grade the site. The site shall be thoroughly cleaned and approved by the ENGINEER.

END OF SECTION

SECTION 02200
GENERAL EARTHWORK

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes general earthwork complete with: removal of topsoil; removal and disposal of structures and obstructions; protection of existing sewers, tiles and mains; protection of existing building and improvements; protection of trees and other types of vegetation; protection of utility lines; requirements for pavement replacement; restoration of driveways and parking areas; restoration of sidewalks; restoration of disturbed areas; soil erosion and sedimentation control; and removal, transportation, and disposal of excess excavation.

B. Related Work Specified Elsewhere

1. Section 02140: Dewatering during Construction

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

1. Florida Department of Transportation
2. St. John's River Water Management District

B. Requirements of Regulatory Agencies

The CONTRACTOR, at his expense, shall prepare all plans, obtain all approvals, secure all permits, and post all bonds or deposits required to comply with 2.01 Florida Environmental Land and Water Management Act of 1972 (380.012 F.S. et seq.) and related statutes.

1.03 SUBMITTALS

A. Reports

1. Written permission for the use of all disposal and borrow sites shall be obtained and copies shall be furnished to the ENGINEER.

2. Material testing reports including sieve analysis shall be submitted for Granular Material proposed for use as backfill.

1.04 JOB CONDITIONS

A. Protection

1. Protection of Plant Life

All trees, shrubs, and other types of vegetation not within the limits of the Work or not designated on the Plans or by the ENGINEER to be removed, shall be carefully protected from damage or injury during the various construction operations. Any tree, shrub or other type of vegetation not designated to be removed but which is damaged by the CONTRACTOR'S operation shall be repaired or replaced by the CONTRACTOR, at his expense, as directed by the ENGINEER.

2. Protection of Existing Structures and Improvements

All existing culverts, sewers, drainage structures, manholes, water gate wells, hydrants, water mains, utility poles, overhead lines, underground conduits, underground cables, pavement, or other types of improvements within the construction limits, not designated on the Plans or directed by the ENGINEER to be removed, shall be carefully protected from damage during the construction operations. Any type of existing structure or improvement not designated to be removed, but which is damaged by the CONTRACTOR'S operations shall be repaired or replaced by the CONTRACTOR, at his expense.

B. Maintaining Drainage

All existing open drains, field and roadway ditches, drainage tile, sewers, enclosed drains, natural and artificial watercourses, surface drainage or any other types of drainage within the limits of the Work shall be maintained and free to discharge during the excavating, backfilling and compacting operations.

Any drainage facility not designated to be abandoned, but which is damaged, and/or any drainage interrupted by the CONTRACTOR'S operation shall be immediately repaired, replaced, or cleared by the CONTRACTOR, as directed by the ENGINEER. All costs incurred shall be incidental to the excavating, backfilling and compacting or grading operations.

1.05 GUARANTEE

Existing trees destroyed by neglect of the General CONTRACTOR or his subcontractor's, will be replaced by the General CONTRACTOR. The tree value assessment shall be an average between the OWNERS estimator and the CONTRACTOR'S estimator. The assessors shall possess a Masters Degree in horticulture or have a minimum of ten (10) years horticulture experience. Replacement of tree species and location shall be determined by the ENGINEER.

PART 2 – PRODUCTS

2.01 MATERIALS

Suitable material shall be clean fine sand material with no more than 12% passing a No. 200 sieve and be free of rubble, organics, clay, debris, and other deleterious material and meeting the approval of the ENGINEER.

PART 3 – EXECUTION

3.01 PREPARATION

A. General

The CONTRACTOR and the ENGINEER shall meet before commencement of site clearing to discuss locations of top soil spoils, construction circulation and materials storage in relation to the preservation of existing plant materials. This meeting shall be requested by the CONTRACTOR two (2) weeks prior to site clearing operations commence.

B. Dewatering

Dewatering shall be in accordance with Section 02140 – Dewatering During Construction. The area within the vicinity of the new Work shall be dewatered prior to commencing any construction activities. The depth of the dewatering shall be sufficient to allow the Work area to remain in a dry condition during the various construction operations. The costs incurred for furnishing, installing, maintaining and removing the dewatering equipment shall be at the CONTRACTOR'S expense.

3.02 PERFORMANCE

A. General

The various construction operations shall be restricted to the existing right-of-way or as indicated on the Plans. If additional area is required, the CONTRACTOR shall furnish the ENGINEER with written permission obtained from the property owner for any part of the operations he conducts outside of the right-of-way or limits indicated. Barriers shall be installed in locations as directed by the ENGINEER.

B. Existing Utilities

When existing utilities are shown on the Plans, their locations are approximate only, as secured in the field investigation and from available public records. The CONTRACTOR, prior to the start of construction, shall contact Sunshine One Facilities Locating Service and/or the public agency or utility having jurisdiction to request the verification of all utilities within the construction area.

When existing utility lines, structures or utility poles are encountered during the performance of the Work, the CONTRACTOR, at his expense, shall perform his operations in such a manner that the service will be uninterrupted.

The CONTRACTOR shall expose all existing utility lines prior to any excavation operation, to determine any conflict with the proposed improvement. The CONTRACTOR shall be responsible for any relocation required as a result of any conflict of existing utilities with the proposed improvement.

Should it become necessary to move any utility structure, line or pole, whether called for on the Plans or otherwise found necessary to be moved, the CONTRACTOR shall make all arrangements with the Owner of the utility for the moving. All costs incurred for such moving shall be at the CONTRACTOR'S expense unless indicated otherwise. However, before disturbing a utility line, structure or pole, the CONTRACTOR shall furnish the ENGINEER with satisfactory evidence, in writing, that proper arrangements have been made with the Owner of the utility.

C. Existing Sewers, Tile and Mains

Existing sanitary sewers, storm sewers, drain tile, septic tank bed tiles, water mains or building services or leads, that are encountered during the performance of the Work that require relocation or are damaged, shall be restored with new materials equal in quality

and type to the materials encountered.

The new material shall be installed as specified on the Plans or as directed by the ENGINEER. The bedding and backfill material, unless otherwise specified, shall be an approved granular material, compacted to 95% of its maximum unit weight.

Seepage bed tile and water mains shall be replaced in accordance with the requirement of the appropriate local Department of Health.

The relocation or protection of existing sewers, tiles, tile field, water mains or building services and leads shall be at the CONTRACTOR'S expense, unless otherwise indicated in the Contract Documents.

D. Existing Structures

Existing surface and subsurface structures may be shown on the Plans, in locations considered most probable from information secured in the field investigation and from available public records. Neither the correctness nor completeness of such information is guaranteed or implied. All structures shall be protected, preserved or restored by the CONTRACTOR, at his expense.

Unless otherwise specified on the Plans, the CONTRACTOR, at his expense, shall remove any abandoned culvert, pipe, sewer, structure or part of a structure which is to be replaced or rendered useless by the new construction.

The structure shall be broken down to at least 12 inches below the subgrade. All pipes connected to the structure shall be plugged with a brick, masonry or concrete bulkhead approved by the ENGINEER. The remainder of the excavation shall be backfilled with a granular material, compacted in place, and shall meet with the approval of the ENGINEER.

If a structure is to be removed from a system that is to remain in service, a bypass system, approved by the ENGINEER, shall be installed and maintained by the CONTRACTOR, during the rebuilding period.

Salvaged materials derived therefrom shall become the property of the CONTRACTOR and unless otherwise specified on the Plans or in the Summary of Work, shall be disposed of by the CONTRACTOR, at his expense.

E. Trees

All trees except those specified on the Plans to be removed, shall be effectively protected by the CONTRACTOR during his construction operations. Individual trees to be preserved shall have tree protection barriers installed at the drip line of each tree.

F. Fences

Fences shall be removed and replaced or shall be removed as indicated on the Plans or as directed by the ENGINEER. If any of the existing material is damaged or destroyed, the CONTRACTOR shall replace the material at his expense.

Where fencing is encountered during construction, and its removal was not called for on the Plans or was not directed by the ENGINEER, it shall be replaced or restored, at the CONTRACTOR’S expense, to a condition comparable to that prior to construction.

After the fence removal or relocation operations are complete, all surplus material shall be removed and disposed of by the CONTRACTOR, at his expense, unless otherwise called for on the Plans or as directed by the ENGINEER.

Any holes or voids resulting from the fence removal operation shall be backfilled with a suitable material, approved by the ENGINEER.

Where fences are encountered that are being used to confine livestock or to provide security, the same shall be immediately replaced following the disturbance. During the disturbance, the CONTRACTOR, at his expense, shall provide, install and maintain a temporary fence, meeting the approval of the ENGINEER.

G. Guardrail

Beam guardrail and cable guardrail shall be relocated or shall be removed as specified on the Plans or as directed by the ENGINEER. If any of the existing material is damaged or destroyed, the CONTRACTOR shall replace the material at his expense.

Where guardrail is encountered during construction, and its removal was not called for on the Plans or was not directed by the ENGINEER, it shall be replaced or restored, at the CONTRACTOR'S expense, to a condition comparable to that prior to construction.

After the guardrail removal or relocation operations are complete, all surplus material shall be removed and disposed of by the CONTRACTOR, at his expense, unless otherwise called for on the Plans or as directed by the ENGINEER.

Any holes or voids resulting from the guardrail removal operation shall be backfilled with a suitable material, approved by the ENGINEER.

H. Adjust Structures

Structures to be adjusted shall be as called for on the Plans or as directed by the ENGINEER. Adjustment or structures shall apply where the elevation of the casting is either raised 12 inches or less, or lowered six (6) inches or less.

The existing frame and cover shall be carefully removed and stored, and shall be reinstalled on the same structure, unless a new frame and cover are called for on the Plans or as directed by the ENGINEER.

The brick or concrete adjustment rings shall be set in mortar or installed as recommended by the manufacturer and as approved by the ENGINEER.

The outside surface of the new brick or block structures shall receive a masonry plaster coat, a minimum of 2 inch thick.

The structure shall be properly backfilled with a granular material, compacted in place, and meeting the approval of the ENGINEER.

The flow in the entire system shall be maintained, at the CONTRACTOR's expense, while performing any part of the Work. Also, the structure shall be cleaned and all unsuitable material shall be disposed of at the CONTRACTOR's expense.

I. Holes

Earth removed during any phase of the excavation or removal operations, resulting in a

hole or void, shall be replaced by backfilling to the proposed subgrade with a suitable granular material approved by the ENGINEER. The material shall be placed and compacted to 95% of maximum unit weight as determined by modified proctor (ASTM D-1557). The material moisture content shall be within two percentage points of optimum.

The furnishing, placing, compacting, and testing of the backfill material shall be at the CONTRACTOR'S expense.

N. Restoration

Areas not paved shall be restored in accordance with the type and location specified herein unless indicated otherwise on the Plans. The disturbed areas may be shaped by Machine Grading or another method approved by the ENGINEER to achieve the line and grade shown on the Plans. Areas where slopes are 1 on 4 or flatter shall be restored with topsoil, seed and mulch. Areas with slopes steeper than 1 on 4 shall be restored with sod.

Any excess material from the restoration operation shall be disposed of by the CONTRACTOR at his expense.

The disturbed areas shall be graded to receive either topsoil and seed or topsoil and sod. The topsoil, seed, sod, fertilizer and mulch shall conform to the requirements specified on the Plans and Specifications.

The CONTRACTOR, at his expense, shall furnish, place, and compact any additional fill, meeting the approval of the ENGINEER, needed to restore the disturbed areas to the lines and grades called for on the Plans or as determined by the ENGINEER.

The CONTRACTOR, at his expense, shall restore all disturbed areas to their original condition, including storage areas, laydown areas, and parking areas to the satisfaction of the OWNER.

O. Soil Erosion and Sedimentation Control

If the permit is required, the CONTRACTOR, at his expense, shall prepare all plans, obtain all approvals, secure all permits and post all bonds and deposits required to comply with 2.01 Florida Environmental Land and Water Act of 1972 (380.012 F.S. et seq.) and related statutes.

The CONTRACTOR shall provide the ENGINEER with a copy of the soil erosion permit issued by the local enforcing agency for the Project, prior to commencing any type of earthwork on the Project.

P. Excess Excavation

Excess excavation shall be defined as all surplus earth material realized from the construction that is free of brush, roots, stumps, broken concrete, pipe, debris, and other extraneous material.

The CONTRACTOR shall transport all excess excavation to a site(s) approved by the OWNER. The excess excavation shall be graded by the CONTRACTOR to provide positive surface drainage of the site(s). The grading shall be done such that adjacent properties are not damaged or affected. The grading shall include removal of all surface irregularities to provide a smooth surface (± 0.25 foot). The CONTRACTOR shall be responsible for obtaining and paying for any required permits.

Proper disposal of all excess excavation, including transportation, grading, protection of adjacent properties and soil erosion control, shall be considered as a final cleanup item. No additional payment will be made for this item.

Any brush, roots, stumps, broken concrete, pipe, debris, and other extraneous material from the construction shall become the property of the CONTRACTOR and shall be disposed of at proper repository. Removal and disposal of this material shall be considered as part of final cleanup. No additional payment will be made for this item.

OWNER approval of the final site(s) condition in writing will be required prior to final payment authorization.

3.03 MAINTENANCE

Maintain tree protection barriers during the entire course of construction. Any position of a barrier which has been destroyed will be replaced at the start of the next working day.

Do not allow vehicular or pedestrian violation of the tree protection barrier. Do not store materials within tree protection barrier limits.

END OF SECTION

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SECTION 02215
SITE GRADING

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes site grading as indicated on the Plans, complete with removing and salvaging topsoil, rough grading and finish grading.

B. Related Work Specified Elsewhere

1. Section 01025: Measurement and Payment
2. Section 02100: Clearing and Grubbing
3. Section 02200: General Earthwork

PART 2 – PRODUCTS

2.01 MATERIALS

A. Suitable material shall be clean fine sand material with no more than 12% passing a No. 200 sieve and be free of rubble, organics, clay, debris, and other deleterious material and meeting the approval of the ENGINEER.

PART 3 – EXECUTION

3.01 PERFORMANCE

A. Site Grading

Sites shall be graded as specified on the Plans or as directed by the ENGINEER. The CONTRACTOR shall carry out the grading operation to prevent standing water and soil saturation detrimental to structures and improvements. Provisions shall be made to preserve and protect trees and other vegetation specified on the Plans or directed by the ENGINEER not to be removed.

B. Removing Topsoil

Topsoil shall be removed from the site in an amount equivalent to the quantity required by the Plans. Topsoil shall be disposed of by the CONTRACTOR at his expense.

Before removing topsoil, all vegetation shall be reduced to a height of approximately four (4) inches and all such vegetation and all brush, stones, rocks, and any other objectionable litter or foreign material shall be removed and disposed of before the ground is broken for topsoil removal.

Equipment and methods of operations shall be such as to avoid the lifting of the subsoil. If soil or weather conditions are unsuitable, the CONTRACTOR shall cease stripping until directed by the ENGINEER that stripping can resume.

Topsoil shall be removed within the grading limits for cuts and shall be removed to a width

and depth specified on the Plans or as directed by the ENGINEER.

The topsoil shall be stockpiled within the limits of construction in areas designated on the Plans or as directed by the ENGINEER. Stockpiles shall be located and shaped so as to avoid diversion of storm water runoff, either in or out of the limits of construction, towards buildings, creation of standing water or interference of controlled irrigation. The stockpile shall avoid placing topsoil around trunks and root areas of trees to be preserved.

Topsoil shall be kept separate from other excavated materials and shall be completely removed from any designated area prior to the beginning of regular excavation or fill in the area.

The topsoil stockpiles shall be located as near the original locations as possible and no payment will be made for overhaul.

C. Rough Grading

The site shall be graded as necessary to comply with the Plans or as directed by the ENGINEER. The subgrade shall be roughly established by cut or fill, approximately parallel to proposed finished grades and to elevations which allow for thickness of topsoil and installation of site or roadway improvements.

In fill areas all debris shall be removed from the area to be filled. All material detrimental to site improvement shall be removed from the site and acceptably disposed of as specified in General Earthwork, of the Specifications.

Original ground on sloping sites shall be scarified and benched or otherwise treated to provide adequate bond and to prevent slippage of fill.

Suitable fill material shall be placed in loose 12-inch lifts and compacted to at least 95% of the maximum dry density as determined by Modified Proctor (ASTM D-1557) at a moisture content within two percentage points of optimum. Density testing shall be at the expense of the CONTRACTOR. Field density tests shall be conducted at least once per lift per 5000 square feet in areas which are not related to structures. Density test reports shall be submitted to the ENGINEER.

The OWNER reserves the right to employ third party testing, at the OWNER's expense. The CONTRACTOR shall be responsible for costs incurred to remove, replace, and retest materials which fail to meet the placement specifications.

D. Finish Grading

The subgrade shall be smoothed parallel to proposed finished grades and elevations specified on the Plans. The subgrade shall be scarified to assure bond with the topsoil prior to spreading of the topsoil.

The topsoil shall be spread uniformly to provide a smooth, even surface at a finish grade specified on the Plans or acceptable to the ENGINEER. Topsoil shall be spread only after the ENGINEER has approved the subgrade. After spreading, the topsoil shall be compacted lightly as necessary to minimize settlement. Final grades shall not vary more than 1/10 of a foot from the elevations indicated on the Plans.

END OF SECTION

SECTION 02223
STRUCTURAL EXCAVATION AND BACKFILL

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes excavation for structures, removal and disposal of excavated materials, backfilling, backfill materials and compaction.

B. Related Work Specified Elsewhere

1. Section 02100: Clearing and Grubbing
2. Section 02140: Dewatering during Construction
3. Section 02200: General Earthwork
4. Section 02215: Site Grading

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

1. ASTM - American Society of Testing and Materials
2. AASHTO - American Association of State Highway Transportation Officials
3. FDOT - Florida Department of Transportation

1.03 SUBMITTAL

A. Test Reports

1. Compaction

a. The CONTRACTOR shall provide the ENGINEER with test results of the compaction of the backfill. The testing for compaction shall be performed by a testing laboratory approved by the ENGINEER. The test results shall be signed and sealed by a Professional Engineer. Compaction testing shall be at the CONTRACTOR's expense.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Suitable material shall be clean fine sand material with no more than 12% passing a No. 200 sieve and be free of rubble, organics, clay, debris, and other deleterious material and meeting the approval of the ENGINEER.

PART 3 – EXECUTION

3.01 PREPARATION

A. Dewatering

1. The area within the vicinity of the new Work shall be dewatered in accordance with Section 02140 prior to the excavation operation. The depth of the dewatering shall be sufficient to allow the excavation to remain in a dry condition during the construction of the structure, including the excavating, backfilling and compacting operations.

3.02 PERFORMANCE

A. Excavation

1. Excavation shall include the site clearing and grubbing, the excavating and disposing of all materials encountered, the supporting and protecting of all structures and/or utilities encountered above and below the ground surface, and the removal of water from the construction site. Excavation shall also include the removal of existing structures, as shown on the Plans or as directed by the ENGINEER. Rock excavation, if applicable, shall be performed as a part of the excavation in accordance with specifications contained elsewhere.

2. The CONTRACTOR shall keep the limits of his excavation operations within a reasonably close conformity with the location and grade, of each structure.

3. The excavated materials shall be temporarily stored in a manner that will not cause damage to trees, shrubs, fences, improvements, utilities, private property or traffic. The excavated materials shall not be placed at such locations that will endanger the banks of the excavation by imposing loads thereon.

4. The excavation shall be of sufficient size to allow for the construction of the new Work, the placing and compacting of the backfill and for the dewatering operation.

5. When concrete is to bear on or against an excavated surface other than rock, special care shall be taken not to disturb the surface. The final removal of the foundation material to grade shall not be made until just prior to the placing of the concrete.

6. Concrete shall not be placed until the depth of the excavation has been checked and the suitability of foundation material has been reviewed by the ENGINEER.

7. Excavated material, determined by the ENGINEER as suitable for backfill may be used. All excess materials shall be disposed by the CONTRACTOR, at his expense, as specified in General Earthwork, of the Specifications.

8. The elevations for the bottom of footings shall be subject to such changes as are necessary to insure a satisfactory foundation. Any changes required shall be reviewed by the ENGINEER prior to making the change.

9. The surface of all rock or other hard material upon which concrete is to be placed shall be freed from all loose fragments, cleaned and cut to a firm surface. The surface shall be level, stepped or serrated, as shown on the Plans.

10. All unsound material underlying proposed structures shall be removed and replaced with suitable fill approved by the ENGINEER. Suitable fill material shall be placed in loose 12-inch lifts and compacted to at least 95% of the maximum dry density as determined by Modified Proctor (ASTM D-1557) at a moisture content within two percentage points of optimum.

B. Subgrade Preparation

1. Building/structure and tank areas shall be proof-rolled to provide a stable and unyielding subgrade prior to placing fill.

2. Proof rolling shall consist of compaction with a large diameter vibratory drum roller. The roller shall have a drum weight of at least ten tons. Proof-rolling shall consist of a minimum of ten overlapping passes in a criss-cross pattern with a maximum travel speed of two feet per second.

3. The CONTRACTOR shall be responsible for protection of adjacent structures to prevent damage due to compaction equipment.

4. Areas observed to be soft or yielding shall require over-excavation and backfilling with suitable material.

5. Subgrade shall be compacted to at least 95% of the material's maximum dry density as determined by Modified Proctor (ASTM D-1557). Soil moisture conditioning may be required to meet this requirement.

C. Sheeting, Shoring, and Bracing

1. The CONTRACTOR shall furnish, place and maintain at all times such sheeting, shoring, and bracing of the excavated area as may be required for safety of the workmen and for protection of the new Work or adjacent structures, including pavement, curbs, sidewalks, pipelines and conduits next to, or crossing the excavated area, and for the protection and safety of pedestrian and vehicular traffic.

2. The CONTRACTOR shall be responsible for the complete design of all the sheeting, shoring, and bracing Work. Prior to installing the sheeting, shoring or bracing, the CONTRACTOR shall submit Plans for this Work to the ENGINEER for his information.

3. Sheeting, shoring and bracing shall conform to current federal or state regulations for safety.

4. Where indicated on the Plans and where necessary in the Work, install and leave sheeting, shoring and bracing in place. No extra compensation shall be paid to the CONTRACTOR for sheeting, shoring or bracing left in place.

5. Supports for pipes, conduits, etc., crossing the excavated area shall conform to the requirements of the owners of such facilities and if necessary, shall be left in place.

6. The furnishing, placing, maintaining and removing of sheeting, shoring and bracing materials shall be at the CONTRACTOR'S expense.

7. The CONTRACTOR shall not remove the sheeting, shoring or bracing until the structure has obtained sufficient strength to support the external loads. The sheeting, shoring and bracing material shall not come in contact with the structure, but shall be installed so that no concentrated loads or horizontal thrusts are transmitted to the structure.

D. Backfill

1. Backfill material shall be placed only after the new Work and backfill material have been inspected by the ENGINEER.

2. Backfill shall not be placed against any portion of the new Work until the required curing, surface finishing and waterproofing of such portions have been completed. Backfill, which will place an unequalized horizontal loading on the new Work, shall not be placed until the concrete has attained at least 70% of its design strength. To equalize horizontal loadings, the required backfill around the new Work shall be placed on opposite sides at the same time.

3. Granular material acceptable to the ENGINEER shall be used for backfilling the new Work unless otherwise indicated on the Plans or within these specifications. Material from the excavation may be used for backfill if approved by the ENGINEER.

4. Large stones, boulders, broken rocks, concrete, and masonry shall not be used in the backfill.

5. The backfill shall be carried up to the surface of the adjacent ground or to the elevation of the proposed grade, and its top surface shall be neatly graded. Fills around all new Work shall be trimmed to the lines shown on the Plans or as directed by the ENGINEER.

E. Compacting Backfill

1. Suitable fill material shall be placed in loose 12-inch lifts and compacted to at least 95% of the maximum dry density as determined by Modified Proctor (ASTM D-1557) at a moisture content within two percentage points of optimum. Density testing shall be at the expense of the CONTRACTOR.

2. The OWNER reserves the right to employ third party testing, at the OWNER's expense. The CONTRACTOR shall be responsible for costs incurred to remove, replace, and retest materials which fail to meet the placement specifications.

3. Compaction of the backfill will not be paid for separately, but shall be considered incidental to the Work of backfilling and shall include all the Work of manipulating the soil to obtain the specified densities and quality control testing. No additional compensation will be allowed for any delay required to obtain the specified moisture content or the specified density.

F. Cleanup

1. Immediately following the placing and compacting of the backfill, the excess material shall be removed and disposed of by the CONTRACTOR, at his expense, as specified in General Earthwork, of the Specifications.

2. The construction area shall be graded and left in a neat, workmanlike condition.

3.03 FIELD QUALITY CONTROL

A. Testing

1. During the course of the Work, the ENGINEER will require testing for compaction or density of the backfill. The taking of samples and the testing required shall be

performed by a testing laboratory approved by the ENGINEER at no additional cost to the OWNER.

2. The CONTRACTOR shall furnish the ENGINEER with two (2) copies of the results of all tests. Test results shall be signed and sealed by a Professional Engineer.

3. Field density tests shall be conducted at least once per lift per 2500 square feet for areas of structural backfill. Density test reports shall be submitted to the ENGINEER.

B. Defective Work

1. Any portion of the backfill which is deficient shall be corrected by methods meeting the approval of the ENGINEER. Any additional testing or sampling required because of apparent deficiencies shall be at no additional cost to the OWNER.

END OF SECTION

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SECTION 02226
TRENCHING, BACKFILLING AND COMPACTION

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes open trench construction, complete with trenching, sheeting, shoring, bracing, backfilling, backfill materials and compaction.

B. Related Work Specified Elsewhere

1. Section 02100: Clearing and Grubbing
2. Section 02140: Dewatering during Construction
3. Section 02200: General Earthwork

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

1. ASTM - American Society of Testing and Materials
2. AASHTO - American Association of State Highway Transportation Officials
3. FDOT - Florida Department of Transportation
4. OSHA - Occupational Safety and Hazard Administration

1.03 SUBMITTALS

A. Test Reports

1. Compaction

a. The CONTRACTOR shall provide the ENGINEER with test results of the compaction of the backfill. The testing for compaction shall be performed by a testing laboratory approved by the ENGINEER. The test results shall be signed and sealed by a Professional Engineer. Compaction testing shall be at the CONTRACTOR's expense.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Suitable Fill

Suitable material shall be clean fine sand material with no more than 12% passing a No. 200 sieve and be free of rubble, organics, clay, debris, and other deleterious material and meeting the approval of the ENGINEER.

B. Concrete

The concrete shall conform to FDOT, Section 345, use Class I; 2,500-psi strength; Type I cement; 5.5 sacks cement per cubic yard; 5 coarse aggregate; silica sand fine aggregate; three (3) percent to six (6) percent air content; 3-inch maximum slump; no admixtures without the ENGINEER's review.

PART 3 – EXECUTION

3.01 PREPARATION

A. Dewatering

The area within the vicinity of the trenching operation shall be dewatered in accordance with Section 02140 prior to the trenching operation. The depth of the dewatering shall be sufficient to allow the trench excavation operation including backfilling and compacting to proceed in a dry condition.

3.02 PERFORMANCE

A. Trench Excavation

Open cut trench excavation shall include the site clearing and grubbing, the excavating and disposing of materials encountered, the supporting and protecting of all structures and/or utilities encountered above and below the ground surface, and the removal of water from the construction site.

The trench shall be excavated in reasonable close conformity with the lines and grades on the Plans or as established by the ENGINEER.

The excavated materials shall be temporarily stored along the trench in a manner that will not cause damage to trees, shrubs, fences, improvements, utilities, private property or traffic. The excavated materials shall not be placed at such locations that will endanger the trench banks by imposing loads thereon.

The trench shall be of sufficient width to provide adequate working space to permit the installation of the pipe and the compaction of the bedding material under and around the pipe. However, the width of the trench from below the pipe bedding to 12 inches above the top of the pipe shall not exceed the dimensions shown on the plans.

To support the additional load of the backfill when the maximum trench width as specified for rigid pipe is exceeded, the CONTRACTOR shall install, at his expense, concrete encasement which shall completely surround the pipe and shall have a minimum thickness at any point of 1/4 of the outside diameter of the pipe or four (4) inches, whichever is greater, or at his expense, install another type bedding, approved by the ENGINEER. The concrete encasement shall consist of 3,000 psi strength concrete.

To support the additional load of the backfill when the maximum trench width as specified for flexible or semi-rigid pipe is exceeded, the CONTRACTOR shall install, at his expense, standard pipe bedding to the full width between undisturbed trench walls or at least 2.5 pipe diameters on each side of the pipe.

When, through the CONTRACTOR's construction procedure or because of unsuitable existing ground conditions, it becomes impossible to maintain alignment and grade properly, the CONTRACTOR, at his expense, shall excavate below the normal trench bottom grade and shall fill the void with a large size aggregate or 2,500 psi concrete as approved by the ENGINEER to insure that the pipe when laid in the proper bedding will maintain correct alignment and proper grade.

All trench excavations, including those for shafts and structures, shall be adequately braced and/or sheeted where necessary to prevent caving or squeezing of the soil.

B. Sheeting, Shoring, and Bracing

The CONTRACTOR shall furnish, place and maintain at all times such sheeting, shoring, and bracing of the trench and/or shaft as may be required for safety of the workmen and for protection of the new Work or adjacent structures, including pavement, curbs, sidewalks, pipelines and conduits next to, or crossing the trench area, and for the protection and safety of pedestrian and vehicular traffic.

The CONTRACTOR shall be responsible for the complete design of all the sheeting, shoring, and bracing Work. Prior to installing the sheeting, shoring or bracing, the CONTRACTOR shall submit Plans for this Work to the ENGINEER for his information.

Sheeting, shoring and bracing shall conform to current federal or state regulations for safety.

Where indicated on the Plans and where necessary in the Work, install and leave sheeting, shoring and bracing in place. No extra compensation shall be paid to the CONTRACTOR for sheeting, shoring or bracing left in place.

Supports for pipes, conduits, etc., crossing the trench shall conform to the requirements of the owners of such facilities and if necessary, shall be left in place.

The furnishing, placing, maintaining and removing of sheeting, shoring and bracing materials shall be at the CONTRACTOR'S expense.

The CONTRACTOR shall not remove the trench sheeting, shoring or bracing unless the pipe has been properly bedded and the trench backfilled to sufficiently support the external loads. The sheeting, shoring and bracing material shall not come in contact with the pipe, but shall be installed so that no concentrated loads or horizontal thrusts are transmitted to the pipe.

C. Backfilling Trenches

Backfill material shall be placed on sections of bedded pipes only after such pipe bedding and backfill materials have been approved by the ENGINEER.

The trench backfilling shall follow the pipe laying as closely as possible. However, at no time shall the pipe laying in any trench precede backfilling of that trench by more than 100 feet, unless otherwise directed by the ENGINEER.

The backfill material shall be placed and compacted to the maximum dry density as

specified on the Plans for the type of trench being backfilled.

Compaction tests shall be conducted at least every 300 linear feet of trench or as required by the ENGINEER.

Compaction of the backfill will not be paid for separately, but shall be considered incidental to the Work of backfilling and shall include all the Work of manipulating the soil to obtain the specified densities, and compaction testing. No additional compensation will be allowed for any delay required to obtain the specified moisture content or the specified density.

D. Cleanup

Immediately following the placing and compacting of the backfill, the excess material shall be removed and disposed of by the CONTRACTOR, at his expense, as specified in General Earthwork, of the Specifications.

The construction area shall be graded and left in a neat, workmanlike condition.

3.03 FIELD QUALITY CONTROL

A. Testing

1. During the course of the Work, the ENGINEER will require testing for compaction or density of the backfill. The taking of samples and the testing required shall be performed by a testing laboratory approved by the ENGINEER at no additional cost to the OWNER.

2. The CONTRACTOR shall furnish the ENGINEER with two (2) copies of the results of all tests. Test results shall be signed and sealed by a Professional Engineer.

3. Field density tests shall be conducted at least once per lift per 300 linear feet. Density test reports shall be submitted to the ENGINEER.

B. Defective Work

Any portion of the backfill which is deficient in the specified density shall be corrected by the methods meeting the approval of the ENGINEER. Any extra testing or sampling required because of apparent deficiencies shall be at the CONTRACTOR'S expense.

END OF SECTION

SECTION 02229
EARTHWORK FOR PAVING

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes Earthwork for Paving complete with excavation; subgrade undercut and backfill, embankments; subbase; ditching; restoration; complete with materials, field quality control and appurtenances.

B. Related Work Specified Elsewhere

1. Section 01025: Measurement and Payment
2. Section 02200: General Earthwork
3. Section 02230: Base Courses

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

1. ASTM - American Society for Testing and Materials
2. AASHTO - American Association of State Highways and Transportation Officials
3 FDOT - Florida Department of Transportation

1.03 SUBMITTALS

A. Test Reports

1. Sieve Analysis
   a. The testing lab shall provide the ENGINEER with the sieve analysis of the backfill material. The testing of the material shall be performed by a testing laboratory approved by the ENGINEER. Test results shall be signed and sealed by a Professional Engineer. Testing shall be at the CONTRACTOR's expense.

2. Compaction and Moisture Testing
   a. The testing lab shall provide the ENGINEER with the compaction and moisture tests of the backfill and subgrade materials. The testing of the materials shall be performed by a testing laboratory approved by the ENGINEER. Test results shall be signed and sealed by a Professional Engineer. Testing shall be at the CONTRACTOR's expense.

3. Bearing Value
   a. The testing lab shall provide the ENGINEER with the bearing value of the subgrade and/or subbase materials. The testing of the materials shall be performed by a testing laboratory approved by the ENGINEER. These results shall be signed and sealed by a Professional Engineer. Testing shall be at the CONTRACTOR's expense.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Suitable Material

Suitable material shall be clean fine sand material with no more than 12% passing a No. 200 sieve and be free of rubble, organics, clay, debris, and other deleterious material and meeting the approval of the ENGINEER.

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

A. Existing Improvements

The CONTRACTOR shall expose any existing infrastructure to which the new Work is to be connected and notify the ENGINEER of same. The CONTRACTOR will verify the vertical and horizontal locations of the existing system and shall inform the ENGINEER if the locations differ from the Contract Drawings.

3.02 PERFORMANCE

A. General

1. The CONTRACTOR shall rough grade as close as possible to finished subgrade leaving a minimum to be removed in fine grading.

2. During the excavation operation, including the placing of the subbase, the Work area shall be kept free of water. A dewatering system shall be provided and maintained by the CONTRACTOR at his expense. The dewatering system shall remain in operation as directed by the ENGINEER.

3. The finish subgrade surface shall not vary more than 1-inch in ten (10) feet.

B. Pavement Excavation

1. Pavement excavation shall consist of all Work required to construct the earth grade and its appurtenances true to the lines, grades, and cross sections called for on the Plans and in accordance with these Specifications. Excavation shall consist of the following items, any or all of which may be included or incidental to it; removing trees, stumps, hedges, roots, salvaging and stockpiling topsoil, subgrade or subbase stabilization, excavation for structures, trimming and finishing earth grade, fine grading, right-of-way ditching and restoration, and the disposal of all unsuitable material.

2. All large stones, trees, stumps, brush, shrubs, logs, matted roots, other vegetation and debris occurring between lines three (3) feet outside the grading limits shall be completely removed and properly disposed of as specified in Section 02100, Clearing and Grubbing.

3. All earth and other existing materials shall be excavated for the full depth and width of the cross section as shown on the Plans.

4. Excess excavated material shall be removed from the project by the CONTRACTOR along approved routes to disposal sites approved by the OWNER. Disposal of excess excavation and maintenance of the dump sites shall be considered incidental to the price paid for excavation and shall be as specified in Section 02200, General Earthwork.

C. Utility Poles

The CONTRACTOR shall coordinate any removal or relocation required as a result of any conflict of existing utility poles with proposed improvements.

D. Holes

1. Earth removed during any phase of the excavation or removal operations, resulting in a hole or void, shall be replaced by backfilling to the proposed subgrade with a suitable granular material approved by the ENGINEER. The material shall be compacted to 95% of maximum unit weight as determined by Modified Proctor (ASTM D-1557).

2. The furnishing, placing, compacting, and testing of the backfill material shall be at the CONTRACTOR'S expense.

G. Unsuitable Subgrade Excavation

1. Unsuitable subgrade excavation shall be the operation of removing unsuitable soils, as determined by the ENGINEER in cut areas after the subgrade has been established.

2. The areas excavated of unsuitable material shall be backfilled with suitable fill. The backfill shall be compacted as noted on the Contract Drawings.

K. Subgrade

1. The area to be paved shall be excavated and graded to the line, grade and cross section as indicated on the Plans.

2. When called for on the Plans or in the Specifications the designated portions of the roadbed shall be stabilized to provide a firm and unyielding subgrade, having the required bearing value specified on the plans. The subgrade should be compacted and tested as shown on the Contract Drawings.

3. The subgrade between lines two (2) feet on either side of the proposed edge of pavement or curb shall be compacted to 95% of the maximum unit weight for a depth of eight inches.

4. The subgrade shall be completed ahead of placing forms a distance equal to the distance of one (1) days average paving operation. Prior to the paving operation, the subgrade shall be shaped and compacted to the Plan cross section by approved mechanical means.

L. Subbase

1. Subbase material shall be evenly spread and compacted.

2. The thickness of each layer placed shall be determined by the required density obtained but shall not exceed 12 inches in depth, loose measure.

3. The subbase shall be constructed to the alignment, grade and cross section shown on the Plans. Should the subgrade at any time prior or during the placing of the subbase become soft or unstable so that rutting occurs in the subgrade, or if the subgrade material is forced up into the subbase material, the operation shall immediately cease and the mixed material shall be removed and disposed of. The subgrade shall be corrected and new subbase material placed and compacted, and shall be considered incidental to the construction of the Project.

M. Roadway Ditching

1. Ditching shall be constructed at the locations called for on the Plans or as directed by the ENGINEER. The ditch may be shaped by Machine Grading or another method approved by the ENGINEER to achieve the cross section, line and grade shown on the Plans.

2. The excess material from the ditch construction shall be disposed of by the CONTRACTOR at his expense.

3. The ditch section shall be graded to receive either topsoil and seed or topsoil and sod. The topsoil, seed, sod, fertilizer and mulch shall conform to the requirements specified on the Plans and in Section 02940, Sodding.

4. The CONTRACTOR, at his expense, shall furnish, place and compact any additional material needed to construct the ditch at the location and cross sections called for on the Plans.

N. Machine Grading

1. The Work of machine grading shall consist of light grading of such character that, in general, the excavation from ditches and roadbed will be utilized in shaping shoulders and adjacent shallow fills and the work can be performed by a blade grader or similar equipment. Machine grading shall apply on the sections shown on Plans or specified in the Proposal.

2. The Work shall include all necessary scarifying, plowing, disking, moving and shaping the earth to develop the cross section shown on Plans. Ditches shall be in reasonably close conformity with the line and grade as shown on the Plans or as directed and must drain runoff waters to outlets shown on the Plans or designated by the ENGINEER. The roadbed shall be finished to grade with a blade grader or equivalent equipment. All intersections, approaches, entrances, and driveways shall be graded as shown or as directed, except that loading and hauling of earth will not be required as part of this Work.

O. Trimming and Finishing Earth Grade

1. After the earth grade has been constructed to the required grade, all stones and rocks more than three (3) inches in diameter, appearing on the surface of the subgrade shall be removed.

2. The earth grade and the subgrade shall be trimmed to the grade called for on the Plans. The subgrade, where a subbase is required, shall be trimmed to the

established grade within ± 0.1 foot. Where a subbase is not required, the subgrade shall be trimmed to the established grade within ± 3/4 inch.

3. The earth grade outside the subgrade shall be trimmed, all irregularities made smooth and the entire site or roadway completed to the required lines, grades, and cross sections. Backslopes and fill slopes shall be finished as specified or required.

3.03 FIELD QUALITY CONTROL

A. Testing

The CONTRACTOR will test for compaction and moisture of the backfill and subgrade materials, sieve analysis of the backfill and subgrade materials, and bearing valve of the subgrade. The taking of samples and the testing required shall be performed by a testing laboratory approved by the ENGINEER. The ENGINEER shall determine the location and number of samples to be made. The testing laboratory shall furnish the ENGINEER with two (2) certified copies of the results of all tests. Testing procedures shall conform to current FDOT Standards for Construction.

The testing frequency of soil shall be coordinated with input from the ENGINEER. The decision on the testing frequency is determined on the basis of results obtained from the previous tests, soil type, and existing conditions found in the field.

B. Defective Work

1. Any portion of the backfill or subgrade which is deficient in the specified density or bearing valve shall be corrected by methods meeting the approval of the ENGINEER.

2. Any extra testing or sampling required by the ENGINEER, because of deficiencies, shall be at the CONTRACTOR'S expense.

END OF SECTION

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SECTION 02230
BASE COURSES

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes base courses constructed by one (1) of the following methods:

1. Limerock Base

The work specified in this Section consists of the construction of a base course composed of limerock or asphalt base course(s). It shall be constructed on the prepared subgrade, in accordance with these specifications and in conformity with the lines, grades, notes and typical cross section shown in the plans.

2. Limerock Stabilized Base

The work specified in this Section consists of the construction of a base course composed of roadbed soil stabilized with limerock, in accordance with these specifications and in conformity with the lines, grades, notes and typical cross section shown in the plans.

3. Crushed Concrete Base

The work specified in this Section consists of the construction of a base course composed of crushed concrete, on the prepared subgrade, in accordance with these specifications and in conformity with the lines, grades, notes, and typical cross sections shown in the plans.

When the specified compacted thickness of the base is greater than six (6) inches the base shall be constructed in two (2) or more courses. The thickness of the first course shall be approximately one-half the total thickness of the finished base, or enough additional to bear the weight of the construction equipment without disturbing the subgrade.

B. Related Work Specified Elsewhere

1. Section 01025: Measurement and Payment
2. Section 02200: General Earthwork
3. Section 02229: Earthwork for Paving
4. Section 02510: Bituminous Paving

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

1. ASTM - American Society of Testing and Materials
2. AASHTO - American Association of State Highways and Transportation Officials
3. FDOT - Florida Department of Transportation

B. Allowable Tolerances

1. Base Courses
   a. The finished surface shall be shaped to conform to within a tolerance of 3/4 inch in ten (10) feet to the cross section and grades called for on the Plans.

1.03 SUBMITTALS

A. Test Reports

1. Thickness
   a. The testing lab shall provide the ENGINEER with two (2) copies of the test results of the thickness of the compacted base. The core drilling and testing for thickness shall be performed by a testing laboratory approved by the ENGINEER. Test results shall be signed and sealed by a Professional Engineer.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

The base course material shall be transported to the point where it is to be used, over material previously placed if practicable, and dumped on the end of the preceding spread. Hauling over the subgrade and dumping on the subgrade will be permitted when, in the ENGINEERS opinion, these operations will not be detrimental to the base.

1.05 JOB CONDITIONS

A. Environmental Requirements

1. Temperature
   a. Comply with the requirements for aggregate base course installations due to outside ambient air temperatures specified under Article 3.03 of this Section.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Limerock Base

The limerock material shall meet the requirements of FDOT Section 911. At the CONTRACTORS option limerock of either Miami or Ocala formation may be used, but limerock of only one (1) formation may be used on any contract. (Limerock may be

referred to hereinafter as rock.)

B. Limerock Stabilized Base

The stabilizing material used for this construction shall consist of limerock meeting the requirements of FDOT Section 911, as specified for the material to be used in this work.

C. Crushed Concrete Base

The materials used shall conform with the requirements specified in FDOT Section 204 and FDOT Section 901-5. Before any base course material is used it shall first have been tested by the laboratory and approved by the ENGINEER.

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

A. Excavation

Prior to the placing of any base material, examine the excavation for the grades, lines, and levels required to receive the new work. Ascertain that all excavation and compacted subgrades are adequate to receive the new work. Correct all defects and deficiencies before proceeding with the Work.

B. Subgrade Conditions

Prior to the placing of any base material, examine the subgrade to ascertain that it is adequate to receive the base to be placed. If the subgrade remains wet after all surface water has been removed, the ENGINEER may require the installation of edge drain.

C. Existing Improvements

Investigate and verify locations of existing improvements, including structures, to which the new work will be in contact.

Necessary adjustments in line and grade, to align the new work with the existing improvements must be approved by the ENGINEER, prior to any changes.

3.02 PREPARATION

A. Subgrade

The subgrade shall be fine graded to the cross section indicated on the Plans, and shall be thoroughly compacted prior to the placing of the base material.

3.03 INSTALLATION

A. General

The width, thickness and type of base materials shall be installed as indicated on the Plans or as directed by the ENGINEER.

No base material shall be placed until the subgrade, or subbase, or existing surface has

been approved by the ENGINEER.

B. Limerock and Shell Base Courses

The base course shall be placed by a mechanical spreader or other approved means, in uniform layers to such a depth that when compacted, the base course will have the thickness shown on the Plans.

The depth of any one (1) layer, when compacted, shall not be more than six (6) inches. If the required compaction cannot be obtained for the full depth of the base course spread, the thickness of each course shall be reduced or at the approval of the ENGINEER, adequate equipment shall be used to compact the aggregate to the required unit weight.

The subgrade shall be shaped to the specified crown and grade and maintained in a smooth condition. If hauling equipment causes ruts or holes in the subgrade, the hauling equipment will not be permitted on the subgrade, but shall be operated on the base course behind the spreader.

The base course shall be compacted to at least 98% of maximum unit weight as determined by AASHTO T180, by the use of approved pneumatic-tired compaction equipment or vibratory compactors.

The optimum moisture content shall be maintained until the prescribed unit weight is obtained and each layer shall be compacted until the maximum unit weight is attained before placing the succeeding layer.

When approved by the ENGINEER, additional water may be applied by an approved means, to the base course to aid in the compaction and shaping of the material.

Motor graders or other approved equipment shall be used to shape the base course and maintain it until the surface course is placed.

When hauling material over the base course or subgrade, the CONTRACTOR shall limit the weight and speed of his equipment to avoid damage to the subgrade or base course. If the subgrade or base course becomes rutted due to the CONTRACTORS operation, the subgrade or base course shall be removed and replaced, acceptable to the ENGINEER, at the CONTRACTORS expense.

C. Limerock and Shell Stabilized Base Courses

The area to be stabilized shall have been completed to the lines shown in the plans and to a grade parallel to the finished elevation of the stabilized base, before the stabilizing material is added. The elevation of the roadbed shall be such that the base will conform to the requirements of the typical cross section when the work is completed. Any surplus excavated materials resulting from this work shall be disposed of as specified in Article 3.02 of Section 02229, Earthwork For Paving.

The base material shall be mixed using a heavy-duty rotary tiller or other equipment approved by the ENGINEER.

The stabilizing material shall be placed on the areas to be stabilized, and spread uniformly to the loose depth shown in the plans or ordered by the ENGINEER. The stabilizing material shall then be thoroughly mixed with the soil. The mixing shall be done as soon

as practicable but not later than one week after the stabilizing material is placed on the road. At no time shall more stabilizing material be spread in advance of the mixing operations than can be mixed in with the soil within one (1) week.

The mixing operations shall be repeated as often as may be necessary to distribute the stabilizing material uniformly throughout the soil, as determined by the ENGINEER. The material shall be further manipulated until uniform distribution of the stabilizing material throughout the width and depth of the base course is secured.

Mixing of the soil, limerock or shell and water may be accomplished by the central plant mix method in lieu of mixing in place, provided that a uniform mixture, containing the proper amount of water, is obtained.

After mixing is completed the surface shall be so shaped that after being compacted it will conform to the grade and typical cross section shown in the plans.

The depth of mixing of the stabilizing material shall be in accordance with the following table:

SPECIFIED BASE THICKNESS (INCHES)	REQUIRED MIXING DEPTH (INCHES)	
	MINIMUM	MAXIMUM
6	5-1/2	7-1/2
8	7-1/4	9-3/4
10	9	12

In the event that the measured depth of mixing is less than the minimum specified above, the CONTRACTOR shall remix the base course, as directed by the ENGINEER, until the stabilizing material is distributed throughout the base course to the required depth.

Where the measured depth of mixing exceeds the maximum limits specified in the table, the CONTRACTOR shall, at his own expense, add 1-inch, loose measure, of stabilizing material for each inch of mixing depth in excess of the allowable depth (but in no case less than 1-inch of material, for any excess depth), and shall mix the added material in the top six (6) inches of the base, as specified above. The volume of stabilizing material which is added to compensate for excess mixing depth will not be included in the pay quantity, nor will any additional compensation be allowed for the extra mixing required.

After the spreading and mixing of the limerock or shell are completed, compaction shall be accomplished by rolling with either a grid-type roller or a sheepsfoot roller, properly weighted, and with water being added as required. This rolling shall be to the extent directed by the ENGINEER. Final rolling shall be accomplished with traffic rollers and any other compaction equipment which will obtain the specified density.

The material shall have approximately the optimum moisture content and the proper loose consistency, as determined by the ENGINEER, before being compacted. Wetting or drying will be required when the material does not have the proper moisture content to insure the required density. If the material is deficient in moisture, water shall be added and uniformly mixed-in by disking the base course to its full depth. If the material contains an excess of moisture, it shall be caused to dry before being compacted. Wetting or drying operations shall involve manipulation of the entire width and depth of the base as a unit. As soon as proper conditions of moisture are attained the material shall be compacted to a density not less than 98% of the maximum density as determined by AASHTO T 180. The minimum density which will be acceptable at any location outside

the traveled roadway, such as intersections, crossovers, etc., shall be 95% of such maximum.

Each course of multiple-course base shall be compacted as specified above. Prior to the placing of material for the overlying course, the density tests shall have been made on the lower course and the ENGINEER shall have determined that the specified compaction requirements have been met. In the compaction of the upper course the operations of wetting, disking, etc., shall not be such as to disturb the density in the lower course. For multiple-course base the density shall be determined separately for each layer.

The areas being stabilized shall be kept well drained at all times. Wherever ruts or low spots are found the areas affected shall be brought to grade and, if necessary, shall be reshaped and recompacted. The surface of the completed stabilized base, when subjected to traffic, shall be kept moist until the prime coat is applied, so as to prevent dusting and raveling. The base shall be sprinkled with water occasionally, if so directed by the ENGINEER. The CONTRACTOR shall maintain the stabilized base to a true and satisfactory surface and to the specified density until the wearing surface is constructed.

D. Crushed Concrete Base

The composition of the crushed concrete base material shall meet the requirements of FDOT Section 204 and FDOT Section 901-5. The placement and density of the crushed concrete base shall meet the requirements of FDOT Section 200.

The crushed concrete base course shall be placed by a mechanical spreader or other approved means, in uniform layers to such a depth that when compacted, the base course will have the thickness shown on the Plans. Spreading by other means shall be permitted only where and as directed by the ENGINEER.

The depth of any one (1) layer, when compacted, shall not be more than six (6) inches. If the required compaction cannot be obtained for the full depth of the base course spread, the thickness of each course shall be reduced or at the approval of the ENGINEER, adequate equipment shall be used to compact the aggregate to the required unit weight.

The subgrade shall be shaped to the specified crown and grade and maintained in a smooth condition. If hauling equipment causes ruts or holes in the subgrade, the hauling equipment will not be permitted on the subgrade, but shall be operated on the base course behind the spreader.

The base course shall be compacted to at least 100% of maximum unit weight as determined by AASHTO T180, by the use of approved pneumatic-tired compaction equipment or vibratory compactors.

The optimum moisture content shall be maintained until the prescribed unit weight is obtained and each layer shall be compacted until the maximum unit weight is attained before placing the succeeding layer.

When approved by the ENGINEER, additional water may be applied by an approved means, to the base course to aid in the compaction and shaping of the material.

Motor graders or other approved equipment shall be used to shape the base course and maintain it until the surface course is placed.

When hauling material over the base course or subgrade, the CONTRACTOR shall limit the weight and speed of his equipment to avoid damage to the subgrade or base course.

If the subgrade or base course becomes rutted due to the CONTRACTORS operation, the subgrade or base course shall be removed and replaced, acceptable to the ENGINEER, at the CONTRACTOR'S expense.

E. Temperature Limitations

Base course materials shall not be placed when there are indications that the mixtures may become frozen before the maximum unit weight is obtained.

In no case shall the base course be placed on a frozen subgrade or subbase unless otherwise directed by the ENGINEER.

F. Maintenance during Construction

The base course shall be continuously maintained in a smooth and firm condition during all phases of the construction operation.

The CONTRACTOR, at his expense, shall provide additional materials to fill depressions or bind the aggregate, when directed by the ENGINEER.

G. Cleanup

Immediately following the compacting of the base course, the voids on both sides of the base course shall be backfilled with sound earth of topsoil quality.

The backfill shall be compacted, leveled and left in a neat, workmanlike condition.

3.04 FIELD QUALITY CONTROL

A. Testing

During the course of the work, the ENGINEER may require testing for compaction or density and for thickness of material. The testing and coring required shall be performed by a testing laboratory approved by the ENGINEER.

A minimum of 1-depth (thickness) measurement will be made every 400 linear feet per traffic lane. The lane width shall be as indicated on the Plans or as determined by the ENGINEER.

If two (2) lanes are constructed simultaneously, only one (1) test is necessary to represent both lanes.

For areas such as intersections, entrances, cross-overs, ramps, widening strips, acceleration and deceleration lanes, at least 1-depth measurement will be taken for each 1,200 square yards of such areas or fraction thereof. The location of the depth measurement will be at the discretion of the ENGINEER.

The testing frequency of soil shall be coordinated with input from the ENGINEER. The decision on the testing frequency is determined on the basis of results obtained from the

previous tests, soil type, and existing conditions found in the field.

B. Defective Work

1. Thickness

a. Measurements of base course thickness will be made to the nearest 1/4 inch. Depths may be 1/2 inch less than the thickness indicated on the Plans provided that the average of all measurements taken at regular intervals shall be equal to or greater than the specified thickness. In determining the average in place thickness, measurements which are more than 1/2 inch in excess of the thickness indicated on the Plans will be considered as the specified thickness plus 1/2 inch.

Locations of the depth measurements will be as specified herein unless otherwise directed by the ENGINEER. Sections found to be deficient in depth shall be corrected by the CONTRACTOR using methods approved by the ENGINEER.

END OF SECTION

SECTION 02300
PIPE BORING AND JACKING

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes designing and implementing acceptable boring and jacking system methods and procedures; providing, erecting and operating acceptable boring and jacking labor and equipment to complete the installation of underground piping systems; providing and installing casing pipe, casing/carrier pipe, carrier pipe, supports, mats, joints, joint materials, fasteners and accessories; grouting; and protecting adjacent private and public property, utilities and services affected by the boring and jacking work.

B. Related Work Specified Elsewhere

1. Section 01025: Measurement and Payment
2. Section 02140: Dewatering during Construction
3. Section 02226: Trenching, Backfilling, and Compacting
4. Section 02661: Reclaimed Water Main
5. Section 02730: Sanitary Sewers
6. Section 02735: Force Main

1.02 QUALITY ASSURANCE

A. Boring and Jacking Methods

The CONTRACTOR shall be responsible for the complete design of all methods used for pipe boring and jacking including the implementation of all materials, tools, labor, and equipment proposed for use in the Work.

B. Requirements of Regulatory Agencies

1. Federal, State, and Local Regulations

Conform to the requirements of all federal, state, and local regulatory agencies having jurisdiction.

2. Permits and Inspections

Where applicable, obtain and pay for permits and inspections for pipe boring and jacking operations as required by 440.5 F.S. and all government and private agencies having jurisdiction. No additional compensation shall be allowed because of the CONTRACTORS failure to obtain and pay for such permits and inspection. Be aware of and conform with all OWNER obtained permits.

3. Occupational Health and Safety Requirements

Conform to the requirements of the State of Florida and OSHA Safety Requirements.

C. Reference Standards

1. AREA - American Railroad Engineering Association
2. ASTM - American Society for Testing and Material
3. AWWA - American Water Works Association
4. FDOT - Florida Department of Transportation

1.03 SUBMITTALS

A. Detailed Plans and Shop Drawings

Prior to beginning any Work, prepare and submit to the ENGINEER for his information only detailed plans and shop drawings showing the limits of the proposed boring and jacking Work; the materials, equipment and methods of construction proposed for use; the location of shafts, pits and/or approach tunnels to be constructed; and methods to be implemented for protection of personnel, excavations and adjacent structures, property and utilities.

B. Test Reports

Where required, submit test reports for pipe casings used in railroad rights-of-way in accordance with the AREA or the specific railroad company having jurisdiction.

C. Permits and Inspection Records

Prior to beginning any pipe boring and jacking operations, submit copies of all permits and inspection records obtained from state and local authorities having jurisdiction as described under Article 1.02.B.2. of this Section.

1.04 JOB CONDITIONS

A. Soil Conditions

Where soil conditions or obstructions are encountered that prevent the completion of pipe boring and jacking Work started or in progress, develop and submit to the ENGINEER for review alternate methods of performing the Work as described under Article 1.03.A. of this Section. Perform no additional Work until completion of review by the ENGINEER of the alternate method proposed.

B. Protection

1. Personnel

Provide all structures, safety equipment and professional services required to provide for the health and safety of the general public and of personnel involved in pipe boring and jacking Work in accordance with the requirements of the regulatory agencies having jurisdiction.

2. Property, Utilities, and Structures

Take all measures necessary to protect surrounding public and private property, adjacent buildings, roads, drives, sidewalks, drains, sewers, utilities, structures, and appurtenances from damage due to pipe boring and jacking Work. Responsibility and payment for correction of such damage shall be the sole responsibility of the CONTRACTOR.

PART 2 – PRODUCTS

2.01 MATERIAL

A. Casing Pipe

1. Reinforced Concrete Pipe

ASTM C76, embedded circular reinforced, of the class, size and wall thickness shown on the Plans, with ASTM C443 push-on, mortar filled joints or ASTM C361 push-on, steel ring, gasket type, mortar filled joints.

2. Steel Pipe

ASTM A252, Grade 2, welded and seamless steel pipe of size and wall thickness indicated on the Plans.

ASTM A53, Type E or Type S, Grade B, or ASTM A139, Grade B, electric fusion (arc) welded type of size and wall thickness shown on the Plans.

Provide smooth interior. Weld joints to form a leak proof continuous pipe. Provide cathodic protection or coating as indicated on the Plans.

B. Concrete

In accordance with FDOT Section 345, use Class II, 3,500 psi strength; Type I cement; 6 sacks cement per cubic yard; #5 coarse aggregate; silica sand fine aggregate; three (3) percent to five (5) percent air content; 3-inch maximum slump; no admixtures without ENGINEER review.

C. Concrete Reinforcement

In accordance with FDOT Section 931, use ASTM A615, Grade 60, for bars and ASTM A185 for welded wire fabric.

D. Concrete Block

Block cast from Portland cement sand, gravel or crushed stone, of uniform and compact texture, free from cracks or warpage and with square corners conforming to ASTM C139.

PART 3 – EXECUTION

3.01 CONTRACTORS VERIFICATION

A. Grades, Lines, and Levels

Prior to performing any pipe boring and jacking operations, verify the grades, lines and levels to which the new Work is to be installed. Any boring and jacking Work required to adjust grades, lines and levels after Work has started will be at the expense of the CONTRACTOR performing the Work.

B. Existing Structures and Utilities

Prior to beginning any pipe boring and jacking Work, verify in the field the location of existing structures and active utilities scheduled to remain and requiring protection from damage because of the Work. Notify the ENGINEER where such conditions directly affect the progress of the Work.

3.02 PREPARATION

A. Layout of the Work

Stake, mark and layout the Work using suitable stakes and markers to facilitate verification of grades, lines, levels and locations of the Work to be performed in a manner acceptable to the ENGINEER.

From reference points established by the ENGINEER on the surface of the ground, carry line and grade down to the bottom of each shaft. Perform the Work to the line and grades established using methods acceptable to the ENGINEER. Protect such reference points throughout the progress of the Work.

B. Examination of Materials

Prior to performing any boring and jacking Work, examine all pipe for damage due to fabrication, shipment or handling. Inspect pipe for cracks, breaks, bends, dents, broken ends or other damage which might affect the structural integrity, performance requirements, or jointing as shown on the Plans, specified herein or as directed by the ENGINEER. Defective pipe shall be rejected by the ENGINEER and shall be removed from the Work and replaced with acceptable pipe at the expense of the CONTRACTOR.

C. Notifications

Prior to performing any boring and jacking Work, notify all applicable inspecting agencies under Article 1.02.B.2. of Work Schedule with a minimum of two (2) working days notice.

3.03 PERFORMANCE

A. Sheeting, Shoring, and Bracing

Furnish, install and maintain throughout the progress of the Work, such sheeting, shoring, and bracing in tunnels, shafts and trenches as may be required for safety of workmen, for protection of the Work and adjacent structures, and for issuance of applicable agency permits. All sheeting, shoring, and bracing shall be removed after completion of the Work unless otherwise indicated on the Plans or directed by the ENGINEER. Design of earth supports shall be the responsibility of the CONTRACTOR and shall be as required by the nature of the soils encountered. Supports shall be dimensioned and spaced as to prevent caving, loss of earth or squeezing within the neat lines of the excavation. Supports shall effectively restrain movement of the adjacent soil.

The sheeting of pits along any road shall be required if the leading edge of the pits falls within the one-on-one zone of influence from the shoulder point or curb and gutter edge.

The sheeting of pits along railroad rights-of-way shall be required if the leading edge of the pits falls within the railroad right-of-way.

B. Excavation

1. General

Excavate as required to perform all boring and jacking Work to the grades, lines and levels indicated on the Plans and as specified herein. Construct approach trenches, pits and shafts of sufficient length and width to accommodate the equipment being used, the pipe units to be placed and the manpower working. Provide guide timbers or rails in the bottom of the trenches, pits and shafts for keeping the Work on line and grade.

2. Pretunneled Excavation

Perform pretunneled boring or angering excavation by excavating an opening larger than the outside diameter of the pipe to be installed. The diameter of the excavation shall not exceed the outside diameter of the pipe by more than 1-inch.

3. Jacking Excavation

Construct excavation for jacked-in-place pipe by excavating ahead of the pipe approximately 1-inch larger than the outside diameter of the pipe at the top and tapering off towards the invert. Perform excavation from inside the pipe. The excavation shall not be carried ahead of the pipe to a distance which will cause caving of the earth. For unstable ground, the pipe shall precede the auguring or earth-cutting equipment. In no case shall excavations proceed more than 12 inches ahead of the pipe cutting edge. If the above excavation tolerances cannot be met by the CONTRACTOR, jacking excavations shall not proceed ahead of the pipe cutting edge.

Attach a steel cutting edge or shield to the front section of the lead pipe to form or cut the required opening, if necessary. The use of water or other liquids to facilitate placing of pipe or removal of spoil material is prohibited.

C. Casing or Casing/Carrier Pipe Installation

1. General

Use the types and sizes shown on the Plans. Place pipe to the lines and grades indicated on the Plans. Use care to not damage pipe, joints or joint material. Use plywood or other protective joint spacer material to distribute pushing or pulling loads evenly around joints. Install carrier pipe within casing pipe as indicated on Plans. Use white oak skids wired to carrier pipe. Use a minimum of two (2) skids per pipe length such that carrier pipe bells or joints do not bear against casing pipe. Skids shall be notched to prevent wire from riding against the casing pipe. Completely fill voids between outside pipe wall and soil as specified under Article 3.03.E. of this Section.

2. Pretunneled Installation

Install pipe in pretunneled excavations as shown on the Plans under Osmosis Dr. Use care to not disturb or cause caving of the excavation.

3. Jacked Installation

Install pipe in jacked excavation as indicated on the Plans. Closely follow mining operations. Insofar as possible, use continuous operations, extending through weekends and holidays, until the Work is completed to guard against pipe freeze

up due to settlement or compaction of surrounding soil. If necessary, use bentonite lubricant applied under pressure through fittings in the lead pipe to reduce pipe soil friction. Use no less than two (2) jacks of sufficient power to carefully and accurately install the pipe by pushing or jacking pressure. Use a timber bearing pushing frame, built to fit and match the end of the pipe being jacked, to evenly distribute the jacking force over the end of the pipe. Use reaction blocks or backstop supports, installed in the jacking pit, shaft or trench, of sufficient strength to handle the thrust of the jacks.

D. Bulkheading

Provide cast-in-place or concrete masonry unit bulkheads where indicated on the Plans, as specified herein or as required by the ENGINEER. Bulkheading shall be of the types and sizes indicated.

When boring and jacking under railroad rights-of-way, provide temporary bulkheading of headings at the end of each boring operation. When boring and jacking under railroad rights-of-way, provide temporary bulkheading of headings if the Work is shut down for a period exceeding eight (8) hours. Provide temporary bulkheading of headings where soil conditions require such additional protection for shorter shut-down periods as directed by the ENGINEER.

E. Backfilling

1. Casing and Casing/Carrier Pipe

Excavations beyond the neat lines of the pipe shall be backfilled with a sand cement or grout mixture. Any voids judged by the ENGINEER to exist behind such construction shall be grouted. Backfilling of any section of tunnel or bored construction under a road, railroad or public utility, or under or adjacent to any structure shall be done within 24 hours. If, as determined by the ENGINEER. ground or other conditions warrant, backfilling shall be done immediately.

For tamped backfill, fill all voids with sand cement mixture consisting of 1-part Portland cement to not more than ten (10) parts fine aggregate, by volume, tamped thoroughly in place.

For pressure grouted backfill, fill all voids with a grout mixture consisting of one part Portland cement to three parts fine aggregate, by volume, with sufficient water to flow through the grouting pipes. Install grout mixture under pressure from the pipe interior through threaded grout holes in pairs every 16 feet piercing the pipe wall or from the ground surface through insertion pipes.

For 30-inch diameter and larger pipes placed in pretunneled excavation, use tamped or pressure grouted backfill. For less than 30-inch diameter pipes placed in pretunneled excavation and all jacked pipe installations, use pressure grouted backfill.

2. Carrier Pipe

After successful testing of the carrier pipe, backfill the remaining space between the carrier pipe and the casing pipe as indicated on the Plans, required by the appropriate government or private agency having jurisdiction or as directed by the ENGINEER. If backfill is required, use pea gravel or sand blown into the open spaces, unless otherwise required. Brace carrier pipe adequately to prevent

floating or movement during backfilling. Plug ends of casing pipe as detailed on the Plans.

3. Jacking Pit/Approach Trench/Shaft

After the casing and carrier pipe have been installed and approved by the ENGINEER, the CONTRACTOR shall backfill the jacking pits, approach trenches or shafts. The jacking pits, approach trenches or shafts shall be considered as open cut trench and where they exceed the maximum allowable trench width the carrier pipe shall be backfilled as specified in Section 02226, Trenching, Backfilling and Compacting.

F. Acceptance and Inspection

Carrier and casing/carrier pipe Work shall be inspected and accepted under the appropriate section of Related Work Specified Elsewhere.

Casing pipe shall be inspected for cracks, crushings, buckling or other structural damage. Joints shall be inspected for structural damage and water tightness. CONTRACTOR shall remove and replace any damaged or unacceptable Work. Repair Work shall be done to the satisfaction of the ENGINEER.

If any excavation or installation Work done by the CONTRACTOR is to be abandoned or not completed, the CONTRACTOR shall fill all voids and spaces of the abandoned Work, as directed by the ENGINEER.

END OF SECTION

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SECTION 02370
EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.01 SECTION INCLUDES

Designing, providing, maintaining, removing temporary erosion and sedimentation controls.

1.02 REFERENCES

Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction and Roadway and Traffic Design Standards, latest editions:

A. Index No. 102 - Baled Hay or Straw Barriers and Silt Fences

B. Index No. 103 - Turbidity Barriers

C. Specification 300 - Prime and Tack Coats for Base Courses

1.03 OWNER'S INSTRUCTIONS/SEQUENCING

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

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

C. CONTRACTOR will be required to incorporate permanent erosion control features into project at earliest practical time to minimize need for temporary controls.

PART 2 – PRODUCTS

2.01 EROSION CONTROL

A. Seeding and Mulching

B. Sodding

C. Hydro-seeding

D. Coarse Aggregate

E. Prime Coat - Per FDOT Specification 300

2.02 SEDIMENTATION CONTROL

A. Silt Fence - Per FDOT Index No. 102

B. Floating Turbidity Barriers - Per FDOT Index No. 103

C. Hay Bales - Per FDOT Index No. 102

PART 3 – EXECUTION

3.01 EROSION CONTROL

A. Maintain temporary erosion control systems as directed by OWNER or governing authorities to control erosion and siltation during life of contract.

B. Permanently grass cut slopes as excavation proceeds to extent considered desirable and practical.

C. Grass all disturbed areas within 7 days of initial disturbance. Type of grassing shall be as follows: temporary grassing to be sodding at all drainage structures, retention areas, swales and ditches, and where slopes are steeper than 5:1. Temporary grassing can be seed and mulch at all other locations unless otherwise indicated in the drawings or specifications.

D. Erosion control of areas to be paved shall meet the following:

1. Install subgrade and base course materials within 48 hours of the removal/open cutting of existing pavement consisting of streets, driveways, or sidewalk. Install final surface courses within 14 days after removal of existing pavement.

2. Areas to receive asphalt shall receive erosion control measures no later than 48 hours after installation of base course. Temporary erosion control consists of placement of a bituminous prime coat and sanding the surface. Permanent erosion control consists of placement of the structural course.

3. Areas to receive concrete paving shall be either protected with a layer of FDOT coarse aggregate material or shall be paved within 48 hours of installation of the subgrade.

E. Dirt roads are to be stabilized and compacted within 7 days of the completion of trenching and grading activities.

3.02 SEDIMENTATION CONTROL

A. Install prior to construction.

B. Inspect every two weeks during construction.

C. Remove any sediment build-up.

D. Repair and reinstall any damaged or missing sediment control measures. Install additional measures if inspection reveals additional sedimentation control is necessary.

E. Rough excavate and grade any proposed stormwater ponds at the start of site grading activities. Direct site runoff to the ponds to minimize runoff to offsite areas.

END OF SECTION

SECTION 02510
BITUMINOUS PAVING

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

1. This Section includes bituminous paving complete with bituminous materials; bituminous mixtures; installation of bituminous base course, bituminous structural and friction courses, and bituminous curbs; construction of bituminous pavement, sidewalks, and drive approaches.

B. Related Work Specified Elsewhere

1. Section 01025: Measurement and Payment
2. Section 02229: Earthwork for Paving
3. Section 02230: Base Course

1.02 QUALITY ASSURANCE

A. Reference Standards

1. Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

a. ASTM- American Society of Testing & Materials
b. AASHTO- American Association of State Highway and Transportation Officials
c. FDOT- Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, latest edition.

B. Allowable Tolerances

1. Following the final rolling, the surface will be tested longitudinally using a 15-foot straightedge at locations selected by the ENGINEER. The variation of the surface from the testing edge of the straightedge between any two (2) contacts with the surface shall at no point exceed the following limits:

For Bituminous Base Course Mixtures:

Multiple Courses: 3/8 inch for top course
3/4 inch for lower courses

For Bituminous Aggregate or Bituminous Concrete Pavement Mixtures:

Multiple Courses: 3/16 inch for top course
1/4 inch for lower courses

Single Course: 3/16 inch

Variations in excess of the specified tolerance shall be corrected as directed by the ENGINEER.

1.03 SUBMITTALS

A. Reports

1. At the request of the ENGINEER, the CONTRACTOR shall provide the ENGINEER with certification that the various materials to be used conform to the ASTM Standards referred to in the Specifications.

2. The CONTRACTOR shall provide the ENGINEER, or his authorized representative, with the certified batch plant delivery tickets prior to the placing of the materials.

3. The CONTRACTOR shall supply the ENGINEER with a certified job mix design for each type of bituminous mixture used on this Project.

B. Test Reports

1. Mix Design and Thickness

The testing lab shall provide the ENGINEER with two (2) copies of the test results of the mix design and the thickness of the bituminous paving material. The core drilling, testing for mix design and thickness shall be performed by a testing laboratory approved by the ENGINEER. Test results shall be signed and sealed by a Professional Engineer.

1.04 JOB CONDITIONS

A. Environmental Requirements

1. Temperature

Comply with the requirements for bituminous concrete installation due to outside ambient air temperatures specified under Article 3.03 of this Section.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Coarse Aggregate

The coarse aggregate gradation shall conform to ASTM D692 and to coarse aggregate as specified in FDOT, Section 901.

B. Fine Aggregate

The fine aggregate gradation shall conform to ASTM D1073, AASHTO M29, and to fine aggregate as specified in FDOT, Section 902.

C. Mineral Filler

The mineral filler gradation shall conform to AASHTO M17 and to mineral filler as specified in FDOT, Section 917.

D. Bituminous Materials

1. Asphalt Cement

   Viscosity grades for asphalt cement for use in pavement construction shall conform to ASTM D3381, AASHTO M226, and as specified in FDOT, Section 916.

2. Liquid Asphalts

   Liquid asphalts for use in pavement construction shall conform to ASTM D2026, D2027, and D2028, AASHTO M81, and as specified in FDOT, Section 916.

3. Emulsified Asphalt

   Emulsified asphalt for use in pavement construction shall conform to ASTM D244, and as specified in FDOT, Section 916.

2.02 MIXES

A. Composition of Mixtures

1. Bituminous pavement mixtures shall be mixed and placed in accordance with applicable requirements specified in FDOT Sections 320, 330, 334, 337, and 339 as applicable.

2. The CONTRACTOR may elect to blend aggregates. When the CONTRACTOR so elects, the aggregate, the composition and quality of the bituminous mixture, the blending operation, and the use of hot bins shall meet the requirements as specified herein and be approved by the ENGINEER.

3. The specified aggregates, mineral filler (if required), and asphalt cement shall be combined as necessary to produce a mixture proportioned within the master gradation range limits shown in Table A and meeting the uniformity tolerance limits shown in Table C; bituminous mixtures shall also meet the mix design criteria specified in Table B.

4. Composition limits in Table A are shown in percent by weight, based on the total aggregate, including mineral filler, in the mixture.

5. The bituminous mixture specified on the Plans or in the Proposal, when tested at optimum asphalt content in accordance with ASTM D 1559, shall meet the requirements for stability, flow, and voids in mineral aggregate (VMA), as specified in Table B.

6. Mixtures failing to meet the requirements specified in Table B will be rejected and the CONTRACTOR will be required to submit additional samples of aggregates until a material is found which will produce a mixture meeting the Table B requirements.

7. If there is a change in the source of any of the aggregates, a new job-mix formula will be required.

Table A
MASTER GRADATION RANGE
FOR BITUMINOUS MIXTURES

	SUPERPAVE MIXTURE (PERCENT PASSING)					
	SP-9.5		SP-12.5		SP-19.0	
SIEVE SIZE	MIN.	MAX.	MIN.	MAX.	MIN.	MAX
1 inch	-	-	-	-	100	-
3/4 inch	-	-	100	-	90	100
1/2 inch	100	-	90	100	-	90
3/8 inch	90	100	-	90	-	-
No. 4	-	90	-	-	-	-
No. 8	32	67	28	58	23	49
No. 200	2	10	2	10	2	8

Table B
MIX DESIGN CRITERIA FOR
DENSE-GRADED AGGREGATES

MIX TYPE	MINIMUM MARSHAL STABILITY	FLOW	MINIMUM VMA	VOIDS	CONTENT
	(LBS.)	(0.01 IN.)	VMA (%)	(%)	(%)
SP-9.5	1,500	8-14	15	3-7	5.5
SP-12.5	1,500	8-14	14	3-5	5
SP-19.0	1,500	8-14	13	3-5	5

Table C
UNIFORMITY TOLERANCE LIMITS
FOR BITUMINOUS MIXTURE

PERCENTAGE PASSING DESIGNATED SIEVES						
TYPE	RANGE*	3/8-IN	NO.10	NO.40	NO.200	BITUMIN CONTENT
SP-9.5	1	±5	±5	±4	±2	±0.4
SP-12.5	1	±5	±5	±4	±2	±0.4
SP-19.0	1	±5	±5	±4	±2	±0.4

* Maximum allowable deviations permitted from Job Mix Formula within the Master Gradation Range.

8. After the job-mix formula is established, the aggregate gradation and the bitumen content of the bituminous mixture furnished for the Work shall be maintained within the uniformity tolerance limits permitted for the job-mix formula as specified herein under Table C, within the master gradations range as specified in Table A, and within the bitumen content specified in Table B. If two (2) consecutive aggregate gradations on one (1) sieve, or bitumen contents as determined by the field extractions are not within the uniformity tolerance limits, the CONTRACTOR shall suspend all operations. (Work days will be charged during the down time.) Before resuming any production, the CONTRACTOR shall make all necessary alterations to the materials or plant so that the job-mix formula can be maintained within the deviations permitted under Table C, within the master gradation range shown in Table A and within the bitumen content specified in Table B.

9. The CONTRACTOR shall provide uniformity in the gradations of the aggregates placed in the cold feed bins so that the combination of aggregates produced for the mixture by blending the aggregates from two (2) or more cold feed bins will be uniformly fed by means of adjustable feeders onto a belt supplying the asphalt plant. The feeders shall be equipped with cutoffs which will automatically stop the operations to the asphalt plant at any time the flow of any aggregate fraction is changed so as to affect the uniformity of the finished product.

10. The CONTRACTOR has the option of using hot bins for proportioning the aggregates to meet the specified tolerances.

11. Aggregate gradation tests will be made on aggregate extracted from samples of bituminous mixture taken from the trucks. At initial start of production and at other times when tests indicate that the aggregate gradation is fluctuating, truck samples will be taken at a frequency of one (1) sample per 250 tons of mixture, but not more than four (4) samples per day. During other periods where tests indicate the aggregate gradation is stable, truck samples will be taken at a frequency of one (1) sample per 500 tons of mixture, but no more than two (2) samples per day.

12. The OWNER reserves the right to require the CONTRACTOR to discontinue the use of blended aggregate as provided herein and furnish graded aggregate from approved stockpiles, if in the opinion of the ENGINEER, the blended aggregate as incorporated in the bituminous mixture does not meet the requirements specified herein.

13. Any mixture exceeding the maximum tolerances listed in Range 2 under Table C, or exceeding the maximum limits specified for the master gradation range will be rejected.

14. Exact mixture proportions will be based on composite samples of aggregate and the particular bituminous material called for on the Plans and in the Proposal.

15. The mixture proportions shall be varied as directed by the ENGINEER between the limits designated in Table C, except that if highly absorptive aggregate is used, the ENGINEER may specify higher bitumen content without any change in the Contract unit price.

16. For bituminous concrete curb mixtures, asphalt additives consisting of powdered

native bitumen may be used in the mixture in amounts approved by the ENGINEER.

PART 3 – EXECUTION

3.01 CONTRACTORS VERIFICATION

A. Excavation

1. Prior to the installation of any bituminous surface courses or bases, examine the excavation for the grades, lines and levels required to receive the new Work. Ascertain that all excavation and compacted subgrades are adequate to receive the bituminous concrete pavement to be installed. Correct all defects and deficiencies before proceeding with the Work.

B. Subgrade Conditions

1. Prior to the installation of any bituminous surface courses or bases, examine the subgrade to ascertain that it is adequate to receive the bituminous concrete pavement to be installed. If the subgrade remains wet after all surface water has been removed, the ENGINEER may require the installation of underdrains.

C. Surface Conditions

1. Prior to the installation of any bituminous mixtures for surface courses or bases, examine the surface the improvement is to be placed on and ascertain that it is adequate to receive the improvement to be installed.

D. Existing Improvements

1. Investigate and verify location of existing improvements, including structures, to which the new Work is to be connected. Adjustments in line and grade to align the new Work with the existing improvements must be approved by the ENGINEER, prior to any changes.

3.02 PREPARATION

A. Preparation of Foundations

1. For bituminous base course mixtures required to be placed directly on the subgrade, the density, grade and cross section shall meet the approval of the ENGINEER at the time of placement of any mixture.

2. Prior to placing any bituminous mixture, the surface of the existing pavement including joints and cracks shall be thoroughly cleaned of all dirt and debris.

3. All existing structures within the limits of the new Work shall be adjusted as specified in the Plans, or as directed by the ENGINEER.

B. Preparation of Base

1. Prior to the placing of any prime coats or any bituminous surface or base course mixtures, the density, grade and cross section of the subgrade or base shall meet the approval of the ENGINEER at the time of placement of any material.

2. Surfaces that have become too wet or too dry shall be reworked to provide the required density.

C. Chipping Concrete Pavement for Joints

1. If butt joints are specified on the Plans, or by the ENGINEER, the old surface shall be cut back for at least five (5) feet to a depth of at least 1-inch, for the full width of the joint.

D. Edge Trimming

1. Trimming and truing the edge of an existing bituminous surface shall be performed as required to give a straight, sharp edge at the proper elevations.

2. The existing base under the bituminous surface shall be left undisturbed.

E. Removing Bituminous Surfacing

1. When removing an existing bituminous pavement, the edges of the area to be removed shall be cut along straight lines, either perpendicular or parallel to the direction of travel, for the full depth of the bituminous surfacing with the cut edge a minimum of 18 inches back from the disturbed edge of pavement. The cutting of the edges of the area and the breaking up of the bituminous material within the area and the removing and disposing of the unsuitable material are included in the Work of removing bituminous surfacing.

F. Removing Bituminous Patches

1. Where the removal of bituminous patching material is specified on the Plans or as directed by the ENGINEER, it shall be saw cut along the edges of the patched area to prevent the tearing of the adjoining pavement surfaces during the removal operation.

2. The cutting, removing and disposing of bituminous surfacing and unsuitable materials are included in the Work of removing bituminous patches.

G. Hand Patching

1. Where the filling of holes and depressions in the base or the replacing of the patches is specified on the Plans or as directed by the ENGINEER, the filler material shall be an approved bituminous mixture. The mixture selected will be dependent on the depth and size of the patch and the type of mixture and penetration grade of the asphalt cement required. The patches shall be compacted to the required grade by use of a machine vibrator or approved roller.

H. Joint Clean-out

1. Where joint Clean-out is specified on the Plans or as directed by the ENGINEER, the joint sealants and foreign material shall be removed to a depth of up to 1-inch by approved mechanical or hand methods. The removal and disposal of unsuitable materials and the removal and disposal of bituminous surface patches adjacent to joints are included in the Work for joint Clean-out.

I. Repairing Pavement Joints

1. Where existing pavement joints and cracks are to be repaired, as specified on the Plans or as directed by the ENGINEER, the existing bituminous surface and any loose or spalled concrete around the joints and cracks shall be removed. Each joint or crack shall be cleaned and shall be filled with an approved mixture using a penetration grade asphalt and the mixture shall be compacted with a vibratory machine or by an approved method.

J. Preparation of Cover Materials

1. Cover materials used for seal coating shall be sufficiently dry when it comes in contact with bituminous material. The moisture content shall not exceed three (3) percent by weight, dry basis. Satisfactory means shall be provided for the protection of the coating materials against excessive moisture by covering stockpiles, by aeration or through manipulation.

3.03 INSTALLATION

A. General

1. The width, thickness and type of bituminous paving improvement shall be specified on the Plans, indicated in the Proposal or as directed by the ENGINEER.

2. Existing improvements, including structures, shall be protected to prevent their surfaces from being discolored during application of bituminous materials.

B. Equipment Requirements

1. The CONTRACTOR shall furnish sufficient equipment for the placing of the bituminous paving material and the construction of bituminous curbing. The equipment shall be on the job site and ready for normal operation before the placing of material is started. All equipment shall be in good working order. The equipment shall be subject to inspections and testing during construction. The equipment shall be of sufficient capacity that the operation can be continuous and a rate of production obtained which insures good workmanship, and eliminates overloading of the equipment or frequent interruptions or delays. The equipment shall conform to the requirements as specified in FDOT, Section 320.

a. Flasher Lights for Bituminous Concrete Equipment

1) On bituminous construction where traffic is being maintained, chip spreaders, distributors and rollers shall be equipped with at least one (1) approved flashing, rotating, or oscillating amber light and pavers shall be equipped with at least one (1) such light on each side of the paver. The lights shall be mounted so that the warning signal will be visible to traffic in both directions. The lights shall be in operation all the while the Work is in progress.

b. Hauling Equipment

1) Trucks used for hauling bituminous mixtures shall have tight, clean, smooth beds which have been thinly coated with an approved release agent, to prevent the mixture from adhering to the beds. Each truck shall have an adequately secured cover of

such size and material as to completely protect the mixture from the weather and to retard the escape of heat from the mixture.

2) Hauling units creating a hazard on the Project, or adversely affecting the quality of the Work shall be removed from the Project.

c. Pressure Distributor

1) The distributor shall be mounted upon a vehicle which is capable of maintaining the uniform speeds required for proper application of the bituminous material.

2) The pressure distributor shall have a capacity of at least 800 gallons. It shall be equipped with heating facilities capable of maintaining the bituminous material at the specified temperature. A positive displacement type pump, installed so as to permit circulation of the material in the tank and between the tank and the spray bar, shall be provided. The pump power shall be independent of the vehicle power or the pump shall be operated by a power take-off from the vehicle motor in such a manner that uniform distribution of the bituminous material, at the rate specified, will be obtained. Full circulating spray bars shall be available for application widths of 3 to 24 feet in 1-foot increments. The nozzles shall produce a uniform fan spray, and the shutoff shall be instantaneous, with no dripping. Nozzles in various sizes between 1/8 and 1/4 inch, inclusive, shall be available.

3) The spray bar shall be set at the proper height to provide a uniform application at the specified coverage rate.

d. Pavers

1) The paver shall be an approved self-powered machine capable of spreading and finishing the mixture in a uniform layer at the desired thickness and cross section and ready for compaction. The use of any machine in poor mechanical or worn condition, will not be permitted. The paver shall be of such design that the supporting wheels, treads, or other devices ride on the prepared base. The full width of surface being applied shall be screeded by an oscillating or vibrating screed. The paver shall at all times produce a uniformly finished surface, free from tearing or other blemishes that would require hand work. The screed shall be adjustable to provide for tilting to secure the proper drag or compressive action necessary to produce the desired surface texture.

2) The paver shall be equipped with a hopper and an automatic material-depth control device so that each distributing auger and corresponding feeder shall respond automatically to provide for a constant level of mix ahead of the screed unit to the full width of the lane being paved.

3) In order to ensure that adequate material shall be fed to the

center portion of the lane being paved, reverse pitch augers or paddles shall be installed at the inside of one (1) or both ends of the auger shafts to force the mix to the middle portion of the lane. If necessary to prevent segregation of the mix as it drops off the feed conveyor, baffle plates shall be installed at the required location.

4) When extensions are added to the paver, they shall be provided with the same vibrating screed or tamper action as the main unit of the paver, except for paving variable width areas. The extensions shall also be equipped with a continuation of the automatically controlled spreading augers. The screed and any extensions shall be provided with an approved method of heat distribution.

5) Unless specified otherwise, bituminous pavers shall be equipped with an automatically controlled and activated screed and strike-off assembly capable of grade reference and transverse slope control. A manufacturer approved grade referencing attachment, not less than 30 feet in length, shall be used for all lower courses and the first lane of the wearing course. After the first lane of the surface course has been placed, a 10-foot, or longer, grade resurfacing attachment may be substituted for constructing subsequent adjacent lanes of surface course mixture.

6) A self-propelled mechanical spreader capable of maintaining the proper width, depth, and slope without causing segregation of the material, may be used for base courses and for surface courses less than eight (8) feet in width.

7) When surfacing ramps or shoulders, or when the grade of a concrete gutter or other existing installation must be met, the manner of use of the automatic grade reference and slope control devices shall be determined by the ENGINEER.

8) Whenever a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually for the remainder of the normal working day, provided this method of operation will produce results meeting the specification requirements.

e. Crushing Equipment

1) The crushing equipment shall be an approved rotary reduction machine having positive depth control adjustments in increments of 2 inch and capable of reducing material which is at least six (6) inches in thickness. The machine shall be of a type designed by the manufacturer specifically for reduction in size of pavement material, in place, and be capable of reducing the pavement material to the specified size. The cutting drums shall be enclosed and shall have a sprinkling system around the reduction chamber for pollution control. The rate of forward speed must be positively controlled in order to ensure consistent size of reduced material. The machine must be equipped with an accurate tachometer which is mounted in full view of the operator. The

crushing equipment shall meet the approval of the ENGINEER.

f. Mixers

1) Mixers shall be self-propelled and a combination scarifier, pulverizer, mixer, and liquid distributor. Unless otherwise specified, a minimum of two (2) mixers will be required.

2) If asphalt cement is used as a stabilizer, one (1) mixer shall be a self-propelled single-pass stabilizer, combining a cutting rotor, a blending rotor, and at least one (1) mixing rotor in the mixing chamber.

3) The spray bar for distribution of the liquid shall operate in such a manner that all asphalt will be uniformly applied through the mixer at the time of mixing. The equipment for distributing the bituminous material shall be adjustable and shall measure accurately the amounts of bituminous material being applied. The bitumen pump shall be a positive displacement type pump. It shall be equipped in such a manner as to make it possible to check accurately the rate of application of the bitumen at any time. The mixer shall meet the approval of the ENGINEER.

g. Joint Heaters

1) Joint heaters shall be infrared or other approved heaters, equipped with an automatic ignition and extinguishing system to ensure that the heater operates only when the paver is moving. It shall be of sufficient length and heating capacity to adequately soften the edge of the mat. The heater shall be oriented parallel to the joint edge. The bituminous pavement shall not be heated by a direct open flame.

h. Rollers

1) Steel-Wheel

Steel-wheel rollers shall weigh at least eight (8) tons and shall be self-propelled, static, tandem rollers or shall be self-propelled static 3-wheel rollers. Steel-wheel rollers shall be free from backlash, faulty steering mechanism, or worn king bolts. The steering device shall respond readily and permit the roller to be directed on the alignment desired. Rollers shall be equipped with wheel sprinklers and scrapers. Roller wheels shall be smooth and free from openings or projections which will mar the surface of the pavement.

Vibratory rollers will not be allowed.

2) Pneumatic-Tired

The pneumatic-tired roller shall be of the self-propelled type with a total weight, including ballast, not greater than 30 tons. It shall be equipped with a minimum of seven (7) wheels situated on the axles in such a way that the rear group of tires will not follow in

the tracks of the forward group, but will be so spaced that a minimum tire path overlap of 2 inch is obtained. The tires shall be smooth and shall be capable of being inflated to or adapted to achieve a pressure necessary to provide ground-contact pressures of at least 80 pounds per square inch. The tire pressures shall not vary by more than five (5) pounds per square inch between individual tires. The CONTRACTOR shall furnish a tire gage which shall be available at all times to enable the ENGINEER to check the tire pressures. The CONTRACTOR shall furnish the ENGINEER charts or tabulations showing the contact areas and the contact pressures for the full range of tire inflation pressures and tire loadings for the type and size roller used. The roller shall be equipped with a mechanism capable of reversing the motion of the roller smoothly. The roller shall be equipped with wheel sprinklers and scrapers or mats.

i. Chip Spreader

1) The chip spreader shall be self-propelled and shall be equipped with pneumatic tires.

2) The spreader shall be equipped with a screen mounted below the metering gage.

3) The spreader shall be capable of spreading the cover material uniformly at widths of 3 to 12 feet, or separate spreaders shall be provided for the specific widths required. The rate of discharge of the spreader shall be adjustable to spread uniform layers of 10 to 50 pounds per square yard.

j. Drag

1) An approved drag to level and properly distribute the cover material shall be available for use. Such a drag may be made from one (1) layer of chain link fencing eight (8) feet wide and at least ten (10) feet long, so constructed and hitched as to cover half the road width when dragged over the surface, or may be a brush broom drag of approved design.

k. Bituminous Concrete Curbing Machine

1) The bituminous concrete curbing machine shall be self-propelled and shall be capable of laying and satisfactorily compacting curved and straight line curb to the cross section specified on the Plans. It shall be equipped with templates for the cross sections required.

l. Miscellaneous Equipment

1) Sufficient equipment for handling and hauling covered material shall be provided to insure prompt and continuous covering of bituminous materials.

2) A self-propelled power broom, straightedges for testing, thermometers, and all necessary small tools to completely and

satisfactorily finish the Work shall be provided by the CONTRACTOR.

C. Bituminous Prime Coat or Bond Coat

1. The prepared foundation shall be treated with bituminous material for prime coat or bond coat as specified. A bond coat shall be applied to each layer of bituminous mixture before the succeeding layer is placed.

2. Bituminous prime coat and bond coat shall conform to the requirements of FDOT, Section 300, and as specified herein.

3. The bituminous material shall be applied uniformly by means of a pressure distributor, and only in such areas as may be inaccessible to the regular distributor operation shall the bituminous material be applied by means of the hand spraying apparatus of the distributor. Where necessary to accommodate traffic, the surface shall be treated half-width or as directed by the ENGINEER. The foundation shall be free from moisture when the treatment is applied. Under no circumstances shall pools of bituminous material be allowed to remain on the surface.

a. Prime Coat

1) The amount of prime coat to be applied per square yard shall be as specified on the Plans or as directed by the ENGINEER.

2) When prime coat is applied, the surface course shall not be placed until the prime coat has been properly cured. No blotting of the prime coat with aggregate in lieu of proper curing will be permitted.

3) The prime coat may be omitted or reduced when authorized by the ENGINEER.

b. Bond Coat

1) The bond coat shall be applied at the rate specified by the ENGINEER. This rate will be between 0 and 0.10 gallons per square yard on the bituminous or concrete foundation and between 0 and 0.05 gallons per square yard between subsequent courses.

2) The bond coat material shall be applied ahead of the paving operation for a distance of at least 1,500 feet, depending on traffic conditions, as determined by the ENGINEER. The surfacing shall not be placed until the bond coat has cured.

D. Transportation of Mixtures

1. The transportation of the mixtures as specified shall be in accordance with FDOT, Sections 320-7.

E. Placing Bituminous Mixtures

1. Pavers will be required to have an automatically controlled and activated screed

and strike-off assembly except when placing mixtures for: (1) variable width sections, (2) sections of pavement less than 1,000 feet in length, (3) placing the first course of a base course mixture on an earth grade or on a sand subbase, or (4) placing base course mixtures in widths less than eight (8) feet.

a. Placing Bituminous Base Course Mixtures

1) Bituminous base course mixtures shall not be placed in lifts exceeding three (3) inches, unless otherwise approved by the ENGINEER. Approval to place lifts in excess of three (3) inches will be based on the ability of the CONTRACTOR to place and compact the base course to the required cross section and within the specified tolerances.

2) For lifts of 2-1/2 inches or greater, a berm of shoulder material shall be banked against the outside edge of each layer of mixture placed unless the sequence of operations is such that the edges of the material are adequately confined and supported in some other manner. The width of material placed shall be twice the height of the bituminous layer being placed but in no case less than a 6-inch width.

b. Placing Bituminous Mixtures

1) When the application rate for a bituminous pavement exceeds 220 pounds per square yard, the pavement shall be constructed in two (2) or more courses, unless otherwise specified on the Plans or as directed by the ENGINEER.

2) The bituminous mixture shall be placed by an approved self-propelled mechanical paver to such a depth that when compacted, it will have the thickness specified. The mixture shall be dumped into the center of the hopper and care shall be exercised to avoid overloading the paver and spilling the mixture upon the base. The paver speed shall be adjusted at the discretion of the ENGINEER to that speed which, in his opinion, gives the best results for the type of paver being used and which coordinates satisfactorily with the rate of delivery of the mixture to the paver to provide a uniform rate of placing the mixture without intermittent operation of the paver.

3) When delays result in slowing paving operations such that the temperature of the mat immediately behind the screed falls below 170 degrees F, paving shall be stopped and a transverse construction joint placed.

4) Bituminous mixture shall be placed in one or more layers as called for on the Plans or as directed by the ENGINEER. To take out irregularities in the existing road surface, wedging with bituminous mixture shall be done by placing several layers with the paver. Corrections to the foundation by wedging with bituminous material shall be made by placing, compacting, and allowing the material to cool prior to paving.

5) Bituminous mixtures shall be placed using two (2) pavers in

echelon or one (1) paver equipped with an approved joint heater. The ENGINEER may omit the use of the joint heater if the temperature of the previously placed mat does not fall below 170 degrees F prior to placement of the adjacent course.

6) Cold joints will be permitted along acceleration and deceleration lanes, lanes less than full width, irregularly shaped section, and at transverse joints. The edges of the initial mat for all cold joints shall be painted with bituminous material before the bituminous mixture is placed in the adjacent section. In placing the bituminous mixture adjacent to all joints, hand raking or brooming will be required to provide a dense smooth connection.

7) Connections with existing surfaces at the beginning and ending of resurfacing sections and at intersections shall be made by feathering out the mix, by constructing a butt joint, or as directed by the ENGINEER.

8) When placing the bituminous mixture in a lane adjoining a previously placed lane, the mixture shall be placed such that it uniformly overlaps the first lane by two (2) to four (4) inches and is placed at a height above the cold mat equal to the breakdown roller depression on the hot mat. The overlapping material shall be bumped, back onto the hot lane so that the roller will compress the excess material into the hot side of the joint. If, at the opinion of the ENGINEER, the overlap is excessive, the excess material shall be trimmed so as to leave an edge having a uniform thickness. The excess material shall be discarded, it shall not be spread across the surface course.

9) If the lanes are being constructed with two or more pavers in echelon, the loose depths of bituminous material from each paver shall match at the longitudinal joints.

F. Placing Cover Coat for Sand Asphalt Bituminous Mixture

1. Prior to rolling a sand asphalt mixture, the CONTRACTOR shall apply a uniform coating of dry precoated sand. The rate of application for the precoated sand shall be between 0.5 and 2 pounds per square yard, as directed by the ENGINEER. The precoated sand shall be uniformly applied by a mechanical spreader. Spreaders which leave ridges or mounds of the precoated sand will not be permitted. In areas where the mixture is manually placed it shall receive its initial compaction using special compacting equipment before the precoated sand is applied. The precoated sand shall then be applied and the compaction shall be completed using approved methods.

G. Rolling and Compacting of Bituminous Mixtures

1. Each layer of bituminous mixture shall be compacted with approved rollers. At least two (2) rollers will be required when the mixture lay-down rate exceeds 800 square yards per hour.

2. Steel 3-wheel rollers may be used for initial compaction immediately following the paver.

3. The final rolling operation on each layer of bituminous mixture shall be accomplished by use of tandem steel-wheel rollers or by use of vibratory rollers operated in the static mode.

4. Roller wheels shall be kept properly moistened with water.

5. Pneumatic-tired rollers shall be operated in a competent manner and shall not mark or rut the surface or displace the pavement edges. The pneumatic-tired roller shall be ballasted to obtain the required ground-contact pressures as directed by the ENGINEER. To obtain a uniformly textured mat and the desired pavement density, the ENGINEER may direct the CONTRACTOR to raise or lower tire pressures at any time during the rolling operations. The roller operations shall be conducted in such a manner as to prevent scuffing or chatter marks in the pavement surface. The number of passes made by the pneumatic-tired roller shall not be less than two (2) round trip passes over each area. Rolling of the mixture shall begin as soon after placing without undue displacement, picking up the mat, or cracking. Rolling shall start longitudinally at the extreme sides of the lanes and proceed toward the center of the pavement, overlapping on successive trips by at least 2 the width of the drive wheel of the roller. Alternate trips of the roller shall be of slightly different lengths. The maximum roller speed shall not exceed the manufacturers recommended speed for the type of mixture or thickness of layer being placed.

6. When compacting an adjoining lane, the longitudinal joint shall be rolled first with the roller supported mainly on the cold lane with only three (3) to six (6) inches of the roller extending onto the freshly placed bituminous material.

7. Finish rolling with pneumatic-tired rollers shall continue until all roller marks are eliminated.

8. Pneumatic-tired rollers will not be permitted on friction courses.

9. Areas too narrow to be rolled directly by standard 8-ton tandem rollers shall be compacted by self-propelled trench rollers of suitable width, approved by the ENGINEER, and weighing not less than 300 pounds per inch of width.

10. Skin patching on an area that has been rolled will not be permitted. Any mixture that becomes mixed with foreign material or is in any way defective shall be removed and replaced at the CONTRACTORS expense.

11. See Article 3.04 of this Section for compaction test.

H. Weather and Seasonal Limitations

1. Bituminous mixtures shall not be placed nor the prime coat or bond coat applied when rain is threatening or when the moisture on the existing surface would prevent satisfactory bonding.

2. Unless otherwise approved by the ENGINEER in writing, no bituminous materials shall be applied when the air temperature in the shade and away from artificial heat is less than 40 degrees F.

I. Heating Bituminous Materials

1. Bituminous material which requires heating before application shall be heated in

such a manner as to insure a uniform temperature throughout the entire mass with efficient and positive control at all times. It shall be heated to a temperature consistent with the type of material used and only to such temperature as will insure the necessary fluidity. Excessively high temperatures shall be avoided. A thermometer shall be provided to enable the ENGINEER to observe the temperature at any time. Any bituminous material which has been overheated will be rejected. Asphalt emulsion shall be circulated continuously when heated above atmospheric temperature so as to prevent it from separating. The heating of asphalt emulsion to the required temperature for application shall be done entirely in the distributor unless a uniform temperature is maintained in the storage tank by means of a circulating heater. Any asphalt emulsion which has been damaged by continuous heating for too long a time or by alternate heating and cooling will be rejected.

J. Patching

1. Where patching is required on a bituminous surface or concrete surface because of small holes or pitted surface, the holes shall be cleaned of all dirt and foreign material.

2. The bituminous patching material shall be placed, struck off and compacted so that when completed, the patch shall be flush with the adjacent pavement. The compaction may be done with a hand tamper, vibratory compactor or roller.

3. When patching is required for repairing a cut in the pavement, made for the construction of underground structures and utilities, the granular backfill shall be compacted to not less than 95% of the maximum unit weight. An aggregate base material of not less than 12 inches compacted thickness, or a bituminous base of the specified thickness, shall be used.

4. The top of the base shall be 2 to 2-1/2 inches below the surface of the adjacent pavement. Bituminous patching material shall be placed and compacted. The surface of the bituminous patch shall be smooth and shall not vary more than 1/4 inch from the crown and grade of the adjacent pavement.

5. Any variations over 1/4 inch from the established grade shall be corrected as directed by the ENGINEER.

K. Seal Coating

1. Seal coating shall consist of one (1) or more applications of bituminous material applied to the prepared surface and one (1) or more coverings of coarse or fine aggregate applied to the bituminous material.

2. The bituminous materials and the aggregate to be used will be specified on the Plans.

3. The bituminous material specified for surface coat shall be uniformly applied by means of the pressure distributor in the number of applications provided and in the amount per square yard directed by the ENGINEER. Each application of bituminous material shall cure sufficiently to prevent displacement or pickup by traffic or construction equipment before a succeeding application of bituminous material is made.

4. Following the application of surface coat bituminous material, the cover material shall be uniformly spread over the surface by means of approved mechanical spreaders, in the amount per square yard as specified or as directed by the ENGINEER. Truck wheels shall ride on spread cover material and not on bituminous material.

5. Any irregularities or deficiencies in the uniformity of the cover aggregate on the surface shall be corrected by hand spreading and dragging.

6. Following the spreading of each course of cover material, the surface shall be rolled by means of approved rollers.

7. Rolling shall immediately follow the placing of cover material before the bituminous material has set. At no time shall there be more than 300 feet of unrolled cover material. No cover material shall be left unrolled for more than five (5) minutes.

8. Sufficient rolling shall be done to embed the cover material in the bituminous material without crushing the aggregate.

9. For areas deficient in cover material after completion of the surface treatment, additional cover material shall be added. For areas with excessive cover material, the excess cover material shall be removed before the next seal is applied. The adding and removing of cover materials shall be executed at the direction of the ENGINEER.

10. The final application of cover material shall be swept with a power broom.

11. The completed surface shall be maintained with a drag, broom or other approved equipment to keep the material well distributed on the road until all cover material possible has been embedded in the bituminous material. The length of time required for this maintenance will be from two (2) to five (5) days, as directed by the ENGINEER, depending on the weather and the materials used.

L. Bituminous Aggregate Base Course Stabilized in Place

1. Stabilizing of a bituminous aggregate base course, in place, shall consist of scarifying, pulverizing, crushing, adding new material, and shaping to the Plan grade for stabilizing with bituminous material, and shall include shaping, rolling, and compacting the stabilized aggregate to the proper elevation and slope.

2. The additional materials required shall be furnished at the CONTRACTORS expense.

3. The bituminous materials and the aggregates to be used shall be specified on the Plans.

   a. Materials

      1) The bituminous materials used in base course stabilization shall meet the requirements specified in Article 2.02, Mixes, of this Section, and as specified in FDOT, Section 160.

      2) The rate of application of the bituminous material shall be determined by the ENGINEER, with the residual bitumen added

being between two (2) percent and five (5) percent by weight of the bituminous mixture.

3) Additional aggregate, if required by the ENGINEER, shall be as specified in FDOT, Section 914.

b. Scarifying and Pulverizing

1) The material shall be scarified and uniformly pulverized to a maximum size of two (2) inches, except that five (5) percent of the material may be oversized, provided that the oversized material is not so large as to adversely affect the stability and structural integrity of the mixture nor hamper the shaping operations.

2) The material shall be scarified and uniformly pulverized, in one (1) or more passes, to the depth specified on the Plans or as directed by the ENGINEER.

3) The maximum length or width of roadbed to be scarified and pulverized at any one (1) time shall be specified on the Plans or as directed by the ENGINEER.

c. Grading

1) The crushed material shall be rough graded to within 3/4 of an inch of the grades and cross sections called for on the Plans, or as directed by the ENGINEER. Excessive materials shall be removed and disposed of at the CONTRACTORS expense. Additional aggregate shall be placed, if necessary, to attain the required cross sections.

2) After the material has been balanced, it shall be thoroughly mixed. In restrictive areas, the material to be mixed may be bladed into a windrow to provide working room for the mixer.

d. Mixing with Bituminous Materials

1) Prior to adding the bituminous material, the moisture content of the pulverized material shall be adjusted by aerating, adding water, or as directed by the ENGINEER.

2) The bituminous material shall be added only to that material which can be completely mixed, aerated, dried, and compacted in one (1) day, and shall be added through the mixer at the rate and within the temperature range directed by the ENGINEER.

3) The aggregate-bituminous mixture shall be bladed into a windrow and mixed with the mixer, the operation proceeding from one (1) side of the Work area to the other until the mixture presents a uniform composition.

4) Windrowing will not be required where asphalt cement is used, nor for shoulder stabilization, unless directed otherwise by the ENGINEER.

e. Mixture Aeration

1) Aeration of asphalt emulsion mixtures shall continue until the mixture is dried to the moisture content approved by the ENGINEER, within the range of two (2) percent to five (5) percent, based on dry weight.

f. Shaping, Rolling, and Compacting

1) Rolling and compacting shall conform to Paragraph 3.03.G. of this Section unless otherwise specified on the Plans, or as directed by the ENGINEER.

2) Mixing, shaping, and compacting shall be done while the bituminous material is in a workable state. When asphalt cement is used, final shaping and compaction shall be accomplished immediately after the addition of the bituminous material.

3) The mixed material shall be shaped and compacted in reasonably close conformity with the lines, grades, and cross sections shown on the Plans or as established by the ENGINEER.

4) Stabilized material trimmed from the grade shall be used adjacent to the shoulder to complete the cross section as shown on the Plans. Excess material shall be removed and disposed of by the CONTRACTOR at his expense.

5) Rolling shall be done with a pneumatic-tired roller or by a means approved by the ENGINEER.

6) The aggregate-bituminous mixture shall be compacted to not less than 98% of the unit weight obtained by the AASHTO T 180 test method. The test shall be made on the aggregate-bituminous mixture at the field moisture content existing during the compacting operation. Required density shall be maintained until the material has been surfaced.

7) After final rolling, the ENGINEER will test the surface longitudinally using a 10-foot straightedge at selected locations. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall at no point exceed "3/4 inch except that where the Work consists of only stabilizing the shoulder area, the tolerance shall be " 3/8 inch.

g. Curing

1) Prior to the placing of the surface, the ENGINEER may require the base be opened to traffic. At the direction of the ENGINEER, imperfections in the base shall be repaired by the CONTRACTOR at his expense.

h. Weather Limitation

1) Bituminous material shall not be applied to the grade or to the aggregate when rain is threatening or when the air temperature is lower than 55 degrees F.

M. Bituminous Concrete Curb

1. The bituminous concrete curb shall be constructed to the design specified on the Plans or as directed by the ENGINEER and shall include the conditioning and treating of the surface on which the curb is to be placed.

a. Materials

1) The materials used in the construction and installation of bituminous concrete curbing shall meet the requirements specified in Article 2.01, Materials, of this Section, and as specified in FDOT, Section 525.

b. Mixtures

1) The specific materials to produce the bituminous concrete curb mixture shall be combined in accordance with FDOT, Section 320, unless otherwise directed by the ENGINEER.

c. Construction

1) The bituminous curb shall be constructed to conform to the Plans or as directed by the ENGINEER. The method of construction shall conform to FDOT, Section 330, unless otherwise specified.

d. Placing Bituminous Mixture

1) The bituminous mixture shall be thoroughly compacted by a curbing machine to the cross section shown on the Plans, or as determined by the ENGINEER. The curb shall be formed to the density to produce a tight surface texture. Curbs showing segregation, slumping, or misalignment shall be removed and replaced at the CONTRACTORS expense.

e. Protective Seal

1) When specified on the Plans or as directed by the ENGINEER, an application of asphalt emulsion or other approved bituminous coating shall be applied to the finished curb at the joint of the curb and pavement, or to the inside face of the curb, or to both, as a protective seal.

f. Backfilling

1) Backfilling behind the curb shall not commence until the bituminous mixture has cured.

2) The backfill material shall be placed and thoroughly tamped and

compacted to the satisfaction of the ENGINEER, without disturbing the curb, and shall be left in a neat and workmanlike condition.

N. Bituminous Approaches, Sidewalks, and Shoulders

1. This Work shall consist of constructing a bituminous surface course as specified on the Plans, or as directed by the ENGINEER. The bituminous surface course shall be placed on a prepared foundation.

a. Materials

1) The bituminous materials used shall be as specified on the Plans, or as directed by the ENGINEER. Materials acceptable for use are specified in Article 2.01, Materials, of this Section.

b. Mixtures

1) The specific materials to produce the bituminous approach mixture shall be combined in accordance with FDOT, Section 320, unless otherwise directed by the ENGINEER.

c. Preparation of Foundation

1) The existing pavement or base course shall be prepared to receive the bituminous surface course as specified in Article 3.02, Preparation, of this Section.

d. Prime and Bond Coats

1) The bituminous prime and bond coats used shall meet the requirements specified in Article 2.01, Materials, and 3.03, Installation, of this Section, and as specified in FDOT, Section 300. Care shall be taken to prevent spreading of bituminous material on adjoining surfaces. At the direction of the ENGINEER, the prime coat may be omitted.

e. Placing Bituminous Mixture

1) The bituminous mixture shall be placed to the thickness specified on the Plans or as directed by the ENGINEER. Placing the bituminous mixture shall conform to Article 3.03, Installation, of this Section.

2) At the direction of the ENGINEER, the paver used for placing bituminous approaches and sidewalks will not be required to have an automatically controlled or activated screed or strike-off assembly or the corresponding grade referencing equipment. Also, with direction from the ENGINEER, only one (1) roller may be used with each paver.

O. Cleanup

1. The area adjacent to the new Work shall be backfilled with sound earth of topsoil quality.

2. The backfill shall be compacted, leveled and left in a neat, workmanlike condition.

P. Opening Pavement to Traffic

1. The ENGINEER reserves the right to open the pavement to traffic at any time during the construction operation.

3.04 FIELD QUALITY CONTROL

A. Testing

1. Testing for mix designs, aggregate gradation, and physical properties, bitumen content, compaction or density, and thickness of material shall be required.

2. The testing and coring required shall be performed by a testing laboratory approved by the ENGINEER.

3. The cost for testing and coring shall be at the expense of the CONTRACTOR.

4. The OWNER reserves the right to request the exact location of testing.

5. The testing laboratory shall furnish the ENGINEER with two (2) certified copies of the results of all tests.

6. Testing procedures shall conform to current FDOT Standards for Construction.

a. Bituminous Materials

1) Testing of asphalt cements, liquid asphalts, asphalt emulsions, tars shall conform to FDOT, Section 334.

b. Density

1) Rolling shall proceed until the required compaction is attained and the amount of rolling required based on the use of a nuclear gage or on using a specified minimum number of rollers. When the total tonnage for the Project is in excess of 1,000 tons, or as directed by the ENGINEER, the nuclear gage method will be used to govern the compactive requirements.

2) Nuclear Gage Method

i. By use of a modified Marshall Test, the control density for the bituminous mixture to be placed will be determined.

ii. During the CONTRACTORS start-up operations, a rolling procedure to attain the control density will be established. The rolling procedure will be based on the number and type of rollers used and the rolling pattern. The goal of the compactive effort will be to establish a rolling procedure which will achieve 100% of the control density but in any case, the density achieved shall not be less than 95% of the control density. Density values less than 98% will be sufficient cause for the ENGINEER to

require an adjustment in the number or type of rollers being used or in the rolling pattern.

iii. Once the procedure has been established on the start-up section, the procedure shall be used for the remainder of the mixture to be placed, unless subsequent tests indicate a need to change the number of rollers or the rolling pattern.

iv. If difficulties are encountered or if there is a significant change in aggregate or bitumen content, the ENGINEER will determine the control density for the new mixture and require the CONTRACTOR to again establish the number and type of rollers and the rolling pattern required on the new mixture to attain the control density. The compactive procedures thus determined shall be used when placing the remainder of that mixture.

v. Density checks will be made at the discretion of the ENGINEER to determine if the compactive procedure being used is achieving the required density, or if a change in procedure is necessary.

vi. Each layer of bituminous mixture shall be compacted to at least 95% of the control density, using the established procedure.

B. Price Adjustments

1. Asphalt Cement

a. Samples of asphalt cement will be taken prior to incorporation into the mixture and from the bituminous mixture. Where results of tests on these samples deviate from specification requirements, the affected material will be subject to price adjustments on the following basis:

1) Tests on Asphalt Taken Prior to Incorporating into the Mixture

i. When the penetration test results for penetration-graded asphalts, or the viscosity test results conducted at 60 degrees C on viscosity-graded asphalts, deviate from the limits specified in FDOT, Section 916, Bituminous Materials, by ten (10) percent or more, the mixture produced will be evaluated by the ENGINEER and if in his judgment the defective pavement warrants removal, the CONTRACTOR shall remove and replace the affected area at his expense.

ii. If it is determined that the removal is not required, the Contract unit price of the affected mixture will be reduced by ten (10) percent.

2. Bituminous Materials Other Than Asphalt Cement

a. Viscosity, Penetration, and Ductility Requirements

1) When the bituminous material in the bituminous mixture deviates by ten (10) percent or more from the requirements for viscosity, penetration, and ductility specified in FDOT, Section 916, Bituminous Materials, the ENGINEER will evaluate the constructed product in which the bituminous material is used. If in the judgement of the ENGINEER removal is required, the removal and replacement will be at the expense of the CONTRACTOR. If the ENGINEER determines the constructed product can remain, the Contract unit price of the bituminous mixture will be decreased by ten (10) percent

END OF SECTION

SECTION 02523
CURBS, SIDEWALKS AND DRIVEWAYS

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes curb, curb and gutter, valley gutter, special gutter, sidewalks, sidewalk ramps, driveways, and drive approaches complete with concrete materials, concrete curing compounds, joint materials, field quality control and appurtenances.

B. Related Work Specified Elsewhere

1. Section 01025: Measurement and Payment
2. Section 02229: Earthwork for Paving

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

1. ASTM - American Society of Testing and Materials
2. AASHTO - American Association of State Highway and Transportation Officials
3. FDOT - Florida Department of Transportation

1.03 SUBMITTALS

A. Reports

1. Written permission for the use of all local disposal sites shall be obtained and copies shall be furnished to the ENGINEER.

2. The CONTRACTOR shall provide the ENGINEER with certification that the various materials to be used conform to the ASTM Standards referred in the Specification.

B. Test Reports

1. Thickness and Compressive Strength

The ENGINEER shall be provided with two (2) certified copies of the test results of the thickness and compressive strength of the concrete. The core drilling, testing for thickness and compressive strength and the certification of the test results shall be performed by a testing laboratory approved by the ENGINEER.

1.04 JOB CONDITIONS

A. Environmental Requirements

1. Temperature

Comply with the requirements for concrete installation due to outside ambient air temperatures specified under Article 3.03.H. of this Section.

B. Protection

1. Protection Against Rain

Comply with the requirements for protecting new Work against damage from rain, as specified under Article 3.03.H. of this Section.

2. Protection Against Cold Weather

Comply with the requirements for protecting new Work against damage from cold weather, as specified under Article 3.03.H. of this Section.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Concrete

Concrete shall be in accordance with FDOT, Section 345, Class II, 3,400 psi strength; Type I cement; 6.0 sacks cement per cubic yard; Grade 5 or 9 coarse aggregate; silica sand fine aggregate 6.0% $\pm$ 1.0% air content; 3-inch maximum slump; no admixtures without the ENGINEER's approval. Type III cement may be used for high early strength concrete.

B. Ready-Mixed Concrete

Ready-mixed concrete shall conform to ASTM C94, Alternate 2.

C. Water

Water to be used for mixing and curing concrete shall be reasonably clean and free from oil, salt, acid, alkali, chlorides, sugar, vegetable, or other substances injurious to the finished product. Waters from sources approved by the Local Health Department as potable may be used without test. Water requiring testing shall be tested in accordance with the current Method of Test for Quality of Water to be used in Concrete, AASHTO T26.

D. Concrete Curing Compounds

White membrane curing compound for curing concrete shall conform to AASHTO M148, Type 1 clear, or Type 2 white per FDOT Section 925.

E. Premolded Joint Filler

Fiber joint filler shall conform to ASTM D1751. Filler shall be of the thickness, as specified herein, or on the Plans, or as directed by the ENGINEER.

F. Steel Hook Bolts

Hook bolts shall conform to ASTM A706, or for Grade 60 of ASTM A615, A616, or A617.

Hook bolts shall be 5/8-inch diameter, self-tapping.

G. Joint Sealant
Hot-poured type joint sealant shall conform to ASTM D1190.

2.02 MIXES

A. Concrete Mix

1. Concrete shall contain a minimum of six (6) sacks, 94 pounds per sack, of cement per cubic yard and shall yield a minimum compressive strength of 3,400 psi at 28 days.

2. Cement shall be air-entraining Portland cement ASTM C150, Type 1. If high-early strength concrete is desired, Type III is required.

3. High-early concrete can be obtained for small areas by the addition of one sack of cement, Type 1, per cubic yard of concrete.

4. The air content of the concrete shall be 6.0% $\pm$ 1.0% by volume.

5. Maximum slump of the concrete shall be three (3) inches.

6. Ready-mixed concrete in accordance with ASTM C94, Alternate 2, shall be used, unless a written request for other than ready-mixed concrete has been submitted, reviewed and approved by the ENGINEER.

PART 3 – EXECUTION

3.01 CONTRACTORS VERIFICATION

A. Excavation and Forming

1. Prior to the installation of any concrete, examine the excavation and forms for the proper grades, lines, and levels required to receive the new Work. Ascertain that all excavation and compacted subgrades are adequate to receive the concrete to be installed.

2. Correct all defects and deficiencies before proceeding with the Work.

B. Existing Improvements

1. Investigate and verify location of existing improvements to which the new Work is to be connected.

2. Making necessary adjustment in line and grade to align the new Work with the existing improvements must be approved by the ENGINEER, prior to any change.

3.02 PREPARATION

A. Forms

1. The forms shall be of wood or metal, straight and free from warp, clean, and of

sufficient strength to resist springing during the process of depositing concrete against them. For all items constructed on a radius, the contractor will be required to use flexible forms, unless otherwise permitted by the ENGINEER.

2. The forms shall be the full depth of the concrete.

3. Placing of these items by machine methods may be allowed with the approval of the ENGINEER provided that an acceptable finished product, true to line, grade and cross section, is consistently produced.

3.03 INSTALLATION

A. Sidewalks, Sidewalk Ramps, Driveways, and Driveway Approaches

All sidewalks and sidewalk ramps shall be four (4) inches thick except at driveways, where the thickness of the sidewalks shall be six (6) inches. Sidewalks shall be five (5) feet wide unless otherwise noted on Plans, and shall slope 1/4 inch per foot towards the surface drainage side which in general will be towards the center of the road. Normally sidewalks will be located within the right-of-way, parallel the property lines, at a distance of 1-foot from the property line unless otherwise noted on Plans.

Driveways and approaches shall be six (6) inches thick. The width of driveways and driveway approaches shall be as specified on the Plans or as directed by the ENGINEER.

B. Removal of Existing Curb for Sidewalk Ramps and Driveway Approaches

Construction of sidewalk ramps within street intersections where curbed pavement exists shall conform to the current FDOT Roadway and Traffic Design Standards.

Where there is no proper curb drop for the sidewalk ramp or driveway approach, the CONTRACTOR shall saw cut, to full depth of pavement, and remove a minimum of an 18-inch wide curb and gutter section. When mountable curbs are present, the CONTRACTOR shall remove a 24-inch wide curb and gutter section for the construction of sidewalk ramp, as specified above.

The length of curb and gutter removal shall be determined by the ENGINEER in the field but shall be at least as wide as the proposed sidewalk ramp plus 1-foot on each side.

The removed curb and gutter section shall be replaced with material, equal to what was removed and seal joint with hot poured rubber asphalt.

The CONTRACTOR shall install 5/8 inch diameter self tapping hook bolts, in the existing concrete pavement as indicated on the Plans prior to placing concrete for the removed curb and gutter section.

C. Placement of Forms

Wood forms, straight and free from warp, of nominal depth may be used for sidewalk sections less than 25 feet in length.

Forms shall be staked to line and grade in a manner that will prevent deflection and settlement.

When unit slab areas are to be poured, slab division forms shall be so placed that the slab division joints will be straight and continuous.

Forms shall be set for sidewalk ramps to provide a grade toward the centerline of the right-of-way in accordance with current standards. The grade shall be uniform, except as may be necessary to eliminate short grade changes.
Forms shall be oiled before placing concrete. Forms shall remain in place at least 12 hours after the concrete is placed. There shall be sufficient forms placed ahead of the pouring operations to maintain uninterrupted placement of concrete.

The use of slip form pavers can be allowed when approved by the ENGINEER in lieu of the construction system described above.

D. Joints (Curb)

Except for machine placed items, at the option of the contractor, joints may be formed by the use of dummy joints (either formed or sawed) or by the use of sheet metal templates. If sheet metal templates are used they shall be of the dimensions, and shall be set to the lines, shown in the plans. The template shall be held firmly during the placing of the concrete and shall be left in place until the concrete has set sufficiently to hold its shape but shall be removed while the forms are still in place.

For machine placed items, unless an alternate method is approved by the ENGINEER, contraction joints shall be sawed. The joints shall be sawed as soon as the concrete has hardened to the degree that extensive raveling will not occur and before uncontrolled shrinkage cracking begins.

Contraction joints shall be spaced at intervals of ten (10) feet except where a lesser interval is required for closure, but no section shall be less than four (4) feet.

E. Joints (Sidewalk and driveway)

Transverse and longitudinal expansion and plane-of-weakness joints shall be constructed at the locations specified herein, or as indicated on the Plans or as directed by the ENGINEER.

The transverse expansion joints shall be placed for the full width and depth of the new Work. The transverse expansion joints placed against any existing pavement shall be a minimum of six (6) inches deep but no less than the thickness of the concrete being placed.

Longitudinal expansion joints shall conform to the same requirements as transverse expansion joints.

Joints shall be constructed true to line with their faces perpendicular to the surface of the sidewalk. The top shall be slightly below the finished surface of the sidewalk. Transverse joints shall be constructed at right angles to the centerline of the sidewalk and longitudinal joints shall be constructed parallel to the centerline or as directed by the ENGINEER.

Unless otherwise specified in the Plans or unless directed by the ENGINEER, when the sidewalk is constructed in partial width slabs, transverse joints in the succeeding slab shall be placed in line with like joints in the adjacent slab. Also in the case of widening existing sidewalks, transverse joints shall be placed in line with like joint in the existing sidewalk.

Transverse expansion joints, 1/2 inch thick, shall be placed through the sidewalk at uniform intervals of not more than 50 feet and elsewhere as shown on the Plans, or as

directed by the ENGINEER.

Expansion joints, 1/2 inch thick, shall also be placed between the sidewalk and back of abutting parallel curb, buildings or other rigid structures, concrete driveways and driveway approaches. When directed by the ENGINEER, the expansion joint between sidewalks and buildings shall be placed 1-foot from the property line and parallel to it.

Expansion joints, 1-inch thick, shall be placed between sidewalk ramps or driveway approaches and the back of curbs.

Plane-of-weakness joints shall be formed every five (5) feet and shall be produced by use of slab divisions forms extending to the full depth of the concrete or by cutting joints in the concrete, after floating, to a depth equal to 1/4 the thickness of the sidewalk. The cut joints shall not be less than 1/8 inch nor more than 1/4 inch in width and shall be finished smooth and shall be at right angles to the centerline of the sidewalk.

F. Placing and Finishing Concrete

All concrete shall be placed on a prepared, smooth, leveled, rolled and properly compacted base as indicated on the Plans. The surface of the subbase shall be moist with no visible water present prior to placement of the concrete.

The concrete shall be deposited, in a single layer, therein to the depth specified in the Plans or in the Proposal. The concrete shall be thoroughly spaded or vibrated and compacted to fill in all the voids along the forms and joints. The concrete shall be struck off with a strike board until all voids are removed and the surface has the required grade and cross section as indicated on the Plans, or as directed by the ENGINEER. The surface of the concrete shall be floated just enough to produce a smooth surface free from irregularities. All edges and joints shall be rounded with an edger having a 1/4 inch radius.

The repair of minor defects, the forms for curbs shall be removed within 24 hours after the concrete has been placed, and the minor defect then filled with mortar compound of one part portland cement and two parts fine aggregate. Plastering will not be permitted on the face of the curb, and any rejected curb, curb and gutter, or valley curb shall be removed and replaced without additional compensation.

The final finish for all exposed surfaces of curbs shall be given a finish while the concrete is still green. In general only a brush finish will be required. For any surface areas, however which are still too rough or where other surface defects make additional finishing necessary. The ENGINEER may require that the curb be rubbed to a smooth surface with a soft brick or wood block, with water used liberally. Also, if necessary further to provide a suitable surface, the ENGINEER may require additional rubbing, using a thin grout or mortar.

The surface of sidewalks, driveways and approaches shall be broomed to slightly roughen the surface.

The surface of sidewalk ramps shall be textured with a coarse broom transversely to the ramp slope, and shall be coarser roughened than the remainder of the sidewalk.

G. Curing

After finishing operations have been completed and immediately after the free water has left the surface, the surface of the concrete (and sides if slip-forming is used) shall be

completely coated and sealed with a uniform layer of white membrane curing compound. The curing compound shall not be thinned. The curing compound shall be applied at the rate of one gallon per 200 square feet of surface.

The concrete shall be continuously cured for period of at least 72 hours. Curing shall be commenced after finishing has been completed and as soon as the concrete has hardened sufficiently to permit application of the curing material without marring the surface. Any curing material removed or damaged during the 72 hour period shall be replaced immediately.

After forms are removed, the surfaces exposed shall be cured by placing a berm of moist earth against them or by any of the methods described below, for the remainder of the 72 hour curing period.

1. Burlap shall be placed over the entire exposed surface of the concrete, with sufficient extension beyond each side to insure complete coverage. Adjacent strips shall be overlapped a minimum of six inches. The burlap shall be held securely in place such that it will be in continuous contact with the concrete at all times and no earth shall be permitted between the burlap surfaces at laps or between the burlap and the concrete. The burlap shall be saturated with water before being placed and shall be kept thoroughly wet throughout the curing period.

2. Clear membrane curing compound or white-pigmented curing compound shall be applied by hand sprayer in a single film at a uniform coverage of at least one gallon to each 200 square feet. Any cracks, checks or other defects appearing in the coating shall be recoated immediately. The curing compound shall be thoroughly agitated in the drum prior to application as necessary to prevent settlement of the pigment.

3. Polyethylene sheeting shall be placed over the entire exposed surface of the concrete, with sufficient extension beyond each side to insure complete coverage. Adjacent strips shall be overlapped a minimum of six inches. The sheeting shall be held securely in place such that it will be in continuous contact with the concrete at all times.

H. Backfilling and Compaction

After the concrete has set sufficiently, but not later than three days after pouring, the spaces adjacent to exposed surfaces shall be refilled to the required elevation, with suitable material, which shall be placed and thoroughly compacted in layers not thicker than six inches.

I. Barricades

Suitable barricades and lights shall be placed around all newly poured sidewalks, sidewalk ramps, driveways, driveway approaches and curb and gutter section in order to protect the new Work from damage from pedestrians, vehicles and others until the concrete has hardened.

Barricades shall be left in place for a minimum of two (2) days, except for driveway approaches and curb and gutter section. Barricades shall remain in place for a minimum of three (3) days.

Any concrete that suffers surface or structural damage shall be removed and replaced by

the CONTRACTOR at his expense.

J. Protection

1. Against Rain

The CONTRACTOR shall adequately protect the new concrete from the effects of rain before the concrete has sufficiently hardened. For this Work the CONTRACTOR shall have available on the job site at all times enough burlap or 6-mil thick polyurethane film to cover and protect one days work. When rain appears eminent, all operations shall stop and personnel shall begin covering. As soon as the rain ceases, the concrete shall be uncovered and the surface burlap dragged where necessary. Curing compound shall be applied to any areas where the compound has been disturbed or washed away.

2. Against Cold Weather

If concrete is placed between December 15 and February 15, the CONTRACTOR shall have available on the site sufficient amount of clean, dry straw or hay to cover one (1) days production. If the temperature reaches 40 degrees F and is falling, the hay or straw shall be placed 12 inches thick, immediately after the curing compound is applied.

3. Concrete Temperature Limitations

Concrete shall not be placed when the temperature of the concrete at the point of placement is above 95 degrees F.

K. Cleanup

After the concrete has gained sufficient strength, but no sooner than within 12 hours, the fixed forms shall be removed and the spaces on both sides shall be immediately backfilled with sound earth of topsoil quality. The backfill shall be compacted, leveled and left in a neat, workmanlike condition.

3.04 FIELD QUALITY CONTROL

A. Testing

1. Cores

The ENGINEER may require that a minimum of two (2) cores be drilled from the sidewalk for each 500 (or fraction thereof) linear foot section placed. At least one (1) core out of two (2) required will be taken from the sidewalk at the driveway. One (1 core may be required from every 20 (or fraction thereof) driveway approaches or sidewalk ramps installed.

The cores shall be checked for depth and compressive strength. The core drilling and tests shall be done by a testing laboratory designated by the OWNER. The testing laboratory shall furnish the ENGINEER with two (2) certified copies of the test results.

2. Concrete pavement shall have a 28-day compressive strength of 3000 PSI. Portland Cement Concrete control for slump testing, and concrete cylinder samples and testing is required and shall be in accordance with AASHTO and

ASTM Specifications, latest edition. Test reports shall be submitted to the ENGINEER for review. All tests shall be conducted by a geotechnical/soils engineer under contract to the City. Final acceptance shall be based on testing in accordance with other paving requirements.

3. Defective Work

In the event the test results on a core indicates a deficiency in either thickness or compressive strength the following adjustments in the unit price for concrete shall be made:

a. Thickness

Under Required Thickness	Percent of Reduction in Unit Price
0" to 1/4"	None
by more than 1/4" but not exceeding 1/2"	20
by more than 1/2" but not exceeding 1"	50
by more than 1"	Remove and Replace

b. Compressive Strength

Under Required Thickness	Percent of Reduction in Unit Price
0 to 150 psi	None
by more than 150 psi but not exceeding 300 psi	20
by more than 300 psi but not exceeding 500 psi	50
by more than 500 psi	Remove and Replace

The area of the deficient core shall be determined by the drilling and testing of two (2) additional cores, one (1) on each side of the deficient core and 20 feet from it when possible. The extra core drilling and testing shall be at the expense of the CONTRACTOR. Reductions due to deficiencies in thickness or compressive strength are additive; that is, if an area is deficient by 3/8 inch and under strength by 200 psi, the total reduction is 20% plus 20% or 40% reduction.

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SECTION 02580
PAVEMENT MARKINGS

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes pavement markings complete with materials, layout of markings and preparation of pavement surfaces.

B. Related Work Specified Elsewhere

1. Section 01025: Measurement and Payment

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

ASTM- American Society of Testing and Materials
AASHTO- American Association of State Highways and Transportation Officials
FDOT- Florida Department of Transportation

B. Requirements of Regulatory Agencies

Where applicable, pavement markings shall conform to the current requirements of the Manual of Uniform Traffic Control Devices (14.15.010, F.A.C.).

1.03 SUBMITTALS

A. Manufacturers Literature

Submit manufacturer's literature of all paints to be used in the Work. Manufacturer's literature shall show paint: type, texture, color, temperature limitations, recommended use, spreading rate, drying time, and cleanup.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

Deliver all materials to the Project site in original, unopened waterproof containers. Packaging containers shall bear manufacturing labels intact and legible. The label shall contain the following information: name and address of manufacturer and contractor, shipping point, trade mark or trade name, kind of paint, formula, amount in U.S. gallons, date of manufacture and lot number, type of paint and AASHTO Specification Number.

A. Storage

Store all materials in waterproof containers, under protective covering, off the ground and away from extreme heat or cold until ready for use.

B. Handling

Handling of materials shall be in accordance with the manufacturer's recommendations.

1.05 JOB CONDITIONS

A. Environmental Requirements

1. Temperature

Materials shall not be applied when the ambient outside air temperature is below 40 degrees F.

2. Humidity

Material shall not be applied when the ambient outside relative humidity is above 80%.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Traffic Marking Paint

1. Regular Dry Paint

Regular drying pavement marking paint in white and yellow colors shall conform to AASHTO M248, Type N, traffic paint and shall meet the current FDOT specified requirements of FDOT Specifications Section 971 for regular drying traffic paint.

2. Fast Dry Paint

Fast drying pavement marking paint in white and yellow colors shall conform to AASHTO M248, Type F, traffic paint and shall meet the current requirements of FDOT Specifications Section 971 for fast drying traffic paint.

B. Thermoplastic Paving Markings

1. Hot Applied Thermoplastic Pavement Markings

Hot applied thermoplastic pavement markings in white and yellow colors shall conform to AASHTO M249, white and yellow thermoplastic striping materials (solid form) and shall meet the current requirements of FDOT Specifications Section 711 for hot applied thermoplastic paving marking.

2. Preformed Thermoplastic Pavement Markings

Preformed thermoplastic pavement markers in white and yellow colors shall conform to the current requirements of FDOT Specifications Section 711 for cold applied preformed thermoplastic pavement markings.

C. Glass Spheres

1. Glass Spheres for Use in Pavement Markings

Glass beads for reflectorizing white and yellow paint markings of pavement by the drop-in method on fresh paint stripes shall conform to the current requirements of FDOT Specification Section 971 for glass beads for use in pavement markings.

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

A. Existing Conditions

Prior to the placing of any paint, examine the limits of the new Work and ascertain that the existing surfaces are adequate to receive the material to be installed.

3.02 PREPARATION

A. Preparation of Surface

Surfaces to be painted must be thoroughly dry and free from dirt, loose paint, oil, grease, wax and other contaminants.

The costs incurred for removing and disposing of unsuitable materials in preparation of the surfaces to receive the new Work, shall be incidental to the price paid for the pavement markings.

3.03 PERFORMANCE

A. General

1. The pavement marking operation shall be limited to the type of Work and the limits as specified on the Plans. If additional area is required by the CONTRACTOR for storage of equipment or supplies, the CONTRACTOR shall furnish the ENGINEER with written permission obtained from the property owner of the storage area, permitting the storage.

2. Unless otherwise specified on the Plans or directed by the ENGINEER, the CONTRACTOR shall conduct his operations and use of his equipment in such a manner that traffic will be maintained throughout the Project.

For Work within public rights-of-way and other areas as determined by the ENGINEER, the provisions for maintaining traffic shall be as specified in the State of Florida, Manual of Traffic Control and Safe Practices for Street and Highway Construction, Maintenance and Utility Operations, and Manual of Uniform Traffic Control Devices.

All costs incurred in maintaining traffic shall be at the CONTRACTOR'S expense.

3. The CONTRACTOR'S equipment shall have sufficient paint capacity to enable sustained pavement marking operations and shall be equipped so as to assure uniform application of the paint and thermoplastic pavement markings.

When specified, the equipment shall have mechanical bead dispensers or pressurized bead dispensers. In general, the equipment shall be that necessary to accomplish the marking operations in a safe, efficient, and workmanlike manner.

Unless otherwise specified, approved portable equipment and use of hand methods will be allowed.

Unless otherwise specified, pavement markings shall be paint applied on bituminous or Portland cement concrete surfaces. The color of the paint, and the width or type of markings shall be as specified on the Plans or as directed by the ENGINEER.

The markings shall be applied so that they adhere adequately to the surface.

B. Layout for Markings

All layout work necessary for the location and placing of markings, as specified on the Plans or as directed by the ENGINEER, shall be the responsibility of the CONTRACTOR and shall be at his expense.

C. Tolerances

New markings and/or retraced markings shall be placed, with reasonable tolerance, in their proper locations. Incorrect or misplaced markings shall be obliterated and remarked in accordance with the ENGINEERS instructions.

Costs incurred to obliterate and remark incorrect or misplaced markings will be at the CONTRACTOR'S expense.

D. Protection of Markings

The protection of the wet paint and thermoplastic pavement markings shall be the responsibility of the CONTRACTOR, and all costs incurred to provide the protection will be at his expense.

E. Weather and Time Limitations

Markings shall not be placed when rain is threatening or when the surface to be painted is wet. No markings shall be applied when the air temperature is less than 40 degrees F, as determined by the ENGINEER.

END OF SECTION

SECTION 02660
POTABLE WATER MAIN

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

The work included under this Specification consists of furnishing all labor, equipment and materials necessary for the construction and testing of water mains and appurtenances as shown on the Drawings and specified herein.

B. Related Work Specified Elsewhere

1. Section 01025: Measurement and Payment
2. Section 02140: Dewatering during Construction
3. Section 02226: Trenching, Backfilling, and Compaction
4. Section 15044: Hydrostatic Testing of Pipe
5. Florida Administrative Code Chapter 62-555.314
6. Florida Administrative Code Chapter 62-555.320

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work of this Section shall conform to the applicable portions of the following Standard Specifications:

1. ANSI - American National Standards Institute
2. ASTM - American Society for Testing and Materials
3. AWWA - American Water Works Association
4. NSF - National Sanitation Foundation

1.03 SUBMITTALS

A. The Contractor shall submit Shop Drawings, work drawings and samples in accordance with the General Conditions and Section 01300.

B. In addition, the requirements of each related section and the following apply.

C. Shop Drawings for piping, valves, hydrants and other equipment and appurtenances shall be prepared by the manufacturer and include, as a minimum, the following:

1. Details of all fittings, valves, hydrants and other appurtenances
2. List of materials of construction standards and spare parts.
3. Provide detailed drawings of joints and gaskets to be supplied.
4. Calculations and/or test data demonstrating that the proposed restrained joint arrangement can transmit the required forces.
5. Copy of the manufacturer's quality control check of materials and production.
6. Provide form the manufacturers an affidavit of compliance with AWWA standards referenced in the specifications. Affidavit shall be included with Shop Drawings submittals.
7. Provide a tabulated layout schedule including:

a. Order of installation and closures.
b. Pipe invert station and elevation at changes of grade and alignment.
c. Elements of curves and bends, both in horizontal and vertical alignment, including elements of the resultant true angular deflections in cases of combined curvature.
d. The limits of each reach of pipe thickness class and of restrained joints.
e. Locations of closures for length adjustment and for construction convenience.
f. Locations of valves, hydrants and other equipment.
g. Methods and locations of support.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Storage of Materials

1. Water Main Piping

Pipe shall be stored in a manner to minimize infiltration of dirt, debris and other extraneous materials.

Piping materials shall not be stacked higher than four (4) feet. Suitable racks, chairs and other supports shall be provided to protect preformed pipe mating surfaces from damage. Store bottom tiers off the ground, alternate tiers and chock tier ends.

2. Valves and Accessories

Store all valves, wells and prefabricated structures off the ground, drained and kept free of water to protect against damage. Valves, wells, their accessories and appurtenances shall be kept in their original containers until ready for installation.

3. Gasket, Glands, and Seals

All joint and sealing materials subject to ultra-violet or ozone attack and used in the water main system shall be protected from the sunlight, atmosphere and weather, stored in suitable enclosures until ready for installation.

B. Handling of Materials

1. Load and unload piping using suitably approved hoists and skidding. Piping shall not be dropped, bumped or allowed to impact against itself. Damaged piping shall be rejected by the ENGINEER.

2. Lifting devices shall be suited to the Work and shall protect surfaces from damage.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Scope

It is the intent of this Article to specify in detail the various types of pipe, joints, and fittings which have been indicated throughout the Plans and Specifications. This Article shall not be construed as allowing any alternate type of material to that which is indicated on the Plans or elsewhere in the Specifications.

B. Ductile Iron Pipe

1. Pipe shall be ANSI/AWWA A21.51/C151, cast and machined in the United States of America with blue marking in accordance with F.A.C 62-555.320. Pressure class shall be as follows:

   a. For buried pipe: Class 250
   b. For above grade or exposed pipe: Flanged, Class 350

2. Joints

   Joints in "runs" of aboveground piping or piping located in vaults and structures shall be flanged. Joints in runs of buried piping shall be of the push-on or mechanical joint type per AWWA C-111 except where flanged joints are required.

   a. Flanged Joint

      i. Flanges shall be Class 125 per ANSI B-16.1. Flanges shall be long-hub type screwed tightly on pipe by machine at the foundry prior to facing and drilling. Flange faces shall be coated with a rust inhibitor immediately after facing and drilling. Field assembled screwed on flanges are prohibited.
      ii. Gaskets to be furnished in SBR (Styrene Butadiene) or an approved equal suitable for sanitary sewage, water, and reuse service.
      iii. All nuts and bolts for flanges shall be Type 316 stainless steel conforming to ASTM A-193, Grade B&M for bolts, and ASTM A-194, Grade M for nuts.

         - Provide washers for each nut. Washer shall be of the same material as the nuts.

   b. Push-on Joint

      i. The plain ends of push-on pipe shall be factory machined to a true circle and chamfered to facilitate fitting the gasket with spigot of pipe marked to visually determine when the spigot is fully seated in the bell of the adjoining section.
      ii. Gaskets to be furnished in SBR (Styrene Butadiene) or an approved equal suitable for sanitary sewage, water, and reuse service conforming to ANSI A21.11.
      iii. Joint deflection shall be limited to 75% of the maximum recommended deflection per the pipe manufacturer.

iv. Joints for pipe that are required to be restrained shall be restrained using a harness device, or “bell restraint.” The harness shall be split to enable installation after the spigot has been installed into the bell. The restraint ring of the harness shall consist of a plurality of individually activated gripping surfaces to hold the spigot.

c. Mechanical Joint Restraints

i. All yard piping shall be restrained. Pipe joints shall be restrained on each side of a fitting with a mechanical joint restraint. Mechanical joint restraints shall be accomplished using a mechanism consisting of plurality of individually activated gripping surfaces incorporated into the design of the follower gland with a compression gasket, conforming to ANSI A21.11. Glands shall be manufactured of ductile iron conforming to ASTM A 536. Restraining devices shall be of ductile iron, heat treated to a minimum hardness of 370 BHN. Twist off nuts shall be used to insure proper actuating of the restraining devices. Bolts and nuts shall be corten, low alloy, high strength steel conforming with AWWA standards. Bolts shall be tee-head conforming to ANSI A21.1, A21.53 and AWWA C 153 and C111.

C. Fittings

1. Below Grade

a. Fittings shall be compact, ductile iron with pressure rating of 250 psi conforming to ANSI A21-53/AWWA C-153 and be the mechanical joint configuration with standard thickness cement mortar lining in accordance with ANSI 21.4/AWWA C 104 and factory applied asphaltic coating per AWWA C 110 and C 153. All fittings shall have ANSI A21.10 laying lengths equivalent to those listed for mechanical joint fittings.

2. Above Grade

a. Above grade fittings shall be flanged in accordance with AWWA C110/ANSI 21.10 with facing and drilling which match AWWA C115 and which also match ANSI B16.1 Class 125 flanges. Exposed fittings shall have factory applied coating of a universal rust-inhibitive primer 2.0 mils dry thickness.

D. Pipe Linings

Cement mortar linings for ductile iron pipe shall conform to the requirements of ANSI A21.4/AWWA C104 of the thicknesses specified and shall be permanently set prior to the application of any additional pipe coating.

E. Pipe Coatings

1. Buried Pipe

Shall have factory applied asphaltic coating in accordance with the requirements of AWWA C151.

2. Exposed Pipe

Shall have factory applied coating of a universal rust-inhibitive primer with 2.0 mils dry thickness and an epoxy-polyamide, UV resistant protective coating.

F. Valves

See valve specifications in Section 15200 – Process Piping and Valves.

G. Electronic Ball Markers

Ball markers shall be placed at crosses, tees, and changes of direction. All markers shall be noted on the As-Built Drawings and shall not be buried at a depth greater than 5 feet below the finish grade elevation.

H. Service Sleeves

The sleeves shall be compatible with the main and service lead, with straps of a ductile material to avoid crushing the main out-of-round. A molded gasket of rubber or neoprene shall completely encircle the tapped opening to insure a watertight connection. The use of lead gaskets is not allowed.

I. Curb Stops

Water service brass of types and sizes compatible with the connecting service pipe type.

J. Water Service Polyethylene (PE) Tubing

Shall be SDR 11, 200 PSI, colored BLUE or longitudinal blue line striped, provided in ductile iron pipe size. Pipe shall be homogeneous throughout, free from voids, cracks, inclusions. And other defects. It shall be uniform as commercially practical in color, density and other physical properties. Pipe surfaces shall be free from gouges and imperfections that could cause leakage.

K. Polyethylene Encasement

All buried pipe, valves, and fittings shall be polyethylene encased, minimum 8 mil thickness, in accordance with AWWA C105, blue in color, and printed with the text WATER.

2.02 ACCEPTABLE MANUFACTURERS

A. Corporation Stop Ball Type

1. Ford FB1100
2. McDonald 4701B-22
3. Mueller P25008

B. Curb Stop

1. Ford B43-342W, BF43-777W

2. McDonald 6100MW-22
3. Mueller P24350, P24335

C. Polyethylene Tubing

1. Endot PE-3408 Endopure
2. Charter Plastics PE-4710 Blue Ice

D. Service Saddle

1. Ford Series FC202, FC101
2. Mueller DR15, DR25
3. Romac Series 202N
4. Smith Blair Series 397

E. Ductile Iron Pipe

1. American
2. Clow
3. Griffin
4. McWane
5. US Pipe

F. Fittings

1. American
2. Sigma
3. Star
4. Union/Tyler

G. Electronic Ball Marker

1. 3M EMS 4”, extended range 5’ ball marker, water 1403 XR

H. Restrained Joint

1. American, Fast Grip Gasket
2. EBAA Iron Mega-lug Series 1100, 1700 Bell Restraint, RS3800 Restrainer
3. Ford UFR-1400 1300C Series
4. Star Series 3000, All Grip Series 3600
5. US Pipe Field Loc Gasket
6. Sigma ONE-LOK-SLD

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

A. Excavation and Bedding

Prior to the installation of any water main piping or materials, examine all trenches and other excavations for the proper grades, lines, levels and clearances required to receive the new Work. Ascertain that all excavation bottoms, compacted subgrades and pipe bedding are adequate to receive water main materials to be installed. Correct all defects and deficiencies before proceeding with the work.

3.02 PREPARATION

A. Pipe Ends

Remove all lumps, blisters excess coatings from the socket and plain ends of pipe. Wire brush and wipe clean the outside surfaces of all plain ends and the inside surfaces of all socket ends before installation. Any pipe or fitting which has acquired a coating of mud or other adhesive foreign material shall be scrubbed clean with heavily chlorinated water.

B. Examination of Materials

All pipe fittings, valves, hydrants, accessories and appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective or damaged materials shall be marked and held for inspection by the ENGINEER. Damaged materials are subject to rejection by the ENGINEER.

3.03 INSTALLATION

A. General

1. Pipe Cleanliness

Foreign matter shall be prevented from entering the pipe while it is being placed in the trench. During and after laying operations, no debris, clothing or other materials shall be placed in the pipe.

2. Pipe Plugs

During the progress of all water main Work, watertight plugs shall be carried along and inserted in the end of each pipe as it is laid to prevent foreign matter or rodents from entering the pipe. This watertight plug shall be fastened in the end of the water main in such a manner as to prevent it from floating or being otherwise displaced whenever construction operations are temporarily halted, such as at noon or at the end of the days Work.

3. Pipe Bearing

Each section of pipe, when placed to grade and line, shall have firm bearing on the trench bedding throughout its length between bell holes.

4. Pipe Cutting

Cutting of pipe shall be done with approved tools and by approved methods suitable for the pipe material. Pipe cutting methods that produce a smooth, square cut end without damage to the pipe and that minimize airborne particles, shall be employed. Pipe cutting shall be performed using the recommendations of the manufacturer of the type of pipe materials being cut and according to the best trade practices.

a. Pipe Linings and Coatings

When cutting pipe or fittings, care shall be taken to prevent damage to linings and coatings. Damage to linings shall be cause for rejection of the complete Section. Damage to exterior coatings shall be corrected to original Specifications.

b. Gaskets

Where pipe using a resilient gasket to effect the seal is cut, the cut pipe end shall be tapered at a 30-degree angle with the centerline of the pipe, and ground smooth, on the outside end to remove any sharp edges or burrs which might damage the gasket.

5. Pipe Laying

Unless otherwise specified, pipe shall be laid with bell ends facing in the direction of laying. After a length of pipe is placed in the trench, the spigot shall be centered in the bell end of the adjacent pipe section, the pipe shoved into position and brought to true alignment and secured with sand tamped under and on both sides of the pipe except at bell holes. Adequate support shall be provided for all water main pipe.

6. Pipe Bedding

After the bottom of trench has been excavated and filled to the required grade with four (4) inches of bank run sand approved by the ENGINEER, meeting the requirements of granular material thoroughly compacted by tamping, the pipe shall be installed strictly in accordance with the manufacturers recommendations. After the pipe is laid, the sand backfill shall be continued to a point 12 inches above the top of pipe barrel. Particular care shall be taken to assure filling and tamping all spaces under, around and above the top of the pipe. Backfill shall be as indicated on the Plans and in the Specifications. A continuous and uniform bedding shall be provided in the trench for all buried pipe.

7. Bolts, Studs, and Nuts

Install bolts, studs, and nuts of the type specified per the manufacturers installation and torqueing requirements. All steel bolts, studs, and nuts shall be painted with bituminous paint after installation.

B. Ductile Iron Pipe

1. Push-On Joints

Joints shall be made by means of a compression type push-on resilient gasket. Gasket shall be pre-lubricated before installation using a lubricant recommended by the pipe manufacturer. The seated joint shall be identified by the visible mark on the spigot of the installed pipe section.

2. Mechanical Joints

Joints shall be made with bolts, molded resilient gasket and ductile iron follower gland. All nuts shall be screwed up finger tight before using a wrench. The gland and rubber gasket shall be brought up evenly at all points around the bell flange and then torqued per the manufacturers recommendations. The normal range of bolt torques to be applied to standard cast iron bolts in a joint and the lengths of wrenches that should satisfactorily produce the ranges of torques are as follows:

Pipe Size (in.)	Bolt Size (in.)	Range of Torque	Length of Wrench
3	5/8	45-60 ft. lb.	8 inches
4-24	3/4	75-90 ft. lb.	10 inches
30-3	1	100-120 ft. lb.	12 inches
42-48	1-1/4	120-150 ft. lb.	14 inches

Exposed portions of bolts shall be covered with mastic.

C. Polyvinyl Chloride Pipe

Polyvinyl chloride pipe shall be laid with gasketed joints in complete accordance with the pipe manufacturers published instructions. The joints shall be sufficiently lubricated using the pipe manufacturers recommended lubricant.

Gaskets for pipe joints shall be inserted with the painted edge facing the end of the bell. Each length of pipe shall be pushed home individually. The pipe shall be positioned so that the reference mark on the spigot end is in line with the bell end.

D. Valves, Fittings, and Appurtenances

1. Valves

All valves shall be installed to the grade, lines, levels and locations indicated on the Plans.

Valve connections shall be as specified for the piping materials used. Valves shall be set with the stem plumb on permanent, firm foundations as indicated on the Plans.

Where required, valves shall be supported with special supports as indicated on the Plans and as approved by the ENGINEER. Valves shall be installed so as not to receive support from the connecting pipe. In no case shall valve installation be used to bring misaligned pipe into alignment.

2. Valve Boxes

Install valve boxes to the grade, lines, levels and locations indicated on the Plans. Valve boxes shall not transmit shock or stress to the valve and shall be set plumb with covers centered over operating nuts and flush with the indicated surface elevations. Valve boxes that shift or fill during backfilling shall be uncovered and reset.

3. Service Sleeves

Where service sleeves are to be installed, the entire circumference of the main shall be free of all loose material. Installation of the sleeve and tapping of the main shall be in accordance with manufacturers recommendations.

4. Curb Stops

Install curb stops of the types and sizes indicated on the Plans.

5. Fittings, Strapping, and Lugged Pipe

a. Fittings

Install all fittings to the lines, levels and locations indicated on the Plans. Installation of fittings shall be with the type of joint specified for piping. Fittings shall be provided with restraints as specified herein as indicated on the Plans and as required for a functional installation.

b. Strapping, Lugged Pipe and Fittings

Where indicated on the Plans and as directed by the ENGINEER, bends in water main piping and piping runs subject to impact reaction shall be secured by means of metal strapping. Install all necessary bands, tie rods, nuts and washers required. No metal strapping shall be used in direct contact with polyvinyl chloride pipe.

Where lugged pipe and special fittings are indicated on the Plans, furnish and install all necessary tie rods, nuts and washers.

E. Air Release Assembly

Provide all materials and construct air release assemblies where indicated on the Plans. Install all valves, fittings, caps, plugs and piping as required. Fittings and joint materials used for air release assemblies shall be as specified herein for the water main piping materials used.

F. Blow-Off Assembly

Provide all materials and construct blow-off assemblies where indicated on the Plans. Blow-off assemblies and pipe shall be installed to the lines, levels and elevations shown, install all valves, fittings, reducers, piping, plugs, joints, etc. as detailed. Blow-off assemblies shall be installed on stable, undisturbed earth materials with changes in directions and returns provided with bedding and restraints as indicated on the Plans, as specified herein and as required for a complete installation. Blow-off assemblies shall include valve boxes as detailed.

G. Tapping Valve Assembly

Install all tapping valve assemblies of sizes and to the lines, elevations, locations and details indicated on the Plans. The tapping sleeve shall be assembled around the main, and the tapping performed in strict accordance with the manufacturers recommendations. Tapping shall be accomplished without interruption of service.

H. Anchors, Encasements, and Restraints

Plugs, tees, sleeves, bends, caps, straps and lug piping shall be provided with suitable anchors, encasements and restraints as indicated on the Plans. Anchoring, encasement and restraint methods shall be as detailed. All bearings shall be as shown. Anchors, encasements and restraints shall rest on firm, stable, compacted subgrade and shall be provided for all standard and special fittings.

I. Water Service Lines

1. General

When so indicated in the Proposal(s), or on the Plans, the CONTRACTOR shall provide water service lines in accordance with Article 3.03.H.2. and 3.03.H.3. of this Section. Otherwise, water service lines are not required.

2. New Water Main

a. General

Water service lines shall be installed after the main has been successfully tested and put into service, including the installation of fire hydrants. The service lines shall be of the type indicated on the Plans, and shall be 3/4 inch diameter unless otherwise indicated on the Plans.

Water service lines shall be provided at the locations indicated on the Plans, within these Contract Documents or as directed by the ENGINEER.

b. Installation Method

Water service lines under concrete or asphalt pavements shall be installed by boring or tunneling, unless otherwise indicated on the Plans or directed by the ENGINEER.

Backfilling of open cut construction shall be in accordance with Section 02226, Trenching, Backfilling, and Compacting, after the service line, including curb stop, has been laid and approved by the ENGINEER. Prior to backfilling the service line the CONTRACTOR shall request an inspection by the ENGINEER and obtain approval of the service line.

Alternative methods such as hydraulic jacking; air jetting; piston mole; etc., may be used to install water service lines if approved by the ENGINEER. The proposed method must be approved by the governmental agency having jurisdiction over the work area and the CONTRACTOR must demonstrate that, in the opinion of the ENGINEER, the method is suitable for local soil and ground conditions. To be found suitable for local conditions, the method must be demonstrated to perform within acceptable horizontal and vertical accuracy limits, must not compress soil beyond acceptable limits, and must not leave voids in the soil. Water jetting shall not be permitted. Final installation of the service pipe must be in accordance with manufacturers recommendations and no joints or fittings shall be allowed under roadway surfaces.

3.04 FIELD QUALITY CONTROL

A. Hydrostatic Testing

After the pipe has been laid and backfilled, the pipe shall be hydrostatically tested for leakage. The CONTRACTOR shall furnish the pump, pipe connection, hydrants, valves and any other necessary apparatus including gages and meters and all personnel necessary for conducting the test. Before applying the test pressure, all air shall be expelled from the pipe. If necessary to accomplish this, taps shall be made at points of higher elevation and afterwards plugged. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter. Flushing shall be at full flow conditions with at least 2.5 feet per second flow rate.

The test shall be made at a pressure of 150 pounds per square inch gage. The full pressure shall be held for at least one (2) hours in accordance with the applicable provisions as set forth in section 4 of AWWA standard C600. Any faulty pipe fitting, gate valves or other accessories which permit leaks during testing shall be replaced by the CONTRACTOR with sound material and the test shall be repeated until specified requirements are met. Testing against existing valves or valves connected to the existing water system is prohibited.

The maximum permissible leakage for Ductile Iron Pipe shall be less than the number of gallons per hour determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

Where:

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 maintained during the leakage test in pounds per square inch, (min. 150 psi)

The testing procedure shall include the continued application of the specified pressure to the test system, for the two hour period, by way of a pump taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container. Should the test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until within the established limits. The Contractor shall furnish the necessary labor, water, pumps, gauges, and all other items required to conduct the required testing and perform necessary repairs.

Should the test pass, the contractor shall exercise the valves at the direction of the inspector to confirm the yard valves can hold pressure. Once all valves have been tested and pass inspection, the hydrostatic testing will be complete.

B. Water for Testing

Water for testing shall be obtained from a potable water supply. The CONTRACTOR shall provide all water required at his own expense and shall make all necessary arrangements with the authority which controls the source of water system and shall be governed in his use of water by all rules and regulations imposed thereon by said authority. The CONTRACTOR shall provide and remove temporary connections, backflow preventers, meters, etc., between the source water system and the mains constructed under this Contract. All temporary connections shall meet the approval of the ENGINEER, the authority controlling the source water system and Public Health authorities having jurisdiction.

C. Disinfection

1. Following successful pressure testing, the Contractor shall disinfect all sections of the distribution system, and receive approval thereof from the appropriate agencies, prior to placing the system in service. Two (2) business days advance notice shall be provided to the Utilities Department before disinfecting procedures start. The disinfection shall be accomplished in accordance with the applicable provisions of AWWA Standard C651, “Disinfecting Water Mains”, and all applicable approval agencies.

2. Care shall be taken to provide disinfection to the total system and extremities shall be carefully flushed to accomplish this end. Following disinfection, bacteriological test results shall be submitted to the Utilities Department. Should the test results be unsatisfactory the piping shall be disinfected and re-tested until sufficient number of satisfactory results are obtained.

3. The Contractor shall furnish all equipment and materials and perform the work necessary for the disinfecting and testing (re-testing if required) procedures, including additional disinfection as required.

4. All internal parts on tapping machines, such as cutting heads, etc. will be disinfected in compliance with AWWA C651, prior to making any tap.

5. Following chlorination, all treated water shall be thoroughly flushed from the pipe until the water throughout its length shows a total chlorine residual not in excess of 3.0 mg/L.

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END SECTION

SECTION 02661
RECLAIMED WATER MAIN

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

The work included under this Specification consists of furnishing all labor, equipment and materials necessary for the construction and testing of reclaimed water mains and appurtenances as shown on the Drawings and specified herein.

B. Related Work Specified Elsewhere

1. Section 01025: Measurement and Payment
2. Section 02140: Dewatering during Construction
3. Section 02226: Trenching, Backfilling, and Compaction
4. Florida Administrative Code Chapter 62-610.469
5. Florida Administrative Code Chapter 62-610.660

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work of this Section shall conform to the applicable portions of the following Standard Specifications:

1. ANSI - American National Standards Institute
2. ASTM - American Society for Testing and Materials
3. AWWA - American Water Works Association
4. NSF - National Sanitation Foundation

1.03 SUBMITTALS

A. The Contractor shall submit Shop Drawings, work drawings and samples in accordance with the General Conditions and Section 01300.

B. In addition, the requirements of each related section and the following apply.

C. Shop Drawings for piping, valves, hydrants and other equipment and appurtenances shall be prepared by the manufacturer and include, as a minimum, the following:

1. Details of all fittings, valves, hydrants and other appurtenances
2. List of materials of construction standards and spare parts.
3. Provide detailed drawings of joints and gaskets to be supplied.
4. Calculations and/or test data demonstrating that the proposed restrained joint arrangement can transmit the required forces.
5. Copy of the manufacturer's quality control check of materials and production.
6. Provide form the manufacturers an affidavit of compliance with AWWA standards referenced in the specifications. Affidavit shall be included with Shop Drawings submittals.
7. Provide a tabulated layout schedule including:

a. Order of installation and closures.
b. Pipe invert station and elevation at changes of grade and alignment.
c. Elements of curves and bends, both in horizontal and vertical alignment, including elements of the resultant true angular deflections in cases of combined curvature.
d. The limits of each reach of pipe thickness class and of restrained joints.
e. Locations of closures for length adjustment and for construction convenience.
f. Locations of valves, hydrants and other equipment.
g. Methods and locations of support.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Storage of Materials

1. Reclaimed Water Main Piping

Pipe shall be stored in a manner to minimize infiltration of dirt, debris and other extraneous materials.

Piping materials shall not be stacked higher than four (4) feet. Suitable racks, chairs and other supports shall be provided to protect preformed pipe mating surfaces from damage. Store bottom tiers off the ground, alternate tiers and chock tier ends.

2. Valves and Accessories

Store all valves, wells and prefabricated structures off the ground, drained and kept free of water to protect against damage. Valves, wells, their accessories and appurtenances shall be kept in their original containers until ready for installation.

3. Gasket, Glands, and Seals

All joint and sealing materials subject to ultra-violet or ozone attack and used in the water main system shall be protected from the sunlight, atmosphere and weather, stored in suitable enclosures until ready for installation.

B. Handling of Materials

1. Load and unload piping using suitably approved hoists and skidding. Piping shall not be dropped, bumped or allowed to impact against itself. Damaged piping shall be rejected by the ENGINEER.

2. Lifting devices shall be suited to the Work and shall protect surfaces from damage.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Scope

It is the intent of this Article to specify in detail the various types of pipe, joints, and fittings which have been indicated throughout the Plans and Specifications. This Article shall not be construed as allowing any alternate type of material to that which is indicated on the Plans or elsewhere in the Specifications.

B. Ductile Iron Pipe

1. Pipe shall be ANSI/AWWA A21.51/C151, cast and machined in the United States of America with purple color or marking in accordance with F.A.C 62-610. Pressure class shall be as follows:

   a. For buried pipe: Class 250
   b. For above grade or exposed pipe: Flanged, Class 350

2. Joints

   Joints in “runs” of aboveground piping or piping located in vaults and structures shall be flanged. Joints in runs of buried piping shall be of the push-on or mechanical joint type per AWWA C-111 except where flanged joints are required.

   a. Flanged Joint

      i. Flanges shall be Class 125 per ANSI B-16.1. Flanges shall be long-hub type screwed tightly on pipe by machine at the foundry prior to facing and drilling. Flange faces shall be coated with a rust inhibitor immediately after facing and drilling. Field assembled screwed on flanges are prohibited.
      ii. Gaskets to be furnished in SBR (Styrene Butadiene) or an approved equal suitable for sanitary sewage, water, and reuse service.
      iii. All nuts and bolts for flanges shall be Type 316 stainless steel conforming to ASTM A-193, Grade B&M for bolts, and ASTM A-194, Grade M for nuts.

         - Provide washers for each nut. Washer shall be of the same material as the nuts.

   b. Push-on Joint

      i. The plain ends of push-on pipe shall be factory machined to a true circle and chamfered to facilitate fitting the gasket with spigot of pipe marked to visually determine when the spigot is fully seated in the bell of the adjoining section.
      ii. Gaskets to be furnished in SBR (Styrene Butadiene) or an approved equal suitable for sanitary sewage, water, and reuse service conforming to ANSI A21.11.
      iii. Joint deflection shall be limited to 75% of the maximum recommended deflection per the pipe manufacturer.

iv. Joints for pipe that are required to be restrained shall be restrained using a harness device, or “bell restraint.” The harness shall be split to enable installation after the spigot has been installed into the bell. The restraint ring of the harness shall consist of a plurality of individually activated gripping surfaces to hold the spigot.

c. Mechanical Joint Restraints

i. All yard piping shall be restrained. Pipe joints shall be restrained on each side of a fitting with a mechanical joint restraint. Mechanical joint restraints shall be accomplished using a mechanism consisting of plurality of individually activated gripping surfaces incorporated into the design of the follower gland with a compression gasket, conforming to ANSI A21.11. Glands shall be manufactured of ductile iron conforming to ASTM A 536. Restraining devices shall be of ductile iron, heat treated to a minimum hardness of 370 BHN. Twist off nuts shall be used to insure proper actuating of the restraining devices. Bolts and nuts shall be corten, low alloy, high strength steel conforming with AWWA standards. Bolts shall be tee-head conforming to ANSI A21.1, A21.53 and AWWA C 153 and C111.

C. Fittings

1. Below Grade

a. Fittings shall be compact, ductile iron with pressure rating of 250 psi conforming to ANSI A21-53/AWWA C-153 and be the mechanical joint configuration with standard thickness cement mortar lining in accordance with ANSI 21.4/AWWA C 104 and factory applied asphaltic coating per AWWA C 110 and C 153. All fittings shall have ANSI A21.10 laying lengths equivalent to those listed for mechanical joint fittings.

2. Above Grade

a. Above grade fittings shall be flanged in accordance with AWWA C110/ANSI 21.10 with facing and drilling which match AWWA C115 and which also match ANSI B16.1 Class 125 flanges. Exposed fittings shall have factory applied coating of a universal rust-inhibitive primer 2.0 mils dry thickness.

D. Pipe Linings

Cement mortar linings for ductile iron pipe shall conform to the requirements of ANSI A21.4/AWWA C104 of the thicknesses specified and shall be permanently set prior to the application of any additional pipe coating.

E. Pipe Coatings

1. Buried Pipe

Shall have factory applied asphaltic coating in accordance with the requirements of AWWA C151.

2. Exposed Pipe

   Shall have factory applied coating of a universal rust-inhibitive primer with 2.0 mils dry thickness, and an epoxy-polyamide, UV resistant coating.

3. All exterior pipe and fittings shall be color coded or marked using pantone purple 522C (PURPLE) as a predominant color to differentiate drinking water from reclaimed or other water.

4. Underground metal pipe shall have PURPLE stripes applied to the pipe wall located at no greater the 90-degree intervals around the pipe, and that will remain intact during and after installation of the pipe.

F. Valves

   See valve specifications in Section 15200 – Process Piping and Valves.

G. Service Sleeves

   The sleeves shall be compatible with the main and service lead, with straps of a ductile material to avoid crushing the main out-of-round. A molded gasket of rubber or neoprene shall completely encircle the tapped opening to insure a watertight connection. The use of lead gaskets is not allowed.

H. Hydrants

1. Hydrant Assemblies shall consist of:

   a. Hydrant tee
   b. 4-inch gate valve and valve box with concrete pad with embedded ID tag
   c. 4-inch hydrant branch piping. Provide barrel extensions, as required, for hydrant to be installed at proper grade.
   d. Hydrant
   e. Stone drainage material
   f. Mechanical restraints
   g. Hydrant concrete shear pad

2. All hydrants shall conform to latest edition of AWWA C-502 and be covered by ten (10) year warranty.

3. The upper barrel of the hydrant shall receive an Epoxy coating primer on both the interior and exterior. The exterior shall then receive a factory applied two coat polyurethane high gloss pantone purple 522C coating. The standpipe shall by bitumen coated internally and externally with a bury line present below the brake flange to indicate proper installation depth.

4. Connections

   a. Two (2) 2-1/2 inch NST hose connections with 60 degree V threads, 7-1/2 threads to the inch, with external outside diameter 3-1/16 inch, National Standard

b. One (1) 4-1/2 inch NST pump connection with four threads to the inch, with external outside diameter 5-3/4 inches, National Standard
c. Threads shall be lubricated with Never-Seez or equivalent before delivery.

5. Working parts

a. 1-1/2” pentagon operating nut shall open counter clockwise and have a protective weather cover
b. Main valve shall be EPDM rubber and shall not bottom out onto the shoe connection.

I. Electronic Ball Markers

Ball markers shall be placed at crosses, tees, and changes of direction. All markers shall be noted on the As-Built Drawings and shall not be buried at a depth greater than 5 feet below the finish grade elevation.

J. Curb Stops

Reclaimed water service brass of types and sizes compatible with the connecting service pipe type.

K. Reclaimed Water Service Polyethylene (PE) Tubing

Shall be SDR 11, 200 PSI, colored PURPLE or longitudinal purple line striped, provided in ductile iron pipe size. Pipe shall be homogeneous throughout, free from voids, cracks, inclusions. And other defects. It shall be uniform as commercially practical in color, density and other physical properties. Pipe surfaces shall be free from gouges and imperfections that could cause leakage.

L. Polyethylene Encasement

All buried pipe, valves, and fittings shall be polyethylene encased, minimum 8 mil thickness, in accordance with AWWA C105, PURPLE in color, and printed with the text “RECLAIMED WATER – DO NOT DRINK”.

2.02 ACCEPTABLE MANUFACTURERS

A. Corporation Stop Ball Type

1. Ford FB1100
2. McDonald 4701B-22
3. Mueller P25008

B. Curb Stop

1. Ford B43-342W, BF43-777W
2. McDonald 6100MW-22
3. Mueller P24350, P24335

C. Polyethylene Tubing

1. Endot PE-3408 Endopure
2. Charter Plastics PE-4710 Lavender

D. Service Saddle

1. Ford Series FC202, FC101
2. Mueller DR15, DR25
3. Romac Series 202N
4. Smith Blair Series 397

E. Ductile Iron Pipe

1. American
2. Clow
3. Griffin
4. McWane
5. US Pipe

F. Fittings

1. American
2. Sigma
3. Star
4. Union/Tyler

G. Restrained Joint

1. American, Fast Grip Gasket
2. EBAA Iron Mega-lug Series 1100, 1700 Bell Restraint, RS3800 Restrainer
3. Ford UFR-1400 1300C Series
4. Star Series 3000, All Grip Series 3600
5. US Pipe Field Loc Gasket
6. Sigma ONE-LOK-SLD

H. Electronic Ball Marker

1. 3M ES 4” ball, 5’ range marker, General Purpose 1428 XR

I. Fire Hydrant

1. American Flow Control, B-84-B-5
2. Mueller, Super Centurion

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

A. Excavation and Bedding

Prior to the installation of any water main piping or materials, examine all trenches and other excavations for the proper grades, lines, levels and clearances required to receive the new Work. Ascertain that all excavation bottoms, compacted subgrades and pipe bedding are adequate to receive water main materials to be installed. Correct all defects and deficiencies before proceeding with the work.

3.02 PREPARATION

A. Pipe Ends

Remove all lumps, blisters excess coatings from the socket and plain ends of pipe. Wire brush and wipe clean the outside surfaces of all plain ends and the inside surfaces of all socket ends before installation. Any pipe or fitting which has acquired a coating of mud or other adhesive foreign material shall be scrubbed clean.

B. Examination of Materials

All pipe fittings, valves, hydrants, accessories and appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective or damaged materials shall be marked and held for inspection by the ENGINEER. Damaged materials are subject to rejection by the ENGINEER.

3.03 INSTALLATION

A. General

1. Pipe Cleanliness

Foreign matter shall be prevented from entering the pipe while it is being placed in the trench. During and after laying operations, no debris, clothing or other materials shall be placed in the pipe.

2. Pipe Plugs

During the progress of all reclaimed water main Work, watertight plugs shall be carried along and inserted in the end of each pipe as it is laid to prevent foreign matter or rodents from entering the pipe. This watertight plug shall be fastened in the end of the water main in such a manner as to prevent it from floating or being otherwise displaced whenever construction operations are temporarily halted, such as at noon or at the end of the days Work.

3. Pipe Bearing

Each section of pipe, when placed to grade and line, shall have firm bearing on the trench bedding throughout its length between bell holes.

4. Pipe Cutting

Cutting of pipe shall be done with approved tools and by approved methods suitable for the pipe material. Pipe cutting methods that produce a smooth, square cut end without damage to the pipe and that minimize airborne particles, shall be employed. Pipe cutting shall be performed using the recommendations of the manufacturer of the type of pipe materials being cut and according to the best trade practices.

a. Pipe Linings and Coatings

When cutting pipe or fittings, care shall be taken to prevent damage to linings and coatings. Damage to linings shall be cause for rejection of the complete Section. Damage to exterior coatings shall be corrected to original Specifications.

b. Gaskets

Where pipe using a resilient gasket to effect the seal is cut, the cut pipe end shall be tapered at a 30-degree angle with the centerline of the pipe, and ground smooth, on the outside end to remove any sharp edges or burrs which might damage the gasket.

5. Pipe Laying

Unless otherwise specified, pipe shall be laid with bell ends facing in the direction of laying. After a length of pipe is placed in the trench, the spigot shall be centered in the bell end of the adjacent pipe section, the pipe shoved into position and brought to true alignment and secured with sand tamped under and on both sides of the pipe except at bell holes. Adequate support shall be provided for all water main pipe.

6. Pipe Bedding

After the bottom of trench has been excavated and filled to the required grade with four (4) inches of bank run sand approved by the ENGINEER, meeting the requirements of granular material thoroughly compacted by tamping, the pipe shall be installed strictly in accordance with the manufacturers recommendations. After the pipe is laid, the sand backfill shall be continued to a point 12 inches above the top of pipe barrel. Particular care shall be taken to assure filling and tamping all spaces under, around and above the top of the pipe. Backfill shall be as indicated on the Plans and in the Specifications. A continuous and uniform bedding shall be provided in the trench for all buried pipe.

7. Bolts, Studs, and Nuts

Install bolts, studs, and nuts of the type specified per the manufacturers installation and torqueing requirements. All steel bolts, studs, and nuts shall be painted with bituminous paint after installation.

B. Ductile Iron Pipe

1. Push-On Joints

Joints shall be made by means of a compression type push-on resilient gasket. Gasket shall be pre-lubricated before installation using a lubricant recommended by the pipe manufacturer. The seated joint shall be identified by the visible mark on the spigot of the installed pipe section.

2. Mechanical Joints

Joints shall be made with bolts, molded resilient gasket and ductile iron follower gland. All nuts shall be screwed up finger tight before using a wrench. The gland and rubber gasket shall be brought up evenly at all points around the bell flange and then torqued per the manufacturers recommendations. The normal range of

bolt torques to be applied to standard cast iron bolts in a joint and the lengths of wrenches that should satisfactorily produce the ranges of torques are as follows:

Pipe Size (in.)	Bolt Size (in.)	Range of Torque	Length of Wrench
3	5/8	45-60 ft. lb.	8 inches
4-24	3/4	75-90 ft. lb.	10 inches
30-36	1	100-120 ft. lb.	12 inches
42-48	1-1/4	120-150 ft. lb.	14 inches

Exposed portions of bolts shall be covered with mastic.

C. Polyvinyl Chloride Pipe

Polyvinyl chloride pipe shall be laid with gasketed joints in complete accordance with the pipe manufacturers published instructions. The joints shall be sufficiently lubricated using the pipe manufacturers recommended lubricant.

Gaskets for pipe joints shall be inserted with the painted edge facing the end of the bell. Each length of pipe shall be pushed home individually. The pipe shall be positioned so that the reference mark on the spigot end is in line with the bell end.

D. Valves, Fittings, and Appurtenances

1. Valves

All valves shall be installed to the grade, lines, levels and locations indicated on the Plans.

Valve connections shall be as specified for the piping materials used. Valves shall be set with the stem plumb on permanent, firm foundations as indicated on the Plans.

Where required, valves shall be supported with special supports as indicated on the Plans and as approved by the ENGINEER. Valves shall be installed so as not to receive support from the connecting pipe. In no case shall valve installation be used to bring misaligned pipe into alignment.

2. Valve Boxes

Install valve boxes to the grade, lines, levels and locations indicated on the Plans. Valve boxes shall not transmit shock or stress to the valve and shall be set plumb with covers centered over operating nuts and flush with the indicated surface elevations. Valve boxes that shift or fill during backfilling shall be uncovered and reset.

3. Service Sleeves

Where service sleeves are to be installed, the entire circumference of the main shall be free of all loose material. Installation of the sleeve and tapping of the main shall be in accordance with manufacturers recommendations.

4. Curb Stops

Install curb stops of the types and sizes indicated on the Plans.

5. Fittings, Strapping, and Lugged Pipe

a. Fittings

Install all fittings to the lines, levels and locations indicated on the Plans. Installation of fittings shall be with the type of joint specified for piping. Fittings shall be provided with restraints as specified herein as indicated on the Plans and as required for a functional installation.

b. Strapping, Lugged Pipe and Fittings

Where indicated on the Plans and as directed by the ENGINEER, bends in water main piping and piping runs subject to impact reaction shall be secured by means of metal strapping. Install all necessary bands, tie rods, nuts and washers required. No metal strapping shall be used in direct contact with polyvinyl chloride pipe.

Where lugged pipe and special fittings are indicated on the Plans, furnish and install all necessary tie rods, nuts and washers.

E. Air Release Assembly

Provide all materials and construct air release assemblies where indicated on the Plans. Install all valves, fittings, caps, plugs and piping as required. Fittings and joint materials used for air release assemblies shall be as specified herein for the water main piping materials used.

F. Blow-Off Assembly

Provide all materials and construct blow-off assemblies where indicated on the Plans. Blow-off assemblies and pipe shall be installed to the lines, levels and elevations shown, install all valves, fittings, reducers, piping, plugs, joints, etc. as detailed. Blow-off assemblies shall be installed on stable, undisturbed earth materials with changes in directions and returns provided with bedding and restraints as indicated on the Plans, as specified herein and as required for a complete installation. Blow-off assemblies shall include valve boxes as detailed.

G. Tapping Valve Assembly

Install all tapping valve assemblies of sizes and to the lines, elevations, locations and details indicated on the Plans. The tapping sleeve shall be assembled around the main, and the tapping performed in strict accordance with the manufacturers recommendations. Tapping shall be accomplished without interruption of service.

H. Anchors, Encasements, and Restraints

Plugs, tees, sleeves, bends, caps, saddles and lug piping shall be provided with suitable anchors, encasements and restraints as indicated on the Plans. Anchoring, encasement and restraint methods shall be as detailed. All bearings shall be as shown. Anchors, encasements and restraints shall rest on firm, stable, compacted subgrade and shall be provided for all standard and special fittings.

I. Reclaimed Water Service Lines

1. General

When so indicated in the Proposal(s), or on the Plans, the CONTRACTOR shall provide reclaimed water service lines in accordance with Article 2.01 and 3.03 of

this Section. Otherwise, service lines are not required.

2. New Reclaimed Water Main

a. General

Reclaimed water service lines shall be installed after the main has been successfully tested and put into service, including the installation of fire hydrants. The service lines shall be of the type indicated on the Plans, and shall be 3/4 inch diameter unless otherwise indicated on the Plans.

Reclaimed water service lines shall be provided at the locations indicated on the Plans, within these Contract Documents or as directed by the ENGINEER.

b. Installation Method

Reclaimed water service lines under concrete or asphalt pavements shall be installed by boring or tunneling, unless otherwise indicated on the Plans or directed by the ENGINEER.

Backfilling of open cut construction shall be in accordance with Section 02226, Trenching Backfilling, after the service line, including curb stop, has been laid and approved by the ENGINEER. Prior to backfilling the service line the CONTRACTOR shall request an inspection by the ENGINEER and obtain approval of the service line.

Alternative methods such as hydraulic jacking; air jetting; piston mole; etc., may be used to install water service lines if approved by the ENGINEER. The proposed method must be approved by the governmental agency having jurisdiction over the work area and the CONTRACTOR must demonstrate that, in the opinion of the ENGINEER, the method is suitable for local soil and ground conditions. To be found suitable for local conditions, the method must be demonstrated to perform within acceptable horizontal and vertical accuracy limits, must not compress soil beyond acceptable limits, and must not leave voids in the soil. Water jetting shall not be permitted. Final installation of the service pipe must be in accordance with manufacturers recommendations and no joints or fittings shall be allowed under roadway surfaces.

3.04 FIELD QUALITY CONTROL

A. Hydrostatic Testing

After the pipe has been laid and backfilled, the pipe shall be hydrostatically tested for leakage. The CONTRACTOR shall furnish the pump, pipe connection, hydrants, valves and any other necessary apparatus including gages and meters and all personnel necessary for conducting the test. Before applying the test pressure, all air shall be expelled from the pipe. If necessary to accomplish this, taps shall be made at points of higher elevation and afterwards plugged. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter. Flushing shall be at full flow conditions with at least 2.5 feet per second flow rate.

The test shall be made at a pressure of 150 pounds per square inch gage. The full pressure shall be held for at least two (2) hours in accordance with the applicable provisions as set forth in section 4 of AWWA standard C600. Any faulty pipe fitting, gate valves or other accessories which permit leaks during testing shall be replaced by the CONTRACTOR with sound material and the test shall be repeated until specified requirements are met.

The maximum permissible leakage for Ductile Iron Pipe shall be less than the number of gallons per hour determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

Where:

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 maintained during the leakage test in pounds per square inch, (min. 150 psi)

The testing procedure shall include the continued application of the specified pressure to the test system, for the two hour period, by way of a pump taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container. Should the test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until within the established limits. The Contractor shall furnish the necessary labor, water, pumps, gauges, and all other items required to conduct the required testing and perform necessary repairs.

Should the test pass, the contractor shall exercise the valves at the direction of the inspector to confirm the yard valves can hold pressure. Once all valves have been tested and pass inspection, the hydrostatic testing will be complete.

B. Water for Testing

Water for testing shall be obtained from a potable water supply. The CONTRACTOR shall provide all water required at his own expense and shall make all necessary arrangements with the authority which controls the source of water system and shall be governed in his use of water by all rules and regulations imposed thereon by said authority. The CONTRACTOR shall provide and remove temporary connections between the source water system and the mains constructed under this Contract. All temporary connections shall meet the approval of the ENGINEER, the authority controlling the source water system and Public Health authorities having jurisdiction.

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END OF SECTION

SECTION 02720
STORM UTILITY DRAINAGE PIPING

PART I – GENERAL

1.01 SCOPE

This Section includes storm sewer Work indicated on the Plans complete with pipes, joints, structures, pipe bedding, final inspection and appurtenances.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Section 02140: Dewatering during Construction
2. Section 02223: Structural Excavation and Backfill
3. Section 02226: Trenching, Backfilling and Compaction
4. Section 03600: Mortar and Grout

1.03 REFERENCE STANDARDS

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

1. ANSI - American National Standard Institute
2. ASTM - ASTM International
3. AASHTO - American Association of State Highway Transportation Officials
4. FDOT - Florida Department of Transportation, latest revision
5. NCPI - National Clay Pipe Institute

1.04 SOURCE QUALITY CONTROL

Laboratory test not less than one (1) percent, with a minimum of three (3) pieces each size, material and class of gravity pipe required in the Work.

1.05 SUBMITTALS

Submit two (2) copies of the laboratory test reports required per Article 1.04 of this Section to the ENGINEER.

Complete Shop Drawings for all manhole tees shall be submitted to the ENGINEER.

Submit shop drawings and design information for all precast concrete box sections.

1.06 STORAGE OF MATERIALS

Piping material shall not be stacked higher than four (4) feet (1.2 m) or as recommended by the manufacturer, whichever is lowest. Suitable racks, chairs, and other supports shall be provided to protect preformed pipe mating surfaces from damage. Store bottom tiers off the ground, alternate tiers and chock tier ends.

Jointing and sealing materials used in the storm sewer system shall be protected from sunlight and stored in as cool and clean a place as practicable until ready for application.

1.07 HANDLING OF MATERIAL

Load and unload materials using suitable approved equipment. Material shall not be dropped, bumped or allowed to impact against itself. Damaged material shall be rejected by the ENGINEER.

Lifting devices shall be suited to the Work and shall protect surfaces from damage.

PART 2 – PRODUCTS

2.01 MATERIALS

It is the intent of the Articles in Part 2 of this specification section is to specify in detail the various types of sewer pipe, joints, manholes, etc. which have been indicated throughout the Plans and Specifications. These Articles shall not be construed as allowing any alternate type of material to that which is indicated on the Plans or elsewhere in the Specifications.

2.02 REINFORCED CONCRETE PIPE

Reinforced concrete pipe shall conform to ASTM C76. Twelve (12) inch thru 30-inch (300 mm thru 750 mm) diameter pipe shall be Class II thru V, Wall B or Wall C, circular reinforced. Thirty-six (36) inch through 108-inch (900 mm thru 2700 mm) diameter pipe shall be Class I through V, Wall B or Wall C, circular reinforced or elliptical reinforced.

When elliptical reinforcement is used, the following method of indexing the steel and the pipe barrel shall be used.

A dummy lift pin form shall be set in the outer pipe wall form projecting into the pipe wall a minimum of 1-3/4 inches (45 mm) and a maximum of 2-1/4 inches (55 mm). An additional spacer chair shall be welded to the elliptical steel cage at the proper location so as to engage the dummy lift pin form during the pipe casting operation.

It is the intent of the spacer chair and dummy lift pin arrangement to provide a means of assuring the final position of the elliptical steel cage within the barrel of the pipe and, further, for providing a means of indexing the pipe in the field to assume proper placement of the pipe.

Prior to shipment of the elliptically reinforced pipe, they shall be striped along the inside top with a minimum 1-inch (25 mm) wide indelible marker so that final inspection of the pipe orientation can be made following completion of the installation.

For circular pipe 114 inches (2850 mm) or larger in diameter, the design information in accordance with Section 6 of ASTM C76, shall be submitted to the ENGINEER for approval, prior to fabrication.

The design of all pipes shall meet the d-load requirements for the class of pipe indicated on the Plans.

When not specified, pipe joints shall be made with cold applied pipe joint sealer. See Article 2.07 for requirements for joints.

2.03 REINFORCED CONCRETE ELLIPTICAL PIPE

Reinforced concrete elliptical pipe shall conform to ASTM C507.

When not specified, pipe joints shall be made with cold applied pipe joint sealer. See Article 2.07

for requirements for joints.

2.04 PRECAST CONCRETE BOX SECTION

Precast concrete box sections shall meet the requirements of ASTM C1433. Unless specified otherwise, CONTRACTOR shall use the same design conditions as exist at the time of construction or as planned for future development.

2.05 JOINTS FOR CONCRETE OR CLAY PIPE

A. Premium Joints

Joints for circular pipe shall conform to FDOT Specification 892 ASTM C443 limited as follows: Section 5.1 of C443, "Physical Requirements for Gaskets," shall be replaced with Section 6.9 of C361, "Rubber Gaskets." Also, Section 5 of C443 shall be limited to a modified grooved tongue to receive a rubber gasket.

Premium joints for elliptical pipe shall conform to ASTM C443 and AASHTO M198 external sealing bands for circular and non-circular concrete pipe. The width of the sealing bands shall be at least equal to twice the depth of the groove. For modified bell tongue and groove pipe, use the next larger gasket. The length of the sealing bands shall be equal to the outside circumference of the pipe at its largest diameter plus an amount equal to the width of the gasket to be used.

An 18” wide strip of filter fabric wrap, Mirafi or approved equal shall be centered on each joint.

Only lubricant, as supplied by the pipe manufacturer, shall be used on the groove and on the tongue in making up joints, and the joints shall be coupled in accordance with the pipe manufacturer's requirement.

The inside annular space of all concrete pipe 36-inch (900 mm) diameter (or equivalent) and larger shall have the inside annular space filled with cement mortar and troweled flush. Mortar shall consist of 1-part Portland cement and two (2) parts of plaster sand. Mortar for inside joints shall be mixed with only enough water for "dry packing."

2.06 CORRUGATED POLYETHYLENE PIPE

A. Smooth-Lined Corrugated Polyethylene Pipe

Smooth lined corrugated polyethylene pipe shall meet the requirements of FDOT section 948.2 and AASHTO M252, Type S for sizes 4” to 10” diameter, and AASHTO M294 Type S for 12” to 48” diameter.

Fittings shall conform to the corresponding pipe specification and be constructed of the same material classification as the pipe. Fittings shall be welded on the interior and exterior at all junctions.

Joints shall be bell & spigot type with rubber gaskets on both sides of the joint conforming to FDOT section 948-2 and ASTM F477. Split collar couplers are not allowed. Joints shall be watertight meeting the performance requirements of ASTM D3212.

An 18” side strip of filter fabric wrap, Mirafi or approved equal shall be centered on each joint.

B. Corrugated Plastic Edge Drain / Underdrains

Corrugated plastic tubing for edge drains or underdrains shall meet the requirements of AASHTO M252 for polyethylene tubing. Pipe shall be wrapped in a Geotextile Pipe Wrap per FDOT Section 948-3.

2.07 SMOOTH PLASTIC PIPE

Smooth plastic pipe for underdrains shall be polyvinyl chloride PVC meeting the requirements of AASHTO M278. Pipe shall be wrapped in a Geotextile Pipe Wrap per FDOT Section 948-3.

2.08 END SECTIONS

The precast concrete end section shall conform to ASTM C76, Class II and as specified in FDOT Section 892. The joint for connection to pipe shall be by means of a gasketed seal tongue and groove. See Article 2.07 of this Section for requirements for the pipe joint sealer.

2.09 STORM STRUCTURES

Materials for storm sewer structures shall conform to the requirements indicated on the Plans and as specified below.

A. Concrete Brick

Concrete brick shall be ASTM C55, Grade S-II, solid units of nominal 3-inch (75 mm) thickness.

B. Concrete Block

Block shall conform to ASTM C139, manufactured of Portland cement conforming to ASTM C150, Type II. Blocks shall be solid curved blocks with the inside and outside surfaces parallel and curved to the required radii. The blocks shall have a groove or other approved type of joint at the ends. Blocks intended for use in the cones or tops of manholes shall have such shape as may be required to form the structure as indicated on the Plans.

C. Precast Concrete

Precast concrete manhole base, cone and riser units shall conform to ASTM C478, and shall be circular with circular reinforcement. For manhole depths to 32 feet (9.7 m), the wall thickness of the sections shall be five (5) inches (125 mm). The joints on precast sections shall be the same as the joints on storm sewer.

Precast concrete manhole tee units shall conform to ASTM C76, Class IV and shall be circular with circular reinforcement. Shop Drawings shall be provided for all manhole tees. The joints on the precast manhole tee shall be the same as the joints on the storm sewer section.

Precast concrete base, top slab, and grade ring units shall conform to ASTM C478.

D. Manhole Steps

Cast iron manhole steps shall conform to ASTM A48, Class 30, gray iron with a minimum cross section dimension of 1-inch (25 mm) in any direction.

Steel reinforced plastic steps shall be of suitably approved co-polymer polypropylene conforming to ASTM D4101, PP0344B33534Z02 with 1/2 inch (12 mm) minimum diameter deformed reinforcing bar conforming to ASTM A615, Grade 60.

Manhole steps shall be of the type and size indicated on the Plans and shall comply with applicable occupational safety and health standards. Manhole steps shall be installed at locations indicated on the Plans.

E. Frames and Covers

Frames and covers for manholes, catch basins, and inlets shall conform to ASTM A48, Class 30, gray iron and shall be of the types and sizes as indicated on the Plans. The castings shall be neatly made and free from cracks, holes and other defects. Surfaces of casting shall be ground to assure proper fit and to prevent rocking.

2.10 CONCRETE

In accordance with FDOT Section 400.

2.11 CONCRETE REINFORCEMENT

In accordance with FDOT Section 415, use ASTM A615, Grade 60 for bars and ASTM A185 for welded wire fabric.

PART 3 – EXECUTION

3.01 VERIFICATION OF EXCAVATION AND BEDDING

Prior to the installation of any storm sewer piping, structures, or materials, examine all trenches and other excavations for the proper grades, lines, levels and clearances required to receive the new Work. Ascertain that all excavation bottoms, compacted subgrades and pipe bedding are adequate to receive the storm sewer materials to be installed. Correct all defects and deficiencies before proceeding with the Work.

3.02 EXISTING STORM SEWERS AND DRAINS

Expose the existing storm sewer and structures to which the new Work is to be connected and notify the ENGINEER of same. The ENGINEER will verify the vertical and horizontal locations of the existing system and shall inform the CONTRACTOR as to the necessary adjustments required to align the new storm sewer Work with the existing system.

3.03 PREPARATION

The outside surface of the spigot end and the inside surface of the bell end of the pipe shall be cleaned and free of any foreign materials, other than the sealant recommended by the manufacturer, prior to installation.

All pipe, frames, covers, accessories, and appurtenances shall be examined carefully for damage and other defects immediately prior to installation. Defective or damaged material shall be rejected and removed from the Project by the CONTRACTOR.

3.04 INSTALLATION - GENERAL

Each section of pipe, when placed to grade and line, shall have firm bearing on the trench bedding throughout its length.

Cutting of pipe shall be done with approved tools and by approved methods suitable for the pipe material. Pipe cutting methods that produce a smooth, square-cut end without damage to the pipe and that minimize air-borne particles, shall be employed. Pipe cutting shall be performed using the recommendations of the manufacturer of the type of the pipe materials being cut and according to the best trade practices. When cutting pipe, care shall be taken to prevent damage to the interior and exterior surfaces. Damage to either shall be cause for rejection of a complete section of pipe.

During the preparation of the pipe bedding and until the trench has been satisfactorily backfilled, the trench shall be kept free of water. A dewatering system, in accordance with Section 31 2319, Dewatering, shall be provided and maintained by the CONTRACTOR. The dewatering system shall remain in operation until the trench is backfilled.

Backfill shall be as indicated on the Plans and as specified in Section 02226, Trenching and Backfilling.

3.05 PIPE LAYING

Installation of pipe shall conform to ASTM C12, and as recommended by the pipe manufacturer. The pipe shall be protected during handling against impact shocks and free fall. Hooks shall not be permitted to come in contact with premolded joint surfaces.

Pipes having premolded joint rings or attached couplings shall be handled so that no weight, including the weight of the pipe itself, will bear on or be supported by the jointing material. Care shall be taken to avoid dragging any pipe on the ground or allowing it to be damaged by contact with gravel, crushed stone, or other hard objects.

All pipe shall be laid to the line and grade called for on the Plans. Each pipe as laid, shall be checked by the CONTRACTOR with line and grade pole or laser system to insure that this result is obtained. When employing a laser system, the CONTRACTOR shall have an independent and alternate means of checking the line and grade. The finished work shall be straight and shall be sighted through between manholes.

Construction shall begin at the outlet end and proceed upgrade with spigot ends pointing in direction of flow. Bell holes shall be excavated so that the full length of the barrel will bear uniformly on the bedding material.

Lubricants, primers or adhesives as recommended by the pipe or joint manufacturer shall be used immediately prior to jointing.

The pipe shall be centered in the bells or grooves and pushed tight together to form a smooth and continuous invert. After laying of pipe, care shall be taken so as not to disturb its line and grade. Any pipe found off grade or out of line shall be re-laid properly by the CONTRACTOR.

Mechanical means shall be used for pulling home all pipe where manual means will not result in pushing and holding the pipe home. Mechanical means shall consist of a cable placed inside of the pipe with a suitable winch, jack, or come along for pulling the pipe home and holding the pipe in position.

Circular concrete pipe with elliptical reinforcement shall be installed with the lift holes to the top of the pipe. The manufacturer's marks designating the top and bottom of the pipe shall not be more than five degrees from the vertical plane through the longitudinal axis of the pipe. After the pipe is installed, the lift holes shall be sealed with suitable concrete plugs.

Type HE elliptical pipe shall be installed with the longer axis placed horizontally within a tolerance of ± five degrees.

Type VE elliptical pipe shall be installed with the longer axis placed vertically within a tolerance of ± five degrees.

3.06 PIPE BEDDING

After the bottom of trench has been excavated the pipe bedding material will be installed in accordance with Section 31 2333, Trenching and Backfilling. The pipe shall then be installed strictly in accordance with the manufacturer's recommendations. After the pipe is laid, the bedding shall be continued above the pipe as specified in Section 02226, Trenching and Backfilling. Particular care shall be taken to assure filling and tamping all spaces under, around and above the top of the pipe.

A continuous and uniform bedding as specified in Section 02226, Trenching and Backfilling, shall be provided in the trench for all buried pipe.

3.07 UNDERDRAINS

The pipe shall be laid in close conformity with the lines or grades shown on the Plans or established by the ENGINEER. The upgrade ends of all underdrains shall be closed with suitable plugs to prevent entry of soil or other foreign material.

Perforated pipe shall be laid with the perforations down.

Underdrains shall be bedded in FDOT open graded drainage course material. The bedding shall have a minimum thickness beneath the pipe of four (4) inches (100 mm), a minimum width of six (6) inches (150 mm) on each side of the pipe and extend to a level not less than 12 inches (300 mm) above the top of the pipe.

The bedding shall be placed equally on both sides of the underdrain at the same time. Staking or other methods to restrain the pipe may be necessary during the backfilling operation to maintain the line and grade of the underdrain.

Rodent screens and outlet endings are required for all underdrains which terminate in a ditch or swale.

3.08 STORM STRUCTURES

Construct storm sewer manholes, catch basins, inlets and other structures to the grades, lines and levels indicated on the Plans and as specified. Structures shall be complete with concrete bases, reinforcing, frames, covers, adjustment bricks, etc., as shown and as required for a complete installation. Storm sewer structures shall conform to the type of material and dimensions indicated on the Plans.

Cast-in-place structures shall be constructed in accordance with Section 03300, Cast-In-Place Concrete.

A. Block Structures

Construct concrete block structures in the locations and according to the details on the Plans. The first course of concrete blocks shall be placed on the prepared base or footings in a full bed of mortar. Mortar joints shall be full and close in all courses. Courses shall be level throughout. Stagger joints in adjoining courses by one-half the length of the block as nearly as practicable. Joints shall be uniform in thickness throughout the structures. Strike all joints and properly point to provide true, smooth surfaces.

B. Precast Concrete Structures

Construct precast concrete structures as detailed on the Plans. Provide mortar joints struck smooth. Provide three (3) to five (5) courses of 8-inch (200 mm) brick or concrete grade rings at top of structure for future adjustment of castings.

A cement mortar plaster coat shall be applied to the exterior surfaces of the brick and block sections of all storm structures as indicated on the Plans. Plaster coat shall be 1/2 inch (10 mm) thick.

Provide and install all frames and covers to the elevations indicated on the Plans. Castings shall be set in a full bed of cement mortar 1/2 inch (10 mm) thick, minimum. Mortar joints shall be struck smooth.

Steps shall be installed at the plant by the manufacturer of precast units. Field install steps for brick, block, or cast in place structures of the types and in the locations indicated on the Plans.

Pipe up to 42 inches (1050 mm) in diameter, shall be connected to storm structures using a grouted joint, as indicated on the Plans. The pipe shall be properly supported, so that any settlement will not disturb the connection.

For pipe, 48 inches (1200 mm) in diameter or larger, the pipe shall be installed as an integral part of the manhole which shall be constructed of 3,500 psi (24 MPa) concrete and reinforcing, as indicated on the Plans.

Manhole tees, as indicated on the Plans, may be used for pipe 42 inches (1050 mm) in diameter or larger. Connection to manhole tees shall be made using tees and pipe having the same type of joint. The pipe and tee shall be properly supported with concrete as indicated on the Plans.

Sump shall be provided, as indicated on the Plans, in all catch basins and storm manholes having outlets of 18 inches (450 mm) in diameter or less.

Flow channels shall be constructed in all structures not requiring a sump and shall be constructed as indicated on the Plans.

3.09 FIELD QUALITY CONTROL

After all the pipe and structures have been laid, constructed and backfilled, the system shall be final inspected. The sewer system shall be ready for the final inspection within two (2) weeks after the completion of each 2,000-foot (600 m) section of sewer installed.

The final inspection shall consist of a visible and audible check of the sewers and structures to ascertain that the steps have been placed, all lift holes jointed, the channeling of the manhole bottoms completed, all visible or audible leaks stopped, all pipe has been placed straight and true to the proper slopes and elevations, the required brick courses for adjustment, the frame and cover properly installed, the required end section installed, all trenches and structures backfilled in a workmanlike manner and that the system has been thoroughly cleaned.

The final inspection shall be considered complete when all the repairs have been made.

3.10 DEFLECTION TEST FOR PLASTIC PIPE

Plastic pipe shall be tested for deflection, but no sooner than 30 days following the backfilling of the pipe. Maximum allowable deflection (reduction in vertical inside diameter) shall be five (5) percent. Locations with excessive deflection shall be excavated and repaired by re-bedding and/or replacement of the pipe. Optional devices for testing include a deflectometer, calibrated television or photography, or a properly sized "go, no-go" mandrel or sewer ball. Mandrel shall have a minimum of nine (9) legs.

END OF SECTION

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SECTION 02730
SANITARY SEWERS

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes sanitary sewer Work indicated on the Plans complete with pipe, joints, structures, pipe bedding, installation, television inspection and testing.

B. Related Work Specified Elsewhere

1. Section 01025: Measurement and Payment
2. Section 02140: Dewatering During Construction
3. Section 02223: Structure Excavation and Backfill
4. Section 02226: Trenching, Backfilling and Compaction
5. Section 03600: Mortar and Grout

1.02 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies

1. Testing

Testing shall conform to the applicable requirements of State and local authorities having jurisdiction, and shall include such tests as: air, exfiltration and infiltration.

B. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

1. ANSI- American National Standard Institute
2. ASTM - American Society for Testing and Materials
3. FDOT - Florida Department of Transportation

C. Source Quality Control

Laboratory test not less than one (1) percent, with a minimum of three (3) pieces, each size, material and class of gravity pipe required in the Work.

1.03 SUBMITTALS

A. Product Data

Submit manufacturer's data for pipe bulk heading devices in accordance with Article 3.03.E. of this Section.

B. Reports

1. A complete field report of the location of all wyes, risers and sewer services shall be submitted to the ENGINEER at the end of each sewer section of the Project or

on the last day of each week, whichever occurs first.

The complete field report shall include witnessing by the CONTRACTOR of the ends of all building leads placed. Witnessing shall consist of recording three (3) horizontal distances to the nearest foot from the end of the sewer services to three (3) permanent structures, with the lines of measurement at minimum angles of 45 degrees with respect to one another. Witnessing shall also include recording of the depth to nearest 2 foot from the invert at the end of the lead to the finish ground above the end of the lead. No payment will be made for unwitnessed installation or for improper witnessed installations.

2. As part of the television inspection, a wye location report shall be submitted to the ENGINEER. The report shall contain the precise location of each wye, notes, photographs, and other pertinent information.

3. Submit two (2) copies of the laboratory test reports required per paragraph 1.02.C. of this Section to the ENGINEER.

C. Shop Drawings

Shop Drawings shall be provided of all manhole tees.

1.04 PRODUCT STORAGE AND HANDLING

A. Storage of Materials

1. Sanitary Sewer Piping

Piping material shall not be stacked higher than four (4) feet. Suitable racks, chairs, and other supports shall be provided to protect preformed pipe mating surfaces from damage. Store bottom tiers off the ground; alternate tiers and chock tier ends.

2. Gaskets

All joint and sealing materials used in the sanitary sewer system shall be protected from sunlight and stored in cool and clean place until ready for installation.

B. Handling of Material

Lifting devices shall be suited to the Work and shall protect surfaces from damage.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Scope

It is the intent of this Article to specify in detail the various types of sewer pipe and joints which have been indicated throughout the Plans and Specifications. This Article shall not be construed as allowing any alternate type of material to that which is indicated on the Plans or elsewhere in the Specifications.

B. Plastic Pipe System

1. ABS Pipe
   a. Truss pipe shall be ASTM D2680, Acrylonitrile- Butadiene-Styrene (ABS). The pipe shall be of a double wall construction, braced with a truss-type structure with all three (3) formed in one (1) extrusion. The truss voids are filled with lightweight concrete to provide additional compressive strength and bracing.
   b. Solid wall pipe shall conform to ASTM D2751, SDR 23.5, Acrylonitrile-Butadiene-Styrene (ABS).
   c. Joints for Acrylonitrile-Butadiene-Styrene (ABS) composite pipe shall be ASTM D2680, Type S.C., a solvent-cemented joint in which pipe solvent cements into a coupling socket to form the joint closure. Installation of the solvent cement shall be in strict accord with the manufacturer's recommendations.

2. PVC Pipe
   a. Pipe in sizes 6-inch through 15-inch shall be ASTM D3034 SDR35, and in sizes 18-inch through 27-inch shall be ASTM F679 SDR35, polyvinyl chloride pipe (PVC).
   b. Joints for polyvinyl chloride pipe (PVC) shall be ASTM D3212, push-on type. A joint in which an elastomeric ring gasket is compressed in the annular space between a bell end or socket and a spigot end of pipe.

C. Structures

Material for sanitary sewer structures shall conform to the requirements listed below:

1. Clay Brick

   Brick shall be ASTM C32, Grade MS, recessed and/or cored as approved by the ENGINEER.

2. Concrete Brick

   Brick shall be ASTM C55, Grade S-11, recessed and/or cored as approved by the ENGINEER.

3. Precast Concrete Units

   Precast concrete units shall conform to ASTM C478, and shall be circular with circular reinforcement. The minimum wall thickness shall be six (6) inches for stack depth sections up to 12 feet and eight (8) inches for depths over 12 feet. Base slab shall be eight (8) inches thick for depths up to 25 feet and 12 inches thick for depths greater than 25 feet.

   Precast doghouse sections shall be used for existing sewer 15 inches and smaller on straight-through runs for a depth up to 20 feet and on right angle runs, with a maximum of four (4) cutouts for depths up to 12 feet. Openings in precast doghouse sections shall be cast in the section before curing and no breaking or chipping of sections will be allowed after the section has cured. The size of the opening shall be cast as indicated on the Plans.

   Precast bottom sections shall be cast with the bottom end flat to provide bearing of the full wall thickness. The openings for sewer pipe shall be cast in the manhole and the bottom section by the manufacturer.

Six (6) inch thru 24-inch connections to manholes shall use a mechanically compressible flexible joint, as indicated on the Plans.

Riser sections of a manhole shall have modified grooved tongue joints with O-ring gaskets or a tongue and groove joint with a butyl rubber based gasket type sealant meeting the requirements of AASHTO M-198 and having a nominal size of 1-inch.

Eccentric cone sections of a manhole shall have modified grooved tongue joints with O-ring gaskets and be provided with 4-stud inserts cast in the top. The top shall have a smooth finished surface.

Concrete grade rings shall have smooth finished top and bottom surfaces. Grade rings shall be provided with O-ring gaskets.

Precast manhole tees will be allowed on straight-through runs with no angle at the manhole and where stubs or openings in manhole are above the tee section.

Precast concrete manhole tee units shall conform to ASTM C76, Class IV and shall be circular with circular reinforcement. The precast tees must be a monolithic pour with wire cage inspection prior to concrete placement. Joints for tee shall be the same as the joints on the sanitary sewer.

4. Manhole Frames and Covers

Manhole frames and covers shall conform to ASTM A48, Class 30, gray iron and shall be of the types and sizes as indicated on the Plans. The castings shall be neatly made and free from cracks, cold sheets, holes and other defects. Surfaces of casting shall be ground to assure proper fit and to prevent rocking.

Manholes using a bolted down frame and cover shall be installed with a bolted waterproof frame with a pressure tight cover as indicated on the Plans.

D. Steel Pipe

Pipe shall conform to ASTM A120, black and hot-dipped galvanized welded and seamless pipe of standard weight.

E. Bolt, Studs, Nuts

Bolt, studs and nuts shall conform to the following ASTM Standards:

Cadmium Plating: ASTM A165, Grade N.S.

Zinc Coating: ASTM A153 or A164, Type G.S.

F. Concrete

In accordance with FDOT Section 345, use Class II; 3,500-psi strength; Type I cement; 6.0 sacks cement per cubic yard; 5 coarse aggregate; silica sand fine aggregate; three (3) percent to six (6) percent air content; three (3) maximum slump; no admixtures without the ENGINEER'S approval.

G. Concrete Reinforcement

In accordance with FDOT Section 931, use ASTM A615, Grade 60 for bars and ASTM A185 for welded wire fabric.

H. Granular Material

Granular material shall be material passing a 1-inch sieve and at least 35% retained on a No. 200 sieve and meeting the approval of the ENGINEER.

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

A. Excavation and Bedding

Prior to the installation of any sanitary sewer piping, structures, or materials, examine all trenches and other excavations for the proper grades, lines, levels and clearances required to receive the new Work. Ascertain that all excavation bottoms, compacted subgrades and piping bedding are adequate to receive the sanitary sewer materials to be installed. Correct all defects and deficiencies before proceeding with the Work.

B. Existing Sanitary Sewers

The CONTRACTOR shall expose the existing sanitary sewer and structures to which the new Work is to be connected and notify the ENGINEER of same. The ENGINEER will verify the vertical and horizontal locations of the existing system and shall inform the CONTRACTOR as to the necessary adjustments required to align the new sanitary sewer work with the existing system.

C. Pipe Class and Joints

Prior to the installation of any sanitary sewer piping, ascertain that the class of pipe, joint material and bedding are as specified herein and as indicated on the Plans.

3.02 PREPARATION

A. Pipe Ends

The outside surface of the spigot end and the inside surface of the bell end shall be cleaned and free of any foreign material, other than sealant recommended by the manufacturer, prior to installation.

B. Examination of Material

All pipe, frames, covers, accessories, and appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective or damaged material shall be marked and held for inspection by the ENGINEER. Damaged materials are subject to rejection by the ENGINEER.

3.03 INSTALLATION

A. General

1. Pipe Bearing

Each section of pipe, when placed to grade and line, shall have firm bearing on the trench bedding throughout its length.

2. Pipe Cutting

Cutting of pipe shall be done with approved tools and by approved methods suitable for the pipe material. Pipe cutting methods that produce a smooth, square-cut end without damage to the pipe and that minimize airborne particles shall be employed. Pipe cutting shall be performed using the recommendations of the manufacturer of the type of pipe materials being cut and according to the best trade practices. When cutting of pipe or fittings, care shall be taken to prevent damage to the lining and the exterior surface. Damage to either shall be cause for rejection of complete section.

3. Dewatering

During the preparation of the pipe bedding and until the trench has been satisfactorily backfilled, the trench shall be kept free of water and sewage. A dewatering system, in accordance with Section 02140, Dewatering, shall be provided and maintained by the CONTRACTOR. The dewatering system shall remain in operation as directed by the ENGINEER.

4. Pipe Laying

a. Rigid Pipe

Installation of rigid pipe shall conform to ASTM C12. All pipe shall be laid to the line and grade called for on the Plans. Each pipe as laid, shall be checked by the CONTRACTOR with line and grade pole or laser system to insure that this result is obtained. When employing a laser system, the CONTRACTOR shall have an alternate and independent means of checking the line and grade. The finished work shall be straight and shall be sighted through between manholes.

Construction shall begin at the outlet end and proceed upgrade with spigot ends pointing in direction of flow. Bell holes shall be excavated so that the full length of the barrel will bear uniformly on the pipe bedding material.

All pipe shall be jointed by means of a resilient gasket. The resilient gasket shall be lubricated and installed to form a watertight joint between the bell and spigot of the pipe. The bell of the pipe in place shall be cleaned and properly lubricated prior to the installation of the next pipe spigot. The pipe shall be centered in the bell or groove. After the spigot is well entered into the bell and the gasket is fully compressed and brought to final shape, check the gasket for proper position around the full circumference of the joint. Complete installation by pushing the pipe tightly together to form a smooth and continuous invert.
Mechanical means shall be used for pulling home all pipe where manual means will not result in pushing and holding the pipe home. Mechanical means shall consist of a cable placed inside of the pipe with a suitable winch, jack, or come along for pulling the pipe home and holding the pipe in position.

After laying pipe, care shall be taken so as not to disturb its line and grade. Any pipe found off grade or out of line shall be relaid.

When adapters are required to properly connect the new pipe to an existing pipe of other materials or manufacture, the nominal inside diameter of adapters shall be the same size as the nominal pipe diameter to which it is to be connected.

b. Flexible Pipe

Installation of flexible pipe shall conform to ASTM D2321.

Except as otherwise specified herein, installation of ABS and PVC piping shall be made in complete accordance with the published installation guide of the pipe manufacturer.

Joints for ABS pipe shall be made by first applying a coat of primer to the inside of the socket and to the outside of the spigot end of the pipe. Without delay, apply a coating of cement to the same surfaces in sufficient quantity that when the spigot is fully inserted into the socket, a bead of excess cement will form around the complete circumference of the outside junction of the spigot and socket. Remove the excess cement and allow the assembly to cure 24 hours.

Joints for PVC pipe shall be made by using a lubricant immediately before joining. Apply lubricant only on the spigot, coating the entire circumference of the spigot bevel plus 1-inch behind the taper. Insert lubricated spigot into the bell, and using normal force insert spigot until insertion stripe mark is flush with the bell entrance.

When jointing ABS or PVC pipe, rotate the pipe when inserting it approximately 1/4 to 2 turns.

Taps to ABS and PVC pipes, where fittings are not provided, shall be made with chemically welded saddle fittings unless otherwise indicated on the Plans. Holes for saddle connections shall be by mechanical hole cutters, or by keyhole saw or saber saw. Holes for saddles shall be laid out with a template and shall be deburred and beveled to provide a smooth hole shaped to conform to the fitting. After the cemented saddle has been fixed to the pipe surface, quickly install band clamps each side of the saddle and tighten.

5. Pipe Bedding

a. Rigid Pipe Bedding

Pipe bedding shall conform to ASTM C12, except as noted.

Class A

The pipe shall be bedded in crushed stone bedding material placed on the trench bottom. The bedding material shall have 100% passing a 3/4 inch sieve and 95% retained on a No. 4 sieve. The bedding shall have a minimum thickness beneath the pipe of six (6) inches or 1/4 of the outside diameter of the pipe, whichever is greater, and shall extend up

the sides of the pipe to the horizontal centerline. The top half of the pipe shall be covered with a monolithic plain concrete arch having a thickness of at least four (4) inches or 1/4 of the inside diameter of the pipe, whichever is greater, at the pipe crown and a minimum width equal to the outside diameter of the pipe plus eight (8) inches or 1-1/4 of the diameter of the pipe, whichever is greater.

Class B

The pipe shall be bedded in crushed stone bedding material placed on the trench bottom. The bedding material shall have 100% passing a 3/4 inch sieve and 95% retained on a No. 4 sieve. The bedding shall have a minimum thickness beneath the pipe of six (6) inches or 1/8 of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe to the horizontal centerline. Backfill from pipe horizontal centerline to a level not less than 12 inches above the top of the pipe shall be natural bank run sand meeting the requirements of granular material. This material shall be placed in 6-inch layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches above the top of pipe.

Class C

The pipe shall be bedded in natural bank run sand, approved by the ENGINEER, meeting the requirements of granular material, placed on the trench bottom. The bedding shall have a minimum thickness beneath the pipe of six (6) inches or 1/8 of the outside diameter of the pipe, whichever is greater, and the bedding shall extend to a level not less than 12 inches above the top of the pipe. This material shall be placed in 6-inch layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches above the top of pipe.

b. Flexible Pipe Bedding

Pipe bedding shall conform to ASTM D2321, except as noted.

Class I
The pipe shall be bedded in crushed angular stone material placed on the trench bottom. The bedding shall have 100% passing a 3/4 inch sieve and 95% retained on a 1/4 inch sieve. The bedding shall have a minimum thickness beneath the pipe of six (6) inches, and shall extend up the sides of the pipe until the top of pipe is covered by a minimum thickness of 12 inches.

Where allowable trench widths are exceeded, Class I bedding shall be used to the full width between undisturbed trench walls. Concrete cradle bedding shall not be used.

A continuous and uniform bedding shall be provided in the trench for all buried pipe.

Class II

The pipe shall be bedded in crushed angular stone material placed on the

trench bottom. The bedding shall have 100% passing a 3/4 inch sieve and 95% retained on a 1/4 inch sieve. The bedding shall have a minimum thickness beneath the pipe of six (6) inches, or 1/8 of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe to the horizontal centerline. Backfill from pipe horizontal centerline to a level not less than 12 inches above the top of the pipe shall be natural bank run sand, approved by the ENGINEER, meeting the requirements of granular material. This material shall be placed in 6-inch layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches above the top of pipe.

Where allowable trench widths are exceeded, Class I bedding shall be used to the full width between undisturbed trench walls. Concrete cradle bedding shall not be used.

A continuous and uniform bedding shall be provided in the trench for all buried pipe.

Class III

The pipe shall be bedded in natural bank run sand, approved by the ENGINEER, meeting the requirements of granular material, placed on the trench bottom. The bedding shall have a minimum thickness beneath the pipe of six (6) inches or 1/8 of the outside diameter of the pipe, whichever is greater, and the bedding shall extend to a level not less than 12 inches above the top of the pipe. This material shall be placed in 6-inch layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches above the top of the pipe.

Where allowable trench widths are exceeded, Class III bedding shall be used to the full width between undisturbed trench walls. Concrete cradle bedding shall not be used.

A continuous and uniform bedding shall be provided in the trench for all buried pipe.

B. Manhole Structures

Construct sanitary sewer manhole structures to the grades, lines and levels indicated on the Plans, or as specified herein. Structures shall be complete with concrete bases, reinforcing, frames, covers, and adjustment rings, as shown and as required for a complete installation. Sanitary manholes as called for on the Plans shall carry a stub opening as specified herein. Wye openings in manholes are prohibited unless indicated on Plans. Sanitary sewer structures shall conform to the dimensions indicated on the Plans and as described below.

Manholes shall be completed and ready for final inspection either before 400 feet of additional sewer construction is completed or within one (1) week after the manhole is constructed, whichever comes first.

1. Brick

Prior to laying, all brick shall be thoroughly wetted and the surfaces allowed to dry

only sufficiently to prevent slippage on the mortar. Broken or chipped brick shall not be used on the face of the structure.

Brick shall be laid in neat, even consecutive courses with full and close mortar joints. Courses shall be level throughout, except as shown or otherwise required. Stagger joints in adjoining courses by 2 a brick as nearly as practicable. At least one (1) course in every seven (7) shall be stretcher courses with intervening courses laid as headers. Length of brick closure pieces shall be not less than the width of one (1) whole brick and, wherever practicable, closures as headers, shall be made from whole brick.

Unless otherwise indicated, joints shall be not more than 2 inch thick and shall be of a uniform thickness throughout the structure. Joints shall be provided as indicated on the Plans. Exposed surfaces shall be true and smooth. Rake all joints to receive plaster coat.

Prior to applying plaster coat, brick shall be thoroughly wetted with water and the surface allowed to dry sufficiently to effect proper bonding.

2. Concrete Block

The first course of concrete block shall be placed on the prepared base in a full bed of mortar. Mortar joints shall be full and closed in all courses. Courses shall be level throughout. Stagger joints in adjoining courses by 2 the length of the block as nearly as practicable.

Joints shall be uniform in thickness throughout the structure. Strike all joints and properly point to provide true, smooth surfaces.

Prior to applying plaster coat, block shall be thoroughly wetted with water and the surface allowed to dry sufficiently to effect proper bonding.

3. Precast Concrete Units

Construct as detailed on the Plans.

Where precast doghouse sections cannot be used, the manhole shall be brick or block to eight (8) inches above top of highest pipe.

4. Plaster Coat

Cement mortar plaster coat shall be applied to the exterior surfaces of the brick and/or concrete block sections of all manholes indicated on the Plans. Plaster coat shall be 2 inch thick.

5. Castings

Provide and install all iron covers, frames, adjusting rings, and anchors to the elevation indicated on the Plans, or as specified herein. Castings shall be set on 1-inch diameter rubber O-ring gasket, resting on adjustment rings. The casting shall be anchored to the precast concrete cone section as indicated on the Plans.

6. Inlet and Outlet Pipe

Pipe, 6-inch thru 24-inch diameters, shall be connected to manholes using an

approved mechanically compressible flexible joint as indicated on the Plans. The pipe shall be properly supported with compacted sand backfill from undisturbed ground so that any settlement will not disturb the connection.

7. Flow Channel

Concrete flow channels shall be constructed in each manhole, as indicated on the Plans. For manholes with outlet pipe diameter of 24 inches or less, the concrete flow channel shall be constructed up to the springline of the pipe, with a 3/4 inch to 1-1/4 inch gap provided at the pipe ends to maintain joint flexibility.

8. Stub Opening

Stub openings shall be at least two (2) pipe, with a minimum length of ten (10) feet, and the first joint located approximately 18 inches from the outside manhole wall. The end of the stub shall have a manufactured bell, which shall be plugged with a watertight manufacturer plug that is blocked to prevent movement.

C. Vent Assembly

Provide all materials and construct vent assemblies where indicated on the Plans. Install all piping, fittings, joints, vents, etc. as detailed. Vent assemblies shall be installed on undisturbed earth and provided with restraints as indicated on the Plans, as specified herein and as required for a complete installation. Vent assemblies shall be connected to manholes as indicated on the Plans.

D. Drop Connection Assembly

Provide all materials and construct drop connection assembly where indicated on the Plans. Install all piping, fittings, joints, etc., as detailed. Tapping of existing manholes for drop connections shall be made by drilling holes through the wall of the manhole at 4-inch centers along the periphery of the opening, to create a plane of weakness joint, before breaking out section. Non-shrink grout shall be used to seal the opening and a 3,500 psi concrete collar 12 inches thick shall be poured around the pipe. Drop connections to existing or new manholes shall be made as indicated on the Plans.

E. Bulkheads

A solid masonry or approved water and airtight bulkhead shall be placed at each point of beginning and at each stub that is constructed or as indicated on the Plans.

At the completion of construction and testing, all the bulkheads shall be removed, unless otherwise indicated on the Plans or as directed by the ENGINEER.

F. Wyes

If the CONTRACTOR fails to place any wyes as herein outlined he shall return to the site and place additional wyes, in an approved manner, at his expense.

If a concrete pipe with an inset opening is being used, a compression type joint shall be cast into bell end of the opening. Wye openings shall be closed with a precast 6-inch stopper, as recommended by the manufacturer, to make a watertight closure.

G. Risers

Risers shall be installed where the sewer is more than 12 feet below the established grade or future grade, and carried to between nine (9) and ten (10) feet of the established grade or future grade, as indicated on the Plans. Six (6) inch pipe with approved compression type joints, or equal cast-in-bell joints with similar fittings shall be installed in the manner indicated on the Plans.

Riser openings shall be closed with a precast stopper, as recommended by the manufacturer, to make a watertight closure.

H. Services

All services shall be 6-inch diameter pipe and shall be laid on a uniform slope of 1/8 inch per foot unless greater slope will provide depth considered adequate by the ENGINEER.

Service depth, shall be as shown by the Plans or as directed by the ENGINEER.

Services under or within five (5) feet of concrete or asphalt pavements shall be installed by boring or tunneling.

Each service shall be closed with a precast stopper, as recommended by the manufacturer, to make a watertight closure.

I. Wye, Riser or Service Marker

Prior to the backfilling of a wye, riser or service, a 2" x 2" (minimum cross section) wooden marker shall be placed from a point immediately in front of the service connection to 1-foot below the finish ground surface. The top of the marker shall be painted green, and labeled sanitary sewer service with station number. DO NOT rest the marker on any portion of the service connection or stopper.

3.04 FIELD QUALITY CONTROL

A. General

After all the pipe, structures, and services have been laid, constructed and backfilled, the system shall be cleaned, final inspected and tested. The cleaning, inspection and testing shall consist of the following parts: cleaning, first inspection, television inspection and testing.

A manhole section is defined as the length of sewer connecting two manholes. Cleaning of sanitary sewer lines shall be conducted on the lines specified. The designated sanitary sewer lines shall be cleaned using high velocity, mechanically powered or hydraulically propelled sewer cleaning equipment as specified. Selection of the equipment used shall be based on the conditions of the lines at the time the work commences. Cleaning of sewer lines shall be accomplished by trapping and collecting all sand, debris, grease and other material, at the next manhole downstream of the line being cleaned, and removal and proper disposal of said materials. The cleaning operations shall also provide a means by which the sewer line can be threaded, i.e., a cable inserted in the line so that the television camera may be pulled through.

The first inspection shall be completed and all repairs made in ample time so that the television inspection of the underground portion of the system, as hereinafter defined, can be completed within four (4) weeks of the completion of the construction. Television inspection shall be considered completed when the necessary construction repairs have been made and the installation retelevised when required, and the system is acceptable

for the testing phase. When retelevision is necessary, an additional two (2) weeks will be allowed for completion. Testing of the system as hereinafter described shall immediately follow the television inspection and shall be completed within a 2-week period.

Failure to maintain a schedule in compliance with the terms of this item will automatically cause the stoppage of other work at the particular site in question until such time as the final inspection of the completed underground portion of the system has progressed to within acceptable limits.

1. Sewer Line Cleaning

The designated sewer manhole sections using equipment and methods approved satisfactory to the OWNER shall be cleaned using high-velocity jet equipment for 18-inch diameter sewer and smaller. The equipment shall be capable of removing dirt, grease, rocks, sand, roots and other materials and obstructions from the sewer lines and manholes, and restore the sewer to a minimum of 95 percent of the original carrying capacity, as required for first inspection, and restore the sewer to a minimum of 95 percent of the original carrying capacity, as required for first inspection.

The equipment shall have a selection of two or more high-velocity nozzles capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. Equipment shall also include a high-velocity gun capable of producing flows from fine spray to a solid stream for washing and scouring manhole walls and floor. The equipment shall carry its own water tank, auxiliary engines, pumps and hydraulically driven hose reel.

The CONTRACTOR shall contact the OWNER regarding a source of water. All costs incurred in obtaining and delivering the hydrant meter water shall be borne by the CONTRACTOR. If hydrants are approved for use by the OWNER, a gate valve shall be used by the CONTRACTOR when operating any hydrant. Proper hydrant operating procedures shall be obtained from the local water department.

Precautions shall be taken to insure that the water does not cause damage of flooding to the public or private property being served by the manhole section involved. Sewers or service laterals damaged as a result of the CONTRACTOR'S operations shall be immediately repaired by the CONTRACTOR at no cost to the OWNER. Damage caused by the materials (liquid or solid) that are blown or pushed back into resident’s homes through the sewer laterals is the responsibility of the CONTRACTOR at no cost to the OWNER.

All sludge, dirt, sand, roots, rocks, grease, and other solid or semi-solid material resulting from the cleaning operation shall be trapped and removed at the downstream manhole of the section being cleaned. Passing material from manhole section to manhole section, which could cause line stoppages, accumulations of sand in wet wells, or damage pumping equipment shall not be permitted.

Under no circumstances shall sewage or solids be dumped onto the ground surface, streets or into ditches, catch basins or storm drains. All solids or semi-solids resulting from the cleaning operations shall be vacuumed into a water tight vacuum truck. The excess liquid shall be returned to the sewer system. The CONTRACTOR shall not be allowed to accumulate debris, sand, etc., on the site of work, except in totally enclosed containers and as approved by the OWNER.

Disposal of the solids or semi-solids shall be at a suitable site selected by the OWNER and paid for by the CONTRACTOR. All materials shall be removed from the site no less than at the end of cleaning operations shall be removed from the site and disposed of at a location approved by the OWNER. The CONTRACTOR will transport to county disposal site. Cost shall be borne by the CONTRACTOR. Disposal of all debris will be arranged for by the OWNER and paid for by the CONTRACTOR.

If there is an interference in the sewer line that will not allow the cleaning equipment to pass, then the equipment shall be backed out of the line and an attempt shall be made to clean the line from the manhole at the other end. If the entire length of the sewer line cannot be cleaned, the CONTRACTOR shall take the necessary steps to cause the cleaning and televising work to proceed at no cost to the owner. Should the cleaning equipment become lodged within the pipe or manhole, the CONTRACTOR shall take whatever steps are necessary to quickly remove the equipment and restore any damages to approved conditions.

Cleaning logs, required as a part of the cleaning work, shall be produced by the CONTRACTOR and shall be printed records which will clearly identify the work performed including documentation of the degree of cleaning required. The logs shall be transmitted to the ENGINEER and become the property of the OWNER.

Any retelevising of the lines due to poor cleaning, video tape quality or insufficient logs as determined by the ENGINEER shall be at the expense of the CONTRACTOR.

2. Testing

The CONTRACTOR shall provide the necessary supervision, labor, tools, equipment and the materials necessary for the tests which shall be conducted in the presence of the ENGINEER. The ENGINEER shall be notified two (2) working days in advance of all testing. The following tests shall be performed and approved prior to placing any system in service:

Leakage tests shall be conducted on all new sewer lines and existing lines which have not been previously approved. All sewers shall be subjected to air, exfiltration or infiltration tests, or a combination of same, prior to acceptance. All sewers over 24-inch diameter shall be subjected to infiltration tests. All sewers of 24-inch diameter or smaller, where the groundwater level above the top of the sewer is over seven (7) feet, shall be subjected to infiltration tests. All sewers of 24-inch diameter or less, where the groundwater level above the top of the sewer is seven (7) feet or less, shall be subjected to air tests or exfiltration tests.

B. Deflection Test for Plastic Pipe

Plastic pipe shall be tested for deflection, but no sooner than thirty days following the backfilling of the pipe. Maximum allowable deflection (reduction in vertical inside diameter) shall be five (5) percent. Locations with excessive deflection shall be excavated and repaired by re-bedding and/or replacement of the pipe.

3.05 SCHEDULES

A. Allowable Pipe Materials

Allowable pipe materials for this Project, based on size and depth of cut, are listed in the

attached schedule or on the Plans. The schedule also lists pipe strength and bedding class requirements for the various types of pipe.

END OF SECTION

SECTION 02735
FORCE MAINS

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

The work included under this Specification consists of furnishing all labor, equipment and materials necessary for the construction and testing of Force Mains and appurtenances as shown on the Drawings and specified herein.

B. Related Work Specified Elsewhere

1. Section 01025: Measurement and Payment
2. Section 02140: Dewatering during Construction
3. Section 02226: Trenching, Backfilling, and Compaction
4. Florida Administrative Code Chapter 62-610.469
5. Florida Administrative Code Chapter 62-610.660

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work of this Section shall conform to the applicable portions of the following Standard Specifications:

1. ANSI - American National Standards Institute
2. ASTM - American Society for Testing and Materials
3. AWWA - American Water Works Association
4. NSF - National Sanitation Foundation

1.03 SUBMITTALS

A. The Contractor shall submit Shop Drawings, work drawings and samples in accordance with the General Conditions and Section 01300.

B. In addition, the requirements of each related section and the following apply.

C. Shop Drawings for piping, valves, hydrants and other equipment and appurtenances shall be prepared by the manufacturer and include, as a minimum, the following:

1. Details of all fittings, valves, hydrants and other appurtenances
2. List of materials of construction standards and spare parts.
3. Provide detailed drawings of joints and gaskets to be supplied.
4. Calculations and/or test data demonstrating that the proposed restrained joint arrangement can transmit the required forces.
5. Copy of the manufacturer's quality control check of materials and production.
6. Provide form the manufacturers an affidavit of compliance with AWWA standards referenced in the specifications. Affidavit shall be included with Shop Drawings submittals.
7. Provide a tabulated layout schedule including:

a. Order of installation and closures.
b. Pipe invert station and elevation at changes of grade and alignment.
c. Elements of curves and bends, both in horizontal and vertical alignment, including elements of the resultant true angular deflections in cases of combined curvature.
d. The limits of each reach of pipe thickness class and of restrained joints.
e. Locations of closures for length adjustment and for construction convenience.
f. Locations of valves, hydrants and other equipment.
g. Methods and locations of support.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Storage of Materials

1. Sanitary Force Main Piping

Pipe shall be stored in a manner to minimize infiltration of dirt, debris and other extraneous materials.

Piping materials shall not be stacked higher than four (4) feet. Suitable racks, chairs and other supports shall be provided to protect preformed pipe mating surfaces from damage. Store bottom tiers off the ground, alternate tiers and chock tier ends.

2. Valves and Accessories

Store all valves, wells and prefabricated structures off the ground, drained and kept free of water to protect against damage. Valves, wells, their accessories and appurtenances shall be kept in their original containers until ready for installation.

3. Gasket, Glands, and Seals

All joint and sealing materials subject to ultra-violet or ozone attack and used in the force main system shall be protected from the sunlight, atmosphere and weather, stored in suitable enclosures until ready for installation.

B. Handling of Materials

1. Load and unload piping using suitably approved hoists and skidding. Piping shall not be dropped, bumped or allowed to impact against itself. Damaged piping shall be rejected by the ENGINEER.

2. Lifting devices shall be suited to the Work and shall protect surfaces from damage.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Scope

It is the intent of this Article to specify in detail the various types of pipe, joints, and fittings which have been indicated throughout the Plans and Specifications. This Article shall not be construed as allowing any alternate type of material to that which is indicated on the Plans or elsewhere in the Specifications.

B. Ductile Iron Pipe

1. Pipe shall be ANSI/AWWA A21.51/C151, cast and machined in the United States of America with green color or marking in accordance with F.A.C 62-610. Pressure class shall be as follows:

   a. For buried pipe: Class 250
   b. For above grade or exposed pipe: Flanged, Class 350

2. Joints

   Joints in "runs" of aboveground piping or piping located in vaults and structures shall be flanged. Joints in runs of buried piping shall be of the push-on or mechanical joint type per AWWA C-111 except where flanged joints are required.

   a. Flanged Joint

      i. Flanges shall be Class 125 per ANSI B-16.1. Flanges shall be long-hub type screwed tightly on pipe by machine at the foundry prior to facing and drilling. Flange faces shall be coated with a rust inhibitor immediately after facing and drilling. Field assembled screwed on flanges are prohibited.
      ii. Gaskets to be furnished in SBR (Styrene Butadiene) or an approved equal suitable for sanitary sewage, water, and reuse service.
      iii. All nuts and bolts for flanges shall be Type 316 stainless steel conforming to ASTM A-193, Grade B&M for bolts, and ASTM A-194, Grade M for nuts.

         - Provide washers for each nut. Washer shall be of the same material as the nuts.

   b. Push-on Joint

      i. The plain ends of push-on pipe shall be factory machined to a true circle and chamfered to facilitate fitting the gasket with spigot of pipe marked to visually determine when the spigot is fully seated in the bell of the adjoining section.
      ii. Gaskets to be furnished in SBR (Styrene Butadiene) or an approved equal suitable for sanitary sewage, water, and reuse service conforming to ANSI A21.11.
      iii. Joint deflection shall be limited to 75% of the maximum recommended deflection per the pipe manufacturer.

iv. Joints for pipe that are required to be restrained shall be restrained using a harness device, or “bell restraint.” The harness shall be split to enable installation after the spigot has been installed into the bell. The restraint ring of the harness shall consist of a plurality of individually activated gripping surfaces to hold the spigot.

c. Mechanical Joint Restraints

i. All yard piping shall be restrained. Pipe joints shall be restrained on each side of a fitting with a mechanical joint restraint. Mechanical joint restraints shall be accomplished using a mechanism consisting of plurality of individually activated gripping surfaces incorporated into the design of the follower gland with a compression gasket, conforming to ANSI A21.11. Glands shall be manufactured of ductile iron conforming to ASTM A 536. Restraining devices shall be of ductile iron, heat treated to a minimum hardness of 370 BHN. Twist off nuts shall be used to insure proper actuating of the restraining devices. Bolts and nuts shall be corten, low alloy, high strength steel conforming with AWWA standards. Bolts shall be tee-head conforming to ANSI A21.1, A21.53 and AWWA C 153 and C111.

C. Fittings

1. Below Grade

a. Fittings shall be compact, ductile iron with pressure rating of 250 psi conforming to ANSI A21-53/AWWA C-153 and be the mechanical joint configuration with standard thickness Protecto 401 lining in accordance with ANSI 21.4/AWWA C 104 and factory applied asphaltic coating per AWWA C 110 and C 153. All fittings shall have ANSI A21.10 laying lengths equivalent to those listed for mechanical joint fittings. Fittings shall be fusion bonded epoxy lined and coated.

2. Above Grade

a. Above grade fittings shall be flanged in accordance with AWWA C110/ANSI 21.10 with facing and drilling which match AWWA C115 and which also match ANSI B16.1 Class 125 flanges. Lining shall be Protecto 401, and exposed fittings shall have factory applied coating of a universal rust-inhibitive primer 2.0 mils dry thickness.

D. Pipe and Fitting Liners

Force mains shall have high build multi-component amine cured Novalac proxy polymenic lining. This coating will have a minimum DFT of 30 mils or a DFT as specified in the manufacturers submittal. Lining shall be TNEMEC, Protecto 401 or approved equal.

E. Pipe Coatings

1. Buried Pipe

Shall have factory applied asphaltic coating in accordance with the requirements of AWWA C151.

2. Exposed Pipe

Shall have factory applied coating of a universal rust-inhibitive primer with 2.0 mils dry thickness, and epoxy-polyamide, UV resistant coated.

3. All exterior pipe and fittings shall be color coded or marked using GREEN as a predominant color to differentiate from other water.

4. Underground metal pipe shall have GREEN stripes applied to the pipe wall located at no greater the 90-degree intervals around the pipe, and that will remain intact during and after installation of the pipe.

F. Valves

See valve specifications in Section 15200 – Process Piping and Valves.

G. Tapping Saddles and Sleeves

The saddles shall be compatible with the main and service lead, with straps of a stainless steel material to avoid crushing the main out-of-round. A molded gasket of rubber or neoprene shall completely encircle the tapped opening to insure a watertight connection. The use of lead gaskets is not allowed. Interior and exterior of saddles and sleeves shall be applied with fusion bonded epoxy per AWWA C116.

H. Electronic Ball Markers

Ball markers shall be placed at crosses, tees, and changes of direction. All markers shall be noted on the As-Built Drawings and shall not be buried at a depth greater than 5 feet below the finish grade elevation.

I. Curb Stops

Sanitary service, brass of types and sizes compatible with the connecting service pipe type.

J. Polyethylene Encasement

All buried pipe, valves, and fittings shall be polyethylene encased, minimum 8 mil thickness, in accordance with AWWA C105, GREEN in color, and printed with the text “SEWER”.

2.02 ACCEPTABLE MANUFACTURERS

A. Corporation Stop Ball Type

1. Ford FB1100
2. McDonald 4701B-22
3. Mueller P25008

B. Curb Stop

1. Ford B43-342W, BF43-777W
2. McDonald 6100MW-22
3. Mueller P24350, P24335

C. Tapping Sleeve

1. Ford Series FTSS
2. JCM, Model 432
3. Mueller, Series H-304 S/S
4. Dresser, style 630
5. Smith Blair Series 665

D. Ductile Iron Pipe

1. American
2. Clow
3. Griffin
4. McWane
5. US Pipe

E. Fittings

1. American
2. Sigma
3. Star
4. Union/Tyler

F. Restrained Joint

1. American, Fast Grip Gasket
2. EBAA Iron Mega-lug Series 1100, 1700 Bell Restraint, RS3800 Restrainer
3. Ford 1400-D
4. Star Series 3000
5. US Pipe Field Loc Gasket
6. Sigma ONE-LOK-SLD

G. Electronic Ball Marker

1. 3M, Scotch Mark EMSII EML #1265 Marker # 1404

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

A. Excavation and Bedding

Prior to the installation of any force main piping or materials, examine all trenches and other excavations for the proper grades, lines, levels and clearances required to receive the new Work. Ascertain that all excavation bottoms, compacted subgrades and pipe bedding are adequate to receive force main materials to be installed. Correct all defects and deficiencies before proceeding with the work.

3.02 PREPARATION

A. Pipe Ends

Remove all lumps, blisters excess coatings from the socket and plain ends of pipe. Wire brush and wipe clean the outside surfaces of all plain ends and the inside surfaces of all socket ends before installation. Any pipe or fitting which has acquired a coating of mud or other adhesive foreign material shall be scrubbed clean.

B. Examination of Materials

All pipe fittings, valves, hydrants, accessories and appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective or damaged materials shall be marked and held for inspection by the ENGINEER. Damaged materials are subject to rejection by the ENGINEER.

3.03 INSTALLATION

A. General

1. Pipe Cleanliness

Foreign matter shall be prevented from entering the pipe while it is being placed in the trench. During and after laying operations, no debris, clothing or other materials shall be placed in the pipe.

2. Pipe Plugs

During the progress of all force main Work, watertight plugs shall be carried along and inserted in the end of each pipe as it is laid to prevent foreign matter or rodents from entering the pipe. This watertight plug shall be fastened in the end of the force main in such a manner as to prevent it from floating or being otherwise displaced whenever construction operations are temporarily halted, such as at noon or at the end of the days Work.

3. Pipe Bearing

Each section of pipe, when placed to grade and line, shall have firm bearing on the trench bedding throughout its length between bell holes.

4. Pipe Cutting

Cutting of pipe shall be done with approved tools and by approved methods suitable for the pipe material. Pipe cutting methods that produce a smooth, square cut end without damage to the pipe and that minimize airborne particles, shall be employed. Pipe cutting shall be performed using the recommendations of the manufacturer of the type of pipe materials being cut and according to the best trade practices.

a. Pipe Linings and Coatings

When cutting pipe or fittings, care shall be taken to prevent damage to linings and coatings. Damage to linings shall be cause for rejection of the complete Section. Damage to exterior coatings shall be corrected to original Specifications.

b. Gaskets

Where pipe using a resilient gasket to effect the seal is cut, the cut pipe end shall be tapered at a 30-degree angle with the centerline of the pipe, and ground smooth, on the outside end to remove any sharp edges or burrs which might damage the gasket.

5. Pipe Laying

Unless otherwise specified, pipe shall be laid with bell ends facing in the direction of laying. After a length of pipe is placed in the trench, the spigot shall be centered in the bell end of the adjacent pipe section, the pipe shoved into position and brought to true alignment and secured with sand tamped under and on both sides of the pipe except at bell holes. Adequate support shall be provided for all force main pipe.

6. Pipe Bedding

After the bottom of trench has been excavated and filled to the required grade with four (4) inches of bank run sand approved by the ENGINEER, meeting the requirements of granular material thoroughly compacted by tamping, the pipe shall be installed strictly in accordance with the manufacturers recommendations. After the pipe is laid, the sand backfill shall be continued to a point 12 inches above the top of pipe barrel. Particular care shall be taken to assure filling and tamping all spaces under, around and above the top of the pipe. Backfill shall be as indicated on the Plans and in the Specifications. A continuous and uniform bedding shall be provided in the trench for all buried pipe.

7. Bolts, Studs, and Nuts

Install bolts, studs, and nuts of the type specified per the manufacturers installation and torqueing requirements. All steel bolts, studs, and nuts shall be painted with bituminous paint after installation.

B. Ductile Iron Pipe

1. Push-On Joints

Joints shall be made by means of a compression type push-on resilient gasket. Gasket shall be pre-lubricated before installation using a lubricant recommended by the pipe manufacturer. The seated joint shall be identified by the visible mark on the spigot of the installed pipe section.

2. Mechanical Joints

Joints shall be made with bolts, molded resilient gasket and ductile iron follower gland. All nuts shall be screwed up finger tight before using a wrench. The gland and rubber gasket shall be brought up evenly at all points around the bell flange and then torqued per the manufacturers recommendations. The normal range of bolt torques to be applied to standard cast iron bolts in a joint and the lengths of wrenches that should satisfactorily produce the ranges of torques are as follows:

Pipe Size (in.)	Bolt Size (in.)	Range of Torque	Length of Wrench
3	5/8	45-60 ft. lb.	8 inches
4-24	3/4	75-90 ft. lb.	10 inches
30-36	1	100-120 ft. lb.	12 inches
42-48	1-1/4	120-150 ft. lb.	14 inches

Exposed portions of bolts shall be covered with mastic.

C. Polyvinyl Chloride Pipe

Polyvinyl chloride pipe shall be laid with gasketed joints in complete accordance with the pipe manufacturers published instructions. The joints shall be sufficiently lubricated using the pipe manufacturers recommended lubricant.

Gaskets for pipe joints shall be inserted with the painted edge facing the end of the bell. Each length of pipe shall be pushed home individually. The pipe shall be positioned so that the reference mark on the spigot end is in line with the bell end.

D. Valves, Fittings, and Appurtenances

1. Valves

All valves shall be installed to the grade, lines, levels and locations indicated on the Plans.

Valve connections shall be as specified for the piping materials used. Valves shall be set with the stem plumb on permanent, firm foundations as indicated on the Plans.

Where required, valves shall be supported with special supports as indicated on the Plans and as approved by the ENGINEER. Valves shall be installed so as not to receive support from the connecting pipe. In no case shall valve installation be used to bring misaligned pipe into alignment.

2. Valve Boxes

Install valve boxes to the grade, lines, levels and locations indicated on the Plans. Valve boxes shall not transmit shock or stress to the valve and shall be set plumb with covers centered over operating nuts and flush with the indicated surface elevations. Valve boxes that shift or fill during backfilling shall be uncovered and reset.

3. Tapping Sleeves

Where tapping sleeves are to be installed, the entire circumference of the main shall be free of all loose material. Installation of the sleeve and tapping of the main shall be in accordance with manufacturers recommendations.

4. Curb Stops

Install curb stops of the types and sizes indicated on the Plans.

5. Fittings, Strapping, and Lugged Pipe

a. Fittings

Install all fittings to the lines, levels and locations indicated on the Plans. Installation of fittings shall be with the type of joint specified for piping. Fittings shall be provided with restraints as specified herein as indicated on the Plans and as required for a functional installation.

b. Strapping, Lugged Pipe and Fittings

Where indicated on the Plans and as directed by the ENGINEER, bends in force main piping and piping runs subject to impact reaction shall be secured by means of metal strapping. Install all necessary bands, tie rods, nuts and washers required. No metal strapping shall be used in direct contact with polyvinyl chloride pipe.

Where lugged pipe and special fittings are indicated on the Plans, furnish and install all necessary tie rods, nuts and washers.

E. Air Release Assembly

Provide all materials and construct air release assemblies where indicated on the Plans. Install all valves, fittings, caps, plugs and piping as required. Fittings and joint materials used for air release assemblies shall be as specified herein for the force main piping materials used. Install air release valves at all high points in the pressure system.

F. Blow-Off Assembly

Provide all materials and construct blow-off assemblies where indicated on the Plans. Blow-off assemblies and pipe shall be installed to the lines, levels and elevations shown, install all valves, fittings, reducers, piping, plugs, joints, etc. as detailed. Blow-off assemblies shall be installed on stable, undisturbed earth materials with changes in directions and returns provided with bedding and restraints as indicated on the Plans, as specified herein and as required for a complete installation. Blow-off assemblies shall include valve boxes as detailed.

G. Tapping Valve Assembly

Install all tapping valve assemblies of sizes and to the lines, elevations, locations and details indicated on the Plans. The tapping sleeve shall be assembled around the main, and the tapping performed in strict accordance with the manufacturers recommendations. Tapping shall be accomplished without interruption of service.

H. Anchors, Encasements, and Restraints

Plugs, tees, sleeves, bends, caps, saddles and lug piping shall be provided with suitable anchors, encasements and restraints as indicated on the Plans. Anchoring, encasement and restraint methods shall be as detailed. All bearings shall be as shown. Anchors, encasements and restraints shall rest on firm, stable, compacted subgrade and shall be provided for all standard and special fittings.

3.04 FIELD QUALITY CONTROL

A. Hydrostatic Testing

After the pipe has been laid and backfilled, the pipe shall be hydrostatically tested for leakage. The CONTRACTOR shall furnish the pump, pipe connection, hydrants, valves and any other necessary apparatus including gages and meters and all personnel necessary for conducting the test. Before applying the test pressure, all air shall be expelled from the pipe. If necessary to accomplish this, taps shall be made at points of higher elevation and afterwards plugged. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter. Flushing shall be at full flow conditions with at least 2.5 feet per second flow rate.

The test shall be made at a pressure of 150 pounds per square inch gage. The full pressure shall be held for at least two (2) hours in accordance with the applicable provisions as set forth in section 4 of AWWA standard C600. Any faulty pipe fitting, gate valves or other accessories which permit leaks during testing shall be replaced by the CONTRACTOR with sound material and the test shall be repeated until specified requirements are met.

The maximum permissible leakage for Ductile Iron Pipe shall be less than the number of gallons per hour determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

Where:

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 maintained during the leakage test in pounds per square inch, (min. 150 psi)

The testing procedure shall include the continued application of the specified pressure to the test system, for the two hour period, by way of a pump taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container. Should the test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until within the established limits. The Contractor shall furnish the necessary labor, water, pumps, gauges, and all other items required to conduct the required testing and perform necessary repairs.

Should the test pass, the contractor shall exercise the valves at the direction of the inspector to confirm the yard valves can hold pressure. Once all valves have been tested and pass inspection, the hydrostatic testing will be complete.

B. Water for Testing

Water for testing shall be obtained from a potable water supply. The CONTRACTOR shall provide all water required at his own expense and shall make all necessary arrangements with the authority which controls the source of water system and shall be governed in his use of water by all rules and regulations imposed thereon by said authority. The CONTRACTOR shall provide and remove temporary connections between the source water system and the mains constructed under this Contract. All temporary connections shall meet the approval of the ENGINEER, the authority controlling the source water system and Public Health authorities having jurisdiction.

END OF SECTION

SECTION 02831
CHAIN LINK FENCES AND GATES

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes chain link fences and gates, concrete for post anchoring, equipment requirements, field quality control and appurtenances required to complete the fencing Work indicated on the Plans.

B. Related Work Specified Elsewhere

The following sections contain requirements that relate to this section:

1. Section 01025: Measurement and Payment
2. Section 02200: General Earthwork

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

1. ASTM - American Society of Testing & Materials
2. FDOT - Florida Department of Transportation
3. IFIA - International Fence Industry Association

B. Single-Source Responsibility

Obtain chain link fences and gates as complete units, including necessary erection accessories, fittings, and fastenings from a single source or manufacturer.

1.03 SUBMITTALS

A. General

Submit the following in accordance with Conditions of Contract.

Product data in the form of manufacturer's technical data, supplier, specifications, and installation instructions for fence posts, fabric, and accessories for the project O & M manual.

B. Shop Drawings

Shop drawings showing location of fence, gates, each post, and details of post installation, extension arms, gate swing, hardware, and accessories.

1.04 JOB CONDITIONS

All trees, shrubs, and vegetation not within the Work limits designated on the Plans by the ENGINEER shall be carefully protected from damage or injury during execution of the Work. It is intended that chain link fence installation have the minimum impact necessary on adjacent existing vegetation to remain.

1.05 WARRANTY

All materials and work furnished under this Section shall be guaranteed for two years after the date of Substantial Completion. The CONTRACTOR shall not be obliged to replace, repair, or restore any portion of the work which is damaged by the OWNER or as a result of the OWNER's negligence. Portions of the work destroyed by vandalism or theft shall be the responsibility of the OWNER after Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

Approved manufacturers are those meeting the requirements of the technical specification and approved by the ENGINEER.

2.02 FABRIC

A. Fabric Mesh – Vinyl Coated

Comply with Chain Link Fence Manufacturers Institute (CLFMI) Product Manual. Furnish one-piece fabric widths for fencing 10 feet high or less. Wire size includes zinc galvanized steel. Aluminum coating is not acceptable.

1. Size: 2 inch mesh, 9 gage wire with knuckled selvage.

2. Class 2 with a minimum coating weight of 1.2002 per square foot.

3. Color: dark green.

B. Steel Framework, General: Posts, Rails, Braces, and Gate Frames

1. Provide framework, fittings, and accessories with manufacturer's standard zinc galvanized steel. All framework shall be schedule 40 or SS40. Provide brace and truss assembly.

2. Color: dark green.

C. Terminal End, Corner, and Pull Posts for Following Fabric Heights:

1. Over 6 feet height: 3-inch OD Type I or II galvanized steel pipe, Schedule 40. For 10 foot height fence, provide posts that are 13 feet in length minimum.

2. For 6 foot height: 2-1/2 inch OD Type I or II galvanized steel pipe, Schedule 40. Provide posts that are 8 feet in length minimum.

3. Color: dark green.

D. Line or Intermediate Posts for Following Fabric Heights:

1. Over 6 foot height: 2-1/2inch OD Type I or II galvanized, Schedule 40. For 10 foot height fence, provide posts that are 12 foot 6 inches in length minimum.

2. For 6 foot height: 2 inch OD Type I or II galvanized, Schedule 40. Provide posts that are 8 feet in length minimum.

3. Color: dark green.

E. Top Rail, Mid-Rail and Bottom Rail

Manufacturer's longest lengths, with expansion-type couplings, approximately 6 inches long, for each joint. Provide means for attaching top rail securely to each gate corner, pull, and end post.

1. Galvanized Steel: 1-5/8 inch OD, Schedule 40.

2. Color: dark green.

2.03 FITTINGS AND ACCESSORIES

A. Material

Comply with ASTM F 626. Heavy malleable galvanized steel, to suit manufacturer's standards.

1. Zinc Coating: Unless specified otherwise, galvanize steel fence fittings and accessories in accordance with ASTM A 153, with zinc weights per Table I.

B. Bottom Tension Wire

Number 7 gauge metallic-coated steel marcelled tension wire conforming to ASTM A 824 with finish to match fabric.

1. Type II Zinc Coated in following class:
   a. Class 2, with a minimum coating weight of 1.20 oz. per sq. ft. of uncoated wire surface.

C. Tie Wires

12-gage (0.106-inch diameter) galvanized steel with a minimum of 0.80 oz. per sq. ft. of zinc coating of surface area in accordance with ASTM A 641, Class 3 or 9-gage (0.106-inch-diameter) aluminum wire alloy 1100-H14 or equal, to match fabric core material.

D. Mid-Rail and Bottom Rail

Same material as top rail. Provide manufacturer's standard heavy malleable galvanized steel aluminum cap for each end.

E. Post and Line Caps

Provide weathertight closure cap for each post. Provide line post caps with loop to receive top rail.

F. Tension or Stretcher Bars

Hot-dip galvanized steel with minimum length 2 inches less than full height of fabric, minimum cross-section of 3/16 inch by 3/4 inch and minimum 1.2 oz. zinc coating per sq. ft. of surface area. Provide one bar for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into post.

G. Tension and Brace Bands

Minimum 3/4-inch-wide hot-dip galvanized steel with minimum 1.2 oz. zinc coating per sq. ft. of surface area.

1. Tension Bands: Minimum 14 gage (0.074 inch) thick.

2. Tension and Brace Bands: Minimum 12 gage (0.105 inch) thick.

H. Gates

Gates are to be galvanized steel with a Schedule 40 1 5/8 inch welded frame.

1. Standard 20 foot width double gate by 6 foot height.

2. 180E pressed steel hinges.

3. Removable drop rod with attachment for locking device.

4. Gate Posts: 4-inch OD Type I or II galvanized steel pipe, Schedule 40.

I. Concrete

Provide concrete consisting of Portland cement, ASTM C 150, aggregates ASTM C 33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 3000 psi. Use at least 4 sacks of cement per cu. yd., 1-inch maximum size aggregate, maximum 3-inch slump, and 2 to 4 percent entrained air.

1. Provide a concrete post base 4 times the diameter of the post with 36 inches minimum depth or as shown on plans.

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

A. Excavation

Prior to the placing of any fencing materials, examine the excavation for the grades, lines, and levels required to receive the new work. Ascertain that all excavation and compacted subgrades are adequate to receive the new work. Correct all defects and deficiencies before proceeding with the Work.

B. Finish Grade Conditions

Prior the placing of any fencing materials, examine the Finished Grade to ascertain that it is adequate to receive the new Work.

C. Existing Improvements

Investigate and verify locations of existing improvements, including structures, with which the new work will be in contact.

Necessary adjustments to align the new work with existing improvements must be approved by the ENGINEER, prior to any changes.

3.02 PREPARATION / GENERAL

Install fence in compliance with ASTM F 567. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

3.03 INSTALLATION

A. Excavation

Drill or hand-excavate (using post-hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.

1. Unless otherwise indicated, excavate hole depths approximately 3 inches lower than post bottom, with bottom of posts set not less than 36 inches below finish grade surface. The diameter for concrete footers are to be four (4) times the diameter of posts unless otherwise shown on the drawings.

B. Setting Posts

Post locations on drawings are schematic. Center posts 6 inches inside of the edge court base. Do not allow a grass strip to remain between posts and court.

Center and align posts in holes 3 inches above bottom of excavation. Space maximum 10 feet o.c., unless otherwise indicated.

1. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
   a. Unless otherwise indicated, extend concrete footings 2 inches above grade and trowel to a crown to shed water.

C. Top Rail, Mid-Rail and Bottom Rails

Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.

D. Brace and Truss Assemblies

Install brace and truss assemblies to plumb posts when diagonal rod is under proper tension

E. Fabric

Leave approximately 2 inches between finish grade and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

F. Tension or Stretcher Bars

Thread through or clamp to fabric 4 inches o.c., and secure to end, corner, pull, and gate posts with tension bands spaced not over 15 inches o.c.

G. Tie Wires

Use U-shaped wire of proper length to secure fabric firmly to posts and rails with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.

1. Maximum Spacing: Tie fabric to line posts 12 inches o.c. and to rails and braces 24 inches o.c.

H. Fasteners

Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads prevent removal of nuts.

3.04 CLEAN UP

A. General

The CONTRACTOR shall restore in an acceptable manner all property, both public and private, which has been damaged during the execution of the work, and shall leave roadways and sidewalks in a neat and presentable condition throughout the entire length of the work under the contract. The placing of materials of any character, rubbish or equipment, on abutting property, with or without the consent of the property owners, shall not constitute satisfactory disposal. Temporary storage of materials and equipment will be coordinated with the OWNER.

Upon completion of work and before Substantial Completion inspection, all aspects of the project site shall be thoroughly and completely cleaned of debris, stains, materials, defacements, and temporary facilities. Likewise, any repairs which are the obligation of the CONTRACTOR shall be completed.

END OF SECTION

SECTION 02940
SODDING

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes sodding complete with earth bed preparation, providing and placing topsoil, compacting and finishing topsoil, furnishing and placing sod, furnishing and placing stakes, watering sod, rolling and tamping sod, mowing sod, replacing defective or deteriorated sod and maintenance and care of sod in place.

B. Related Work Specified Elsewhere

1. Section 01025: Measurement and Payment
2. Section 02200: General Earthwork
3. Section 02215: Site Grading

1.02 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies

1. State Department of Agriculture

Comply with the applicable requirements of the Florida Pesticide Application Act of 1974 with Federal Environmental Pesticides Control Act of 1972 and Florida Department of Agriculture nursery grown sod.

1.03 SUBMITTALS

A. Growers Certificate

Where applicable, submit copies of Sod Growers Certificate to the ENGINEER indicating nursery from which sod was taken, grass species and percentage in accordance with the Florida Pesticide Application Act of 1974 with Federal Environmental Pesticides Control Act of 1972 and Florida Department of Agriculture Regulations referenced above in Article 1.02.A.

B. Topsoil Borrow Pit Agreements

When requested by the ENGINEER, submit evidence of topsoil borrow pit agreement for pits used by the CONTRACTOR.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials

Sod shall be delivered to the project site on suitably approved wooden pallets. Sod shall be delivered in manageable squares and the amount of sod delivered shall not exceed that which can be installed in one (1) 24-hour period. Sod that has been damaged during delivery will be rejected.

B. Storage

Store sod in such a manner as to protect roots and grass material from exposure to wind and sunlight, freezing or other injury. Sod shall be kept moist during storage, under shade or covered with moistened burlap. Sod that has been damaged or has deteriorated because of storage will be rejected.

C. Handling

Sod shall be handled in a manner to prevent breaking or other damage. Sod shall not be handled by pitch forks or by dumping from trucks or other vehicles. Care shall be taken at all times to retain the native soil on the roots of each sod roll during stripping and handling. Sod that has been damaged by handling will be rejected.

1.05 JOB CONDITIONS

A. Environmental Requirements

1. Soil Moisture Conditions for Sod Cutting

Perform sod cutting and removal during soil moisture conditions as specified under paragraph 3.02.B below.

2. Seasonal Limitations

Sod shall not be placed during drought nor between the dates of June 1 and August 15, inclusive, unless directed by the ENGINEER.

3. Temperature Limitations

Sod shall not be placed when the ambient air temperature is below 32 degrees F.

B. Protection

1. Signs and Barricades

Provide suitably approved warning signs and barricades for protection of new sodding from pedestrian or vehicular traffic. Protect all newly sodded areas during the progress of the Work and until the completion of the turf establishment period.

2. Adjacent Construction

Protect all adjacent construction from topsoil spills and perform such cleanup of affected surfaces before it becomes compacted by traffic.

C. Planting Schedule

The CONTRACTOR will be required to have a minimum of 90% of the sod placed at least one (1) month prior to final acceptance of the complete Project to insure adequate rooting of the sod.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Sod

1. General

Dense, well-rooted growths of the species and type indicated on the plans indigenous to the general locality where it is proposed for use, free of noxious weed, relatively free of weeds and undesirable plants, in general, large stones, roots and other material which might be detrimental to the growth, development or future maintenance of the sod.

2. Nursery Sod

Nursery sod, where used, shall have been grown in a prepared seed bed and regularly fertilized and maintained according to established practices for at least two (2) years before cutting.

3. Field or Salvage Sod

Salvage sod existing on areas to be disturbed in construction or field grown sod meeting the requirements of paragraph 2.01.A.1 of this Section shall be used as indicated on the Plans or as directed by the ENGINEER.

4. Harvest Heights

Sod shall be of uniform height when harvested. Vegetation more than five (5) inches in height shall be mowed to a height of three (3) inches or less. When the sod is harvested (cut), the height of the grasses shall be as follows:

Field Grown Sod - 2 to 3 inches

Nursery Grown Sod - 1 to 2 inches

5. Harvest Thickness

Sod when harvested shall have the following average thickness:

Field Grown Sod - 2 inches

Nursery Grown Sod - 1 inch

B. Topsoil

Topsoil shall be the top 12 inches or less of soil taken from the top of the natural and undisturbed ground level and shall be a loam containing a sufficient amount of organic matter to attain proper texture. Topsoil shall be free of undesirable grasses, weed roots or other unsuitable material. All topsoil shall be subject to acceptance by the ENGINEER. The CONTRACTOR shall obtain his own topsoil borrow pit source and shall obtain all necessary permits and agreements for the use of such borrow pits at his own expense.

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

A. Earth Bed

Prior to placing any topsoil, verify that earth bed in areas to receive sod have been completely stabilized to prevent settling and that grades have been made smooth, uniform and parallel to the finished grades and cross sections shown on the Plans. Ascertain that the tops and bottoms of all slopes are rounded off to form vertical curves and have been found acceptable to the ENGINEER. Do no placing of topsoil until all earth bed conditions are accepted.

B. Topsoil

Prior to placing sod, verify that topsoil has been placed on the prepared earth bed to the proper depths shown on the Plans and as specified herein. Do not place any sod until topsoil conditions are satisfactory.

3.02 PREPARATION

A. Off-Site Source Inspection

Prior to commencement of sodding operations, notify the ENGINEER of the off-site sources from which sod is to be furnished. The ENGINEER, at his discretion, will inspect the sod at the off-site source.

B. Sod Harvesting

Sod shall be harvested by cutting into squares or into rectangular sections. The rectangular sections may vary in length, but shall be of equal width and of a size that will permit them to be lifted and rolled without breaking. During the stripping process and all other handling of the sod, care shall be taken to retain the native soil on the roots. Where off-site source inspection of sod is required by the ENGINEER, no sod shall be harvested until such inspection is complete and sod is accepted. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected. When the soil is too dry, permission to cut sod may be granted by the ENGINEER only after it has been sufficiently watered to moisten the soil to the depth at which the sod is to be cut.

C. Preparation of Subgrade

Complete all fine grading within the areas to be covered with topsoil as necessary to bring the surface of the proposed subgrade to the elevations indicated on the Plans and parallel to the proposed finished grade. The surface of the subgrade, immediately prior to being covered with topsoil, shall be raked or otherwise loosened to a minimum depth of two (2) inches to facilitate making a bond between the subsoil and the topsoil.

3.03 INSTALLATION

A. Topsoil

1. Placing and Spreading Topsoil

Topsoil shall be placed and spread over the area indicated on the Plans or as directed by the ENGINEER. Topsoil shall be placed to a depth of three (3) inches, plus or minus 1-inch, unless otherwise indicated on the Plans. At a minimum, topsoil placed shall be sufficiently greater than that shown on the Plans so that, after natural settlement or rolling, the completed Work will conform to the lines, grades and elevations indicated on the Plans.

2. Finishing Topsoil

After spreading topsoil, all large lumps, rocks, roots, debris or other foreign matter shall be removed from the topsoil by raking and disposed of off the site of the Work. Spreading shall be completed in such a manner that sodding operations can proceed without additional moving of topsoil. Topsoil furnished and placed shall be incidental to the sodding operations.

B. Sodding

1. Placing

Sod shall be laid within 24 hours after cutting and shall be properly protected during handling and placing. Sod shall be lifted from trucks or storage piles and placed on a moist earth bed by hand, making close joints without overlapping. All gaps between sections of sod and openings at angles shall be plugged with sod. When placing sod on slopes, the Work shall begin at the base of the slope and progress upward by carefully placing the sod on the smooth slope, in rows, with the lengths running at right angles to the slope. The transverse joints of sod strips shall be staggered and the sod carefully laid to produce tight joints. When the top of slopes are reached, the sod shall be carried back at least two (2) feet over the crest and trimmed to a line which is parallel to the top of the bank. The areas back of the crest shall have been previously graded and the surface of the sod, when placed, shall be two (2) inches below the level of this area and covered with a layer of topsoil at least two (2) inches in depth and thoroughly compacted in a manner that will conduct the surface water from runoff over the edge of the sod. No frozen sod shall be laid nor shall sod be laid on frozen soil.

2. Rolling

Rolling of the sod shall be done after initial watering and after the water has sufficiently soaked into the ground so that distortion of the sod surface and excessive compaction of the sod and the soil will not occur. The roller used shall be a water filled type at least three (3) feet wide and 30 inches in diameter and shall weigh approximately 300 pounds. Roller shall be adequate to cause sod to make firm contact with the soil. A tamper, acceptable to the ENGINEER, shall be used to press the sod firmly in place in areas not accessible to a roller. After tamping or rolling, the sod shall present a smooth, even surface, free from bumps or depressions.

3. Defective Materials

Damaged, deteriorated or otherwise defective sod will be rejected by the ENGINEER. Sod will be rejected which has been permitted to dry out or become otherwise injured during transportation handling, storage or placing. Where permitted by the ENGINEER, rejected sod, if suitable, may be pulverized and used for filling, where necessary.

C. Turf Establishment

1. Watering

After laying, the sod shall be watered until saturated. Sod shall be watered whenever excessive drying is evident during the period set for establishment. Sufficient water shall be applied to wet the sod through completely and to wet at least two (2) inches of the sod bed each time watering is required. Watering shall be done in a manner that will prevent erosion due to the application quantities of water. The watering equipment shall be of a type that will prevent damage to the finished surfaces of topsoil and sod. The sod shall be watered as required until firmly knit in place and in a vigorous growing condition.

2. Mowing

The sodded areas shall be mowed a minimum of three (3) times with mowing equipment acceptable to the ENGINEER. Sod shall be mowed to a height of two (2) inches whenever the average height of the grass becomes four (4) inches. When the amount of cut grass is heavy, the cuttings shall be removed from the sodded areas to prevent destruction of the underlying turf. Where weeds or other undesirable vegetation threaten to smother the planted species, such vegetation shall be mowed or, in the case of rank growths, uprooted, raked and removed from the area. All mowed cuttings, uprooted or raked vegetation, shall be legally disposed of away from the Project Site.

3. Establishment Period

The establishment period shall extend for a period from the time of sodding until the sodded area have received final acceptance of the entire Work covered by the Contract. The minimum period shall be 30 days.

END OF SECTION

SECTION 03100
CONCRETE FORMWORK

PART I – GENERAL

1.01 SCOPE

This Section includes formwork for cast-in-place concrete, complete with furnishing, preparation, installation, coating, protection, adjustment, removal and accessories.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Section 02223: Structural Excavation and Backfill
2. Section 03200: Concrete Reinforcement
3. Section 03300: Cast-In-Place Concrete

1.03 DESIGN STANDARDS

The formwork shall be designed for the loads, lateral pressure, and allowable stresses outlined in "Recommended Practice for Concrete Formwork" ACI 347 and for design considerations, wind loads, allowable stresses and other applicable requirements of the local building code, and as indicated on the drawings. The design and construction of the formwork shall be the responsibility of the CONTRACTOR.

The formwork shall be true in every respect to produce hardened concrete to the required shape, size, grade and alignment as indicated on the Plan, and of sufficient strength, bracing and rigidity to maintain their position and shape under the loads and operations incidental to placing and curing the concrete, as well as all other forces resulting from the movement of the forms. The forms shall be mortar-tight at the time concrete is placed in them and shall be so constructed that the surfaces of the finished concrete will be reasonably free from ridges, fins, offsets, or similar defects. Adequate and suitable means for removing the forms without injury to the surfaces or edges of the finished concrete shall be provided.

1.04 ALLOWABLE TOLERANCES

Formwork shall be constructed such that the hardened surfaces shall conform to the tolerance limits of ACI 347, except as modified below:

Variation from plumb in lines and surfaces of piers, walls, or columns

In any ten (10) feet (3 m) of length: 1/4 inch (5 mm) Maximum for entire length: I-inch (25 mm)

Variation from the level or from the grades

In any ten (10) feet (3 m) of length: 1/4 inch (5 mm) Maximum for entire length: 3/4 inch (20 mm)

Variation of distance between walls, columns and beams

In any ten (10) feet (3 m) of distance: 1/4 inch (5 mm) Maximum for entire distance: I-inch (25 mm)

Variation of the linear lines from established position as indicated on the Plan

In any 20 feet (6 m) of length: 1/2 inch (10 mm) Maximum for entire length: I-inch (25 mm)

Variation in sizes and locations of sleeves, floor openings, and wall openings

Minus: 1/4 inch (5 mm) Plus: 1/2 inch (10 mm) or as required by Link Seal specifications

Variation in cross-sectional dimensions of columns and beams and thickness of slabs and walls

Minus: 1/4 inch (5 mm) Plus: 1/2 inch (10 mm)

Variations of footing dimensions from plan dimensions

Minus: 1/2 inch (10 mm) Plus: 2 inches (50 mm)

Thickness ± 5%, up to maximum of 1 inch (25 mm)

1.05 REFERENCE STANDARDS

ACI- American Concrete Institute

1.06 SUBMITTALS

Submit manufacturer's literature for form coating.

Submit formwork layout plans, design data and procedures if requested by the ENGINEER.

Submit design calculations, sealed by a registered engineer in the state of Florida when required by the Owner.

1.07 STORAGE AND HANDLING

Store and handle form coating to prevent contamination of coating in accordance with manufacturer's recommendations.

1.08 SEQUENCING

Sequence installation of formwork with the Work of Section 03200, Concrete Reinforcement and Section 03300, Cast-In-Place Concrete.

PART 2 – PRODUCTS

2.01 FORM MATERIALS

Use lumber that is straight, uniform width and thickness, free from knots, offsets, holes, dents, warpage and other surface defects.

Use plywood product of standard psi, waterproof, resin-bonded, exterior-type Douglas Fir, face adjacent to concrete shall be Grade B or better.

Metal forms to be smooth metal plate free of surface irregularities.

Chamfer Strips: Use clear white pine, surface against concrete planed, l-inch (25 mm) bevel width or can’t strip.

2.02 FORM COATING

Use non-staining form oil or other mineral oil which will neither discolor nor otherwise injuriously affect the concrete.

2.03 FORM TIES

Use permanently embedded body type with removable end cones on outer ends, permanently embedded portion 1-inch (25 mm) back from concrete face.

2.04 FORMS -GENERAL

Use forms that conform to ACI 347. Fabricate with facing materials that produce the specified tolerance requirements of Article 1.04 of this Section; produce true surfaces, sharp comers and true lines; and are free of offsets, ridges, bulging, waves and concave or convex areas.

2.05 LAYOUT

Use regular and uniform pattern; long dimension of panels vertical; joints horizontal, vertical and aligned; form ties uniformly spaced and aligned in horizontal and vertical rows.

PART 3 – EXECUTION

3.01 PREPARATION

Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. All surfaces of forms and embedded materials shall be cleaned of any mortar from previous concreting and of all other foreign material or water before coating is placed in them.

Forms shall be coated in accordance with manufacturer's recommendations before the form or reinforcement is placed in final position. Surplus coating on form surfaces, or any coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.02 INSTALLATION OF FORMS

Forms shall be sufficiently tight to prevent loss of mortar from the concrete, set true to the lines and elevations indicated on the Plans, tied and braced to remain true during and after concrete placement within tolerances of Article 1.04 of this Section. The ENGINEER may at any time condemn any section or sections of forms found deficient in any respect, and such form shall be promptly removed and replaced.

No wooden spreaders shall be allowed to remain in the concrete. No metal shall be within I-inch (25 mm) of any surface.

Place chamfer strips in forms to bevel all comers, edges, joints and other structural elements exposed to view, including use of dummy chamfer and false joints to provide neat and uniform appearance. Exposed comers and edges shall have 3/4" x 3/4" -45 degree chamfers (20 mm x 20 mm x 45 degree), unless otherwise indicated on the Plan. Exposed corners and edges shall include surfaces inside water and wastewater treatment structures.

Provide temporary openings at the base of wall forms and at the other points when necessary to facilitate cleaning and inspection immediately before depositing concrete.

Secure in position wedges used for final alignment and items to be embedded in concrete.

Forms for keyways shall be prepared in advance of pouring concrete. Keyway forms in slab edges and vertical wall joints shall be rigidly secured in place before the concrete is poured. Forms for keyways for horizontal joints in walls may be placed at the conclusion of the pour, but proper provision shall be made for obtaining and holding the full depth and form of the keyway.

3.03 ADJUSTMENT OF FORMS

Positive means of adjustment should be provided to permit realignment or readjustment of shores if excessive settlement occurs.

A pair of wedges may be used at the top or bottom of shores, but not at both ends, to facilitate vertical adjustment, to correct uneven settlements, or to facilitate dismantling of the formwork.

Screw jacks for pipe shores or scaffold-type shoring may be used at both top and bottom so long as they are secured by the shore or scaffold leg against loosening or falling out, to avoid lateral deflections.

During and after concreting, but before initial set of the concrete, the elevations, camber, and plumbness of formwork systems shall be checked, using telltale devices. Appropriate adjustments shall be promptly made where necessary. If, during construction, any weakness develops and the formwork shows any undue settlement or distortion, the Work shall be stopped, the affected construction removed if permanently damaged, and the formwork strengthened.

Forms, wedges or shoring shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all superimposed dead, temporary construction, and live loads. When forms or shoring are removed, there shall be no excessive deflection or distortion of the concrete. Forms shall be removed in an orderly fashion; with care to avoid surface gouging, comer or edge breakage, or other damage or injury to the concrete surface or physical property; and without impact or shock, to permit the concrete to carry its share of the loads gradually and uniformly. Form removal shall not impair the safety and serviceability of the structure or concrete members.

Forms and shoring in the formwork used to support the weight of concrete in beams, slabs, and other structural members shall remain in place a minimum of 14 days or until the concrete has reached a minimum of 75% of the design compressive strength. The cylinder strength shall be based on test specimens cured in the field under conditions which are not more favorable than the most unfavorable conditions for the portions of the concrete which the test specimens represent and shall be determined in accordance with Section 03300, Cast In Place Concrete.

Formwork for columns, walls and other vertical members shall remain in place a minimum of five (5) days or until the concrete has attained a minimum of 75% of its design strength. Where such formwork also supports the formwork of beams and slabs, the removal times of the latter shall govern. Face and edge forms shall be removed as soon as practicable and permitted by the ENGINEER in order to facilitate effective repair of voids or broken comers before the surface has dried.

Forms and shoring in the formwork shall not be removed without the approval of the ENGINEER. The minimum in-place times are for ordinary conditions and represent cumulative number of days, not necessarily consecutive, after the concrete was placed, during which the temperature of the air surrounding the concrete is above 50 degrees F (10° C). The times may be increased or decreased as directed by the ENGINEER, dependent on air temperatures, cement type, concrete additives or other conditions of the Work in accordance with ACI 347.

3.04 RESHORING

When removing forms before structural members are strong enough to carry dead load and/or construction loads, reshores shall be installed to assure safe distribution of loading. Reshoring operations shall be planned in advance and shall be subject to the ENGINEER's review. During reshoring, no construction loads shall be permitted on the new construction. Reshores shall be placed as soon as practicable after form removal, but in no case later than the end of the working day on which form removal occurs, and shall remain in place until the concrete has acquired the required

strength.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART I – GENERAL

1.01 SCOPE

This Section includes the furnishing, fabrication, placement and care of material used as concrete reinforcement.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Section 03100: Concrete Formwork
2. Section 03300: Cast-In-Place Concrete

1.03 REFERENCE SPECIFICATIONS

The latest or current ACI Standards and Code Requirements for "Concrete and Reinforced Concrete" shall govern all concrete Work except where otherwise specified herein. Copies of standards can be obtained from the American Concrete Institute.

1.04 TESTING AGENCY

All testing agencies shall meet the requirements of Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction, ASTM E329.

1.05 ALLOWABLE TOLERANCES

A. Fabrication

1. Sheared length: ± 1-inch (25 mm).
2. Depth of truss bars: +0, -1/2 inch (+0, -10mm).
3. Stirrups, ties, and spirals: ± 1/2 inch (± 10 mm)
4. All other bends: ± 1-inch (±25 mm).

B. Placement

1. Concrete cover to form surfaces: ± 1/4 inch (± 5 mm).
2. Minimum spacing between bars: -1/4 inch (-5 mm).

C. Top bars in slabs and beams

1. Members eight (8) inches (200 mm) deep or less: ± 1/4 inch (5 mm).
2. Members more than eight (8) inches (200 mm) but not over two (2) feet (600 mm) deep: ± 1-inch (±25 mm).
3. Members more than two (2) feet (600 mm) deep: ± 1-inch (±25 mm).
4. Crosswise of members: Spaced evenly within two (2) inches (50 mm) of stated separation.
5. Lengthwise of members: ± 2 inches (±50 mm).

D. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items:

1. l-bar diameter, with approval from the ENGINEER.

1.06 SOURCE QUALITY CONTROL

Reinforcing steel shall be subject to inspection at the source of supply, fabricator, or after delivery to the Project Site at the discretion of the ENGINEER.

The CONTRACTOR may be required to furnish additional test of reinforcing steel for each 100 tons (90 metric ton) or fraction thereof. Testing for bend, pull, elongation and weight to assure compliance with Specifications shall be in accordance with ASTM A370.

1.07 REFERENCE STANDARDS

1. ACI - American Concrete Institute
2. ASTM - American Society for Testing Materials
3. CRSI - Concrete Reinforcing Steel Institute

1.08 SUBMITTALS

The CONTRACTOR shall submit Shop Drawings indicating the size and dimensions for fabrication and placing of reinforcing steel, including bar schedules, stirrup spacing, and diameter of bend bars. Bar supports type and grade shall be indicated.

The CONTRACTOR shall submit test certificates of the manufacturer's laboratory, identifying chemical and physical analysis of each load of reinforcing steel delivered.

The CONTRACTOR shall submit test certificates of a qualified independent testing agency evaluation of the mechanical splice devices to assure compliance with ACI 318.

1.09 DELIVERY, STORAGE, AND HANDLING

Deliver reinforcement to Project site in bundles tagged and marked in accordance with "Manual of Standard Practice" of the CRSI.

Reinforcing steel shall be stored above ground on platforms or other supports, in an orderly manner to facilitate inspection and checking, and be protected from physical injuries or contamination.

1.10 SEQUENCING

The CONTRACTOR shall coordinate placement of the reinforcing in a manner which will not prevent the proper and timely completion of dependent construction phases.

PART 2 – PRODUCTS

2.01 REINFORCING BARS

All reinforcement shall be of the grade and type as specified herein unless otherwise indicated on the Plans or Shop Drawing.

A. Bars

Deformed and Plain Billet-Steel Bars: ASTM A615, Grade 60.
Rail-Steel Deformed and Plain Bars: ASTM A616, Grade 60.
Axle-Steel Deformed and Plain Bars: ASTM 617, Grade 60.

Low Alloy Steel Deformed Bars: ASTM A 706.

B. Mats

Fabricated steel bar or rod mats of the clipped type shall conform to ASTM A184.

2.02 WELDED WIRE FABRIC

Welded wire fabric shall be in flat mats only.

A. Plain

Conform to ASTM A185, 6 x 6 -w2.9 x w2.9 unless otherwise indicated on the Plans.

B. Deformed

Conform to ASTM A496, 6 x 6 -w2.9 x w2.9 unless otherwise indicated on the Plans.

2.03 TIE WIRE

A. Plain

Conform to Cold Drawn Steel Wire for Concrete Reinforcement, ASTM A82, 16-gage minimum size.

B. Deformed

Conform to Deformed Steel Wire for Concrete Reinforcement, ASTM A496, size D-4 minimum.

2.04 BAR SUPPORTS

All metal bar supports shall be fabricated from cold-drawn steel wire in accordance with current CRSI Standards.

Stainless steel supports shall be of Type 1, with stainless steel wire conforming to ASTM A493 attached to the tips of the support so the non-stainless wire will lie no closer than 1/4 inch (5 mm) from the form surface.

Plastic coated supports shall be of Type 1, with plastic coating of polyethylene conforming to ASTM Dl248 on the legs and tips.

Precast concrete brick supports shall conform to ASTM C55, Type 1, Grade N.

2.05 FABRICATION

Bars shall be bent cold to the shapes and dimensions as indicated on the Plans, or as required by the current "Manual of Standard Practice" of the CRSI. Steel shall not be bent or straightened in a manner that will injure the material. Bars with kinks or improper bends shall not be used.

The diameter of bend measured on the inside of the bar for standard hooks, other than stirrups and tie hooks, shall not be less than the values of the following table.

Minimum Diameters of Bend

Bar Size	Minimum Diameter	
#3 through #8	6 bar diameters	(#10M-#25M)
#9, #10, and #11	8 bar diameters	(#29M-#36M)
#14 and #18	10 bar diameters	(#43M -#57M)

Bends for stirrups and ties with number 5 (# 16M) bar and smaller shall not be less than four bar diameters. For bars larger than No.5 (#16M), shall be according to the "Minimum Diameter of Bend" table above.

Bends for stirrups and ties for welded wire fabric shall not be less than 4-bar diameters for deformed wire larger than D-6 and 2-bar diameters for all other wires. Bends with inside diameter of less than S-bar diameters shall not be less than 4-bar diameters from nearest welded intersection.

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

The CONTRACTOR shall examine the areas in which the reinforcing steel is to be placed to assure proper lines and levels.

3.02 PREPARATION

Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that will reduce bond with concrete or splicing method.

The ends of bars to be butt spliced shall be cut square and smooth.

3.03 INSTALLATION -GENERAL

Reinforcing shall be placed as indicated on the approved Shop Drawings, within allowable tolerances. Bar supports, as indicated on approved Shop Drawings, or in Specifications, shall be used for proper separation and support of reinforcing steel.

3.04 MINIMUM SPACING

Unless otherwise indicated on the Plans, the minimum spacing of bars shall be the following:

Footings and other principal structural members in which the concrete is deposited against the ground shall have three (3) inches (75 mm) of concrete between the bar and the ground contact surface.

Concrete surfaces which, after removal of the forms, are to be exposed to the weather or in contact with the ground or liquids shall be protected with two (2) inches (50 mm) of concrete.

The concrete protective covering for any reinforcement at surfaces not exposed directly to the ground, liquids or weather shall be 3/4 inch (20 mm) for slabs and walls and 1-1/2 inches (40 mm) for beams and girders.

Column spirals or ties shall be protected everywhere by a covering of concrete cast monolithically

with the core and shall be at least 1-1/2 inches (40 mm).

Concrete protection for reinforcement shall in all cases be at least equal to the diameter of bars, except for concrete slabs as noted above.

The minimum center to center distance between parallel bars shall be 2-1/2 times the diameter of the bars. In no case shall the clear spacing between bars be less than one inch (25 mm) nor less than 1-1/3 times the maximum size of the coarse aggregate. The maximum center to center distance in parallel bars shall be 12 inches (300 mm). Where reinforcement in beams and girders is placed in two (2) or more layers, the clear distance between layers shall be not less than 1-inch (25 mm), and the bars in the upper layers shall be placed directly above those in the bottom layer.

Welded wire fabric designated as load-carrying reinforcement shall be overlapped wherever successive mats are continuous in such a way that the overlap measured between outermost cross wires of each fabric sheet is not less than the spacing of the cross wires plus two (2) inches (50 mm). It shall be supported as required for reinforcing bars.

3.05 SPLICING

Splices shall be avoided at points of maximum stress. Splicing of bars shall be in accordance with ACI 318.

Splicing of bars shall be done by overlapping in accordance with ACI Detailing Manual SP-66, and securely laced with wire unless indicated otherwise on the Plans or approved Shop Drawing.

Lap adjoining wire mesh by no less than one (1) full mesh and lace securely with wire. Offset end laps in adjacent widths to prevent continuous splice.

Welded wire fabric reinforcement shall be overlapped wherever successive mats are continuous in such a way that the overlap measured between outermost cross wires of each fabric sheet is not less than one full mesh spacing plus two (2) inches (50 mm). The fabric shall extend across supporting beams and walls and to within four (4) inches (100 mm) of concrete edges. It may extend through contraction joints where alternate wires are field cut. It shall be adequately supported during placing of concrete to insure its proper position in the slab either by the methods of Article 3.06 of this Section or by laying the fabric on a layer of the fresh concrete of the correct depth before placing the upper layer of the slab.

Vertical bars in columns shall be offset at least I-bar diameter at lapped splices. To insure proper placement, templates shall be furnished for all column dowels.

Bars of size 14, 18 or larger (#43M #57M or larger), where size II (#36M) bars are butt spliced to larger sizes and/or when approved by the ENGINEER shall be welded in accordance with ACI 301 by full penetration butt welds. Adequate jigs and clamps or other devices shall be provided by the CONTRACTOR to support, align and hold the longitudinal centerline of the bars in a straight line.

Bars larger than size eleven (#36M) may be butt spliced by mechanical devices approved by the ENGINEER, in accordance with ACI 318. Splices shall be made using manufacturer's standard jigs, clamps, ignition devices and other required accessories to support, align and hold the longitudinal centerline of the bars in a straight line.

3.06 SECURING REINFORCEMENT

Reinforcement shall be securely laced with wire to supports or reinforcing to prevent displacement during the concrete placement, as required by the current "Manual of Standard Practice" of the CRSI.

3.07 FIELD QUALITY CONTROL

The ENGINEER shall inspect the reinforcing steel after it has been installed, and the reinforcing steel placement shall be approved by the ENGINEER prior to placement of concrete.

The CONTRACTOR shall avoid displacement of the reinforcing steel during concrete placement.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART I – GENERAL

1.01 SCOPE

This Section includes all monolithic cast-in-place concrete work complete with materials, mixes, installation and testing.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Section 03100: Concrete Formwork
2. Section 03200: Concrete Reinforcement
3. Section 03600: Mortar and Grout
4. Section 05500: Metal Fabrications

1.03 REFERENCE STANDARDS

Unless otherwise specified, the Work of this Section shall conform to the applicable portions of the following Standard Specifications:

1. ACI - American Concrete Institute
2. ASTM - American Society for Testing and Materials
3. FDOT - Florida Department of Transportation

1.04 REFERENCE SPECIFICATIONS

The latest or current ACI Standards and Code Requirements for "Design Considerations for Environmental Engineering Concrete Structures" shall govern all concrete Work except where otherwise specified herein.

1.05 TESTING AGENCY

All inspections and tests required by this Section shall be performed by organizations acceptable to the ENGINEER.

1.06 ALLOWABLE TOLERANCES

See Section 03100, Concrete Formwork, for the allowable tolerances for concrete surfaces.

1.07 DESIGN CRITERIA

Mixes shall be designed and tested for each size and gradation of aggregates and for each consistency intended for use. Design quantities and test results of each mix shall be submitted for review.

Necessary construction joints are shown on the Plans. Modification of location or placement of construction joints not indicated on the Plans shall be subject to approval of the ENGINEER.

Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs. Beams, girders, and brackets shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.

Expansion joints shall be used where two independent sections of concrete meet so as to protect the Work from thermal expansion.

Keyways shall be provided in all joints where required to provide for either shear or watertightness. Unless otherwise required, the width of keys shall be at least one-third the thickness of the section at that point and their depth at least one-third their width.

1.08 SOURCE QUALITY CONTROL

Furnish tests of cement and aggregates. Material sampling shall conform to the following ASTM Standards:

Cement C183
Aggregates D75

Testing shall be in accordance with applicable ASTM Standards to assure compliance with Specifications.

Make tests for the following quantities, or fraction thereof:

Cement	550 tons (500 metric ton)
Fine Aggregate	2,000 Tons (1800 metric ton)
Coarse Aggregate	2,000 Tons (1800 metric ton)

Use same brand cement for any given structure produced by a single mill unless otherwise provided by authorization of the ENGINEER.

1.09 SUBMITTALS

Submit Shop Drawings showing the location of joints. Included shall be a schedule of the concrete pouring. The location of joints and pouring schedule shall be subject to approval by the ENGINEER.

The CONTRACTOR shall submit test reports for cement and aggregates to assure compliance with the Specifications.

Concrete mixture designs and test data shall be submitted for review by the ENGINEER with a written request for approval. No concrete shall be placed until the CONTRACTOR has received such approval in writing.

Each mixture report shall include:

- Slump on which design is based.
- Total gallons of water per cubic yard (l/m^3).
- Brand, type, composition, and quantity of cement.
- Brand, type, composition, and quantity of pozzolan or other mineral admixtures.
- Brand, type, composition, and quantity of ground granulated blast furnace slag.
- Specific gravity and gradation of each aggregate.
- Ratio of fine to total aggregates.
- Weight (surface dry) of each aggregate, lbs./c.y. (kg/m^3).
- Brand, type, ASTM designation, active chemical ingredients, and quantity of each admixture.

- Air content.
- Compressive strength based on 7-day and 28-day compression tests.
- Time of initial set.

Submit manufacturer's literature of abrasive wear resistant floor finish and of chemical curing compound for review by the ENGINEER.
Submit a sample concrete delivery ticket for review by the ENGINEER.

Submit tickets collected at the site of concrete placement accompanying each load of concrete. A printout system for producing these tickets in connection with automatic batching will be permitted.

Each ticket shall be serially numbered, show the charging time, quantity and grade of concrete, location of delivery and the signatures of inspectors at the plant and site. Transit mixed concrete tickets shall also include revolution counter reading at charging and mixing completion.

Submit reports of the sampling and testing of slump, air content and strength performed.

Submit reports of nondestructive, core and/or liquid retention testing required for acceptance of concrete in place.

1.10 MATERIAL STORAGE AND HANDLING

Materials shall be stored and handled in accordance with ACI 304 and as specified below.

When permission is given to store cement in the open, a floor at least six (6) inches (150 mm) above the ground and a waterproof covering shall be provided and so placed as to insure runoff in case of rain.

Cement sacks shall be thoroughly shaken when emptying sacks into the batch. Cement salvaged by the CONTRACTOR by cleaning sacks mechanically or otherwise, or from discarded sacks of cement, shall not be used in the Work. The use of a fractional sack of cement will not be permitted unless the fractional part is measured by weight. At the time of its use in the Work, the cement shall be free from lumps.

No aggregates which have become intermixed prior to proportioning shall be used. Sufficient aggregate shall be available at the site to preclude the possibility of damaging delays while placing the concrete.

Cars used for shipping aggregates shall be clean and in good repair. The use of straw, marsh, hay or other similar materials for closing cracks or holes in cars will not be tolerated.

Pozzolans and other cementitious materials shall be stored and handled in the manner of cement.

Store and handle curing compound in a manner to prevent contamination.

1.11 ENVIRONMENTAL REQUIREMENTS

Environmental requirements shall be in accordance with ACI 305 for hot weather concreting, and ACI 306 for cold weather concreting. Specific temperature requirements are contained in Article 2.10 of this Section for mixing and Article 3.13 of this Section for placing.

PART 2 – PRODUCTS

2.01 MATERIALS - GENERAL

The materials shall meet the requirements of ACI 301, and ACI 318, ACI 350 and FDOT Specification, Division III.

Concrete materials shall be tested and inspected as the Work progresses. The review and/or check-test of the proposed materials, securing of production samples of materials at plant stockpiles and/or review of the manufacturer's reports for compliance will be performed at no cost to the CONTRACTOR.

Testing and inspection required due to substitution or change of materials requested by the CONTRACTOR shall be at the CONTRACTOR's expense.

2.02 CEMENT

Cement shall be the type as indicated on the Plans or as specified.

- Type II conforming to ASTM C150, for general use, when moderate sulfate resistance is desired.
- Type III and IIIA, conforming to ASTM C150, air-entraining Portland cement for use when high-early strength is specified.
- Type IS and IS-A, conforming to ASTM C595, air-entraining Portland blast-furnace slag cement for use in general concrete construction.
- Type V, for use when high sulfate resistance is desired.

2.03 AGGREGATES

Washing will be required to eliminate the dust, clay, or silt coating. Aggregates which have been washed shall not be used sooner than 24 hours after washing, unless approved by the ENGINEER.

Coarse aggregate shall be gravel or crushed rock, conforming to ASTM C33.

Gravel shall consist of hard, clean, durable particles of rock or pebbles and shall be free from lumps of clay.

Crushed rock shall consist of angular fragments of crushed hard heads or boulders or crushed igneous rock free from weathered rock and of uniform quality.

All sieve and screen analyses determination of clay, silt, and dust content and percentages of objectionable particles will be based on dry weights and conform to FDOT Specifications Section 901, Table 1, Standard sizes of coarse aggregate and shall conform to the physical requirements specified in FDOT, Section 901.

Fine aggregate shall be natural sand, manufactured sand or a combination thereof conforming to ASTM C33.

Fine aggregates shall conform to FDOT Specifications Section 902-2 and to the grading requirements stated therein.

2.04 ADMIXTURES

Admixtures shall be used to achieve concrete as indicated on the Plans or specified herein. Calcium chloride shall not be used.

- Air-entraining, conforming to ASTM C260.
- Pozzolan and Fly Ash, conforming to ASTM C618, Class C.

- Water reducing, conforming to ASTM C494.
- Retarder, conforming to ASTM C494.
- Plasticizer, conforming to ASTM C494.
- Ground granulated blast furnace slag conforming to ASTM C989.

Abrasive wear resistant floor finish shall be packaged, dry combination of Portland cement, graded Quartz aggregate and dispersing agents formulated to produce an abrasive and wear resistant monolithic surface.

2.05 JOINT FILLER

See Section 03600, Mortar and Grout.

2.06 WATER

Water shall be free from oil, acid, alkali, organic matter, and any other deleterious substances. Water approved by the Local Board of Health may be used without testing. Water from other sources shall be tested before using.

2.07 CURING COMPOUND

Shall be adequate to prevent checking, cracking and loss of moisture, conforming to ASTM C309.

2.08 MIXES

Concrete shall consist of a mixture of air-entraining Portland cement, coarse and fine aggregate, and water with admixtures if required. Admixtures shall not be used without the ENGINEER's review. The mixture, combined in proportions, shall meet the requirements of FDOT, Specification Section 345, and ACI 211.1.

Concrete shall be classified and proportioned on the basis of minimum compressive strength at 28 days when cured in a moist room at a temperature within the range of 65 degrees to 75 degrees F. The desired strength of the concrete shall be shown on either the Plans or in the Specifications.

Table 1 shows for each grade of concrete the minimum compressive strength, cement content, and the modulus of rupture. Concrete shall be 5,000 psi, Grade 5.0, unless otherwise shown on the plans.

Aggregates shall be proportioned by weight, except for small structures and for incidental Work requiring less than ten (10) cubic yards (7 m^3) of concrete, in which case they may be proportioned by volume when approved by the ENGINEER.

Cement in bulk, when permitted, shall be proportioned by weight.

When proportioned by volume, the amount of each aggregate required for a single batch shall be measured separately and accurately. Shovel methods of measuring will not be permitted. The unit of volumetric measurement shall be one (1) cubic foot or one (1) cubic meter.

When proportioned by weight, the amount of each aggregate required for a single batch shall be weighed in a separate container. The equipment for weighing shall be of an approved type, and of such accuracy that there shall not be an error of more than one (1) percent in any one (1) batch.

2.09 BATCHING ADMIXTURES

The batching of admixtures to achieve and maintain production of the mix design of concrete shall be in accordance with ACI 212.

If the air content is found to be less or greater than the specified amount, the CONTRACTOR shall immediately discontinue Work and correct the air content.

Decreasing the air content may be accomplished by blending air-entraining Portland cement with Portland cement, manufactured at the same mill, in a ratio which will reduce the air content to a value within the specified limits, this blending shall be reviewed by the ENGINEER.

Increasing the air content may be accomplished by adding to each batch a sufficient amount of air-entraining admixture to bring the air content up to the designed amount.

Pozzolan shall be proportioned based on the mix design approved by the ENGINEER per Article 1.09 of this Section to produce watertight concrete. Additive content shall not exceed 25% for pozzolans of the cement content by weight.

Mineral admixtures shall be proportioned based on the mix design approved by the ENGINEER per Article 1.09 of this Section to produce watertight concrete. Additive content of Ground Granulated Blast Furnace Slag (GGBFS) shall not be less than 25% and shall not exceed 50% of the cementitious material content by weight.

Water Reducer can be used to reduce the water requirement of concrete to obtain consistency of slump, modify workability, increase strength or any other approved use.

2.10 TEMPERATURE LIMITS OF MIXTURE

The temperature of the cement, at the time of delivery to the mixer, shall not exceed 165 degrees F (74°C). It may be required that it be stored at the CONTRACTOR's expense until cooled to that temperature.

The temperature limits of aggregates and water entering the mixer shall be as follows:

LIMITS OF TEMPERATURES

	Minimum	Maximum
Water	75°F (24°C)	140°F (60°C)
Fine Aggregate	65°F (18 °C)	140°F (60°C)
Coarse Aggregate	65°F (18°C)	110°F (43°C)
Concrete (resulting)	60°F (15°C)	90°F (32°C)

2.11 MIXERS AND MIXING

Concrete mixing operations shall be in accordance with ACI 304 and FDOT, Specification Section 345 and shall be subject to random inspection during the progress of the Work at no charge to the CONTRACTOR.

A. Central Mixed Concrete

Mixers shall be capable of quickly and completely discharging without segregation or loss. The efficiency of the mixers shall be maintained at all times through repair or replacement of worn parts when necessary. They shall be provided with readily adjustable, automatic devices which will measure the cement and water within one (1) percent and admixtures within three (3) percent. The drum of the mixer shall be kept free from hardened concrete and shall be completely emptied before recharging. Retempering or remixing concrete that has partially set will not be permitted. The mixer shall be cleaned thoroughly each time when

out of operation for more than 1/2 hour.

Recommended mixing time is a minimum time of one (1) minute for one (1) cubic yard (or cubic meter), with an additional 15 seconds for each additional cubic yard (or cubic meter).

The concrete shall be delivered to the site in clean, tight truck bodies designed for this purpose and painted with paraffin if necessary for easy dumping. The concrete at the point of delivery shall have the proper consistency and shall be free from segregation. Mechanical agitators in the truck bodies will be required if the period of time from the mixing plant to the point of dumping exceeds 30 minutes.

No concrete shall be dumped if the elapsed time from the mixing plant to the point of dumping exceeds 60 minutes.

B. Transit Mixed Concrete

Transit-mix concrete shall be in accordance with ASTM C94. If transit-mix concrete is used, it shall meet all the foregoing requirements specified for central mixed concrete and, in addition, the following:

The batched materials shall be properly proportioned and in a dry state. The proper amount of water shall be added to the mixer on the trucks, and no additional water shall be added. No admixtures or accelerators shall be added except as herein noted, without the approval of the ENGINEER. Trucks shall not be loaded beyond their rated capacity and shall have mixing drums cleaned of all set-up materials at frequent intervals while in use. Trucks with leaking water valves shall not be used.

Recommended mixing speed should be no less than 12 revolutions per minute, with a minimum of 90 revolutions or until the mix is satisfactory.

Mixing shall be continuous after water is added to the mix in the drum, but no concrete shall be placed in the forms more than 90 minutes after water is added to the mix.

Truck-mixed concrete shall be delivered to the site of the Work and discharged from the mixer within the maximum period of 1-1/2 hours from the first introduction of water to the mix. Any concrete which remains in the mixer after this period and any concrete which appears too stiff to be properly workable or which appears to have begun to take its initial set shall be rejected and removed from the site of the Work.

The OWNER may employ an independent testing laboratory to provide a qualified inspector to be present at the plant where batching of concrete occurs. The inspector shall verify the compliance of the mix with the Specifications and shall sign a form indicating the quantity of concrete and the concrete mixture of each load.

2.12 CHANGE OF MIXTURE

If the CONTRACTOR requests a change or substitution of approved batch proportioning, mixing, or delivery operations additional testing and/or inspection shall be at the CONTRACTOR's expense.

2.13 ACCEPTABLE MANUFACTURERS

Acceptable manufacturers of abrasive wear resistant floor finish include: Master Builders Company "Mastercon Aggregate," Sonneborn Building Products "Harcol," or equal.

PART 3 – EXECUTION

3.01 VERIFICATION OF FORMWORK, REINFORCING, AND SUBGRADES

The CONTRACTOR shall inspect formwork, reinforcement and subgrades to confirm compliance with the related Work specified elsewhere.

3.02 EMBEDDED ITEMS

The CONTRACTOR shall verify the location, from certified vendor or applicable engineering drawings, of all embedded items including anchor bolts, wall sleeves, wall casting, railing post sleeves and miscellaneous pipes and conduits and shall install the items accurately at the locations determined.

3.03 BUILDING IN OTHER WORK

The CONTRACTOR shall make all necessary provisions in concrete Work for other Work installed by this or other contractors, and build in all required steel beams, frames, curbs, expansion joints, inserts, hangers, pipes, floor drains, pipe trench covers and frames, anchors, sleeves, floor ducts, fiber and steel conduit, pipe hanger sockets, and all other Work furnished by either this or other contractors.

The CONTRACTOR shall build in all anchors, ties, etc., specified under brick and other Work, in faces of concrete Work which are to be faced with masonry, and any other Work shown or noted to be built into concrete. In addition, the CONTRACTOR shall provide all openings and holes in concrete Work as shown or as needed to accommodate other Work.

3.04 SPECIAL CONCRETE

The CONTRACTOR shall verify the use and/or locations of watertight concrete and/or high-early strength concrete.

3.05 PREPARATION

The CONTRACTOR shall notify the ENGINEER two (2) working days prior to placement of concrete.

Before depositing new concrete on or against existing concrete the existing concrete shall be roughened, thoroughly cleaned of foreign matter and laitance and saturated with water. The cleaned and saturated surface of the hardened concrete, including vertical and inclined surfaces, shall be coated with a bonding agent or slushed with a minimum 2-inch (50 mm) thick coating of concrete without coarse aggregate grout against which the new concrete shall be placed before the mixture has attained its initial set.

Before concrete is placed in any unit, the forms and the placing and fixing of all steel and incidental items shall be complete, and the forms, steel and adjacent concrete shall be thoroughly cleaned and wetted down.

Where indicated on the Plans, the CONTRACTOR shall bridge the subgrade with at least 2,000 psi (13.8 MPa), 3-inch (75 mm) thick lean concrete before placing the reinforcement. This shall be at no extra cost.

No concrete shall be deposited in any unit until the area has been completely dewatered in accordance with Section 02140, Dewatering, and not until after the CONTRACTOR has made satisfactory provisions to eliminate all possibility of water entering or flowing through the concrete while it is being poured or is taking its set. No concrete shall be placed under or on water.

3.06 CONVEYING

The concrete handling equipment shall be of such a nature and shall be so located that the concrete after leaving the mixer will reach its destination with a minimum lapse of time, with no segregation, and loss of slump. The use of drop chutes, except at or in the forms, is prohibited.

The interior hopper slope of concrete buckets shall be not less than 60 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least five (5) times the nominal maximum size aggregate and the area of the gate opening shall be not less than two (2) square feet (0.2 m^2). The maximum dimension shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically or hydraulically operated except for buckets larger than two (2) cubic yards (1.5 m^3) shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means for preventing segregation of the concrete at the transfer points and the point of placing.

Concrete may be conveyed by positive displacement pump when authorized by the ENGINEER. The pumping equipment shall be piston or squeeze pressure type. The pipeline shall be rigid steel pipe or heavy duty flexible rubber hose. The inside diameter of the pipe shall be at least three (3) times the nominal maximum size coarse aggregate in the concrete mixture to be pumped. The maximum size coarse aggregate shall not be reduced to accommodate the pumps.

The distance to be pumped shall not exceed limits recommended by the pump manufacturer. The concrete shall be supplied to the pump continuously. When pumping is completed, concrete remaining in the pipeline shall be ejected without contamination of concrete in place. After each operation, equipment shall be thoroughly cleaned, and flushing water shall be wasted outside of the forms.

3.07 PLACING

All concrete shall be so deposited as to maintain the top surface level, unless otherwise shown on the Plans, and also as to avoid any appreciable flow in the mass.

Where placing operations involve dropping the concrete more than three (3) feet (1 m) in the forms, it shall be deposited through sheet metal or other approved spouts or pipes. These spouts or pipes shall have suitable receiving hoppers at the upper ends, and the lower ends shall be kept within six (6) inches (150 mm) of the newly placed concrete so as to prevent segregation and avoid spattering the reinforcing steel with mortar. Under no circumstances shall concrete that has partly hardened be deposited in the Work.

Each layer of concrete shall be plastic when covered with the following layer and the forms shall be filled at a rate of vertical rise of not less than two (2) feet (600 mm) per hour. Concrete vibrators shall penetrate the initial layer when placing the following layer. Vertical construction joints shall be provided as necessary to comply with these requirements.

Concrete shall be placed and compacted in wall or column forms before any reinforcing steel is placed in the system to be supported by such walls or columns. The portion of any wall or column placed monolithically with a floor or roof slab shall not exceed six (6) feet (1.8 m) of vertical height. Concrete in walls or columns shall set at least two (2) hours before concrete is placed in the structural systems to be supported by such walls or columns.

Concrete shall be set when top finished. All laitance, debris, and surplus water shall be removed from concrete surfaces at tops of forms by screeding, scraping, or other effective means. Wherever the top of a wall will be exposed to weathering, the forms shall be overfilled and after the concrete has settled, the excess shall be screeded off.

No concrete shall be placed in contact with frozen ground. Time between charging and placement of concrete shall not exceed 1-1/2 hours.

Concrete shall be compacted by continuous vibrating, tamping, spading or slicing. Care shall be taken to eliminate all voids and to provide full bond on reinforcing steel and embedded fixtures. Mechanical vibration shall be employed. Concrete shall be compacted and thoroughly worked with suitable tools combined with the use of vibrators applied internally and providing a frequency not less than 7,000 revolutions per minute. All such vibrating, including the methods and equipment, shall be subject to the review of the ENGINEER.

The time of vibrating in any area shall only be sufficient to get efficient compaction, but shall in no case be carried to the point where there is segregation of the fine and coarse materials of the mix. There shall be an absolute minimum of direct vibration of the steel or forms during the process of vibrating. Vibrators shall be inserted and withdrawn from the concrete at numerous locations, from 18 to 30 inches (450 to 750 mm) apart, but shall not be used to transport concrete within the forms. The CONTRACTOR shall have a stand by vibrator on the job site during all concrete pouring operations.

3.08 FINISHING UNFORMED SURFACES

The unformed surfaces of all concrete shall be screeded and given an initial float finish followed by steel troweling.

Screeding shall provide a concrete surface conforming to the proper elevation and contour with all aggregates completely embedded in mortar. All screeded surfaces shall be free of surface irregularities with a height or depth in excess of 1/4 inch (5 mm) as measured from a 10-foot (3 m) straightedge.

Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance with no unnecessary working of the surface. Floating shall be performed with hand floats or suitable mechanical compactor floats.

Troweling shall be performed after the second floating when the surface has hardened sufficiently to prevent an excess of fines being drawn to the surface. Troweling shall produce a dense, smooth, uniform surface free from blemishes and trowel marks. The top surface of driveways, and sidewalks shall be given a broomed finish after troweling.

Unless specified to be beveled, exposed edges of floated or troweled surfaces shall be edged with a tool having 1/4 inch (5 mm) corner radius.

3.09 FINISHING FORMED SURFACES

After removal of forms, the finishing of all concrete surfaces shall be started as soon as its condition will permit. Grind all seams, fins or projections flush with the concrete surface. Fill and point all honeycomb, tie holes and voids. Dampen the surface with water and apply a cement and silica sand slurry to the entire surface to fill small defects and air voids. Remove excess slurry from concrete. Surfaces to be finished shall receive an application of dry Portland cement which shall be rubbed into

the slightly dampened surface with a suitable cloth.

After pointing and removal of projections as specified herein, exposed surfaces of concrete, including walls, columns, beams, pilasters and the undersides of slabs, shall be given a rubbed surface finish.

3.10 FLOORS

Concrete floor finish shall be applied to all building floors not receiving further floor finish. At these locations, the concrete shall be brought to the proper elevation and screeded. The surface shall be given two (2) steel trowelings when the concrete has set sufficiently to finish smoothly. Floors shall be sloped uniformly toward floor drains at a slope of 1/8 inch per foot (10 mm per meter).

The concrete finish on steps and loading platforms shall be wood troweled to true and uniform surface and then steel troweled. The surface shall then be slightly roughened with a broom or by dragging burlap across the surface.

Concrete floors shall be finished with an abrasive resistant floor finish in the areas noted on the finish schedule on the Plans. Premixed floor hardener shall be applied to the surface of the freshly floated concrete floor, in strict accordance with the manufacturer's directions. Color to be selected by the OWNER.

3.11 EXPANSION JOINTS

Comply with the requirements of Section 03250, Concrete Accessories. Expansion joints shall have removable polystyrene joint caps secured to the top thereof and shall be accurately positioned and secured against displacement to clean, smooth concrete surfaces. The joint caps shall be of the size required to install filler strips at the desired level below the finished concrete surface and to form the groove for the joint sealant to the size shown on the Plans. The joint caps shall not be removed until after the concrete curing period.

3.12 CONCRETE CURING

All concrete shall be cured for a period not less than seven (7) consecutive days. The CONTRACTOR shall have adequate equipment and curing material on the job site before concrete placement begins, and it shall be adequate to prevent checking and cracking and loss of moisture from all the surfaces of the concrete. The concrete shall be protected from rain, flowing water, wind and the direct rays of the sun. Openings in concrete shall be sealed to prevent drying of the concrete during the curing period.

Curing compounds shall not be used on surfaces to which additional concrete or other material are to be bonded.

Curing compounds when used shall be applied in strict accordance with the manufacturer's recommendations.

Concrete cured with water shall be kept wet by covering with ponded water or fog spraying to keep all surfaces continuously wet.

Horizontal construction joints and finished surfaces cured with sand shall be covered a minimum thickness of 1-inch (25 mm), uniformly, and kept saturated during the curing period.

Burlap used for curing shall be treated to resist rot and fire and free of sizing or any substances that are injurious to Portland cement or cause discoloration. Strips shall be lapped by half widths. The burlap shall be saturated with water after placement and during the curing period.

Straw or hay shall be in a layer no less than six (6) inches (150 mm) thick and held in place by screens, wire or other means to prevent dispersion by the wind. Care shall be observed to avoid discoloration of the concrete surface from the vegetable fibers and for the flammability of the material. The straw shall be saturated with water after placement and during the curing period.

3.13 ENVIRONMENTAL CONDITIONS

The CONTRACTOR shall provide cold or hot weather protection in accordance with ACI and as specified herein. There shall be no additional cost for hot or cold weather protection of the concrete.

A. Cold Weather Protection

When placing concrete in cold weather, the CONTRACTOR shall plan and prosecute his Work in a manner which shall assure results free from damage through freezing, contraction, and loss of concrete strength.

No concrete shall be poured when the surrounding temperature is below 40 degrees F (4° C), unless the aggregates and water are properly heated. Concrete which has been poured at higher temperatures but has not attained a strength equal to 75% of the required strength of the class of concrete involved, shall be housed and protected in accordance with the provisions of this Section whenever the surrounding temperature falls below 40 degrees F (4° C).

Application of heat to the materials shall be made in a manner which will keep these materials clean and free from injurious substances.

Aggregates may be heated only by steam coils or steam jets, except in the case of small quantities of concrete when other methods may be approved by the ENGINEER. A sufficient quantity of properly heated aggregates shall be on hand prior to starting the pouring of any unit.

Concrete shall be properly housed with canvas, burlap, or other windproof material in such a manner that any necessary removal of the forms or finishing of the concrete can proceed without undue damage to the concrete from the elements. Heating of the housing shall be done in a manner which will maintain a temperature between 50 degrees F and 70 degrees F (10° and 20° C), at all times for at least five (5) days after the pour is complete and 12 hours before the pour begins. All supplemental heating units shall have exhaust vented to the exterior and shall not cause deleterious reactions or deposits to occur to concrete.

B. Hot Weather Protection

Concrete deposited in hot weather shall not have a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Concrete temperature shall be less than 90 degrees F (32° C).

In hot weather, suitable precautions shall be taken to avoid drying of the concrete prior to finishing operations. Use of windbreaks, sunshades, fog sprays, or other devices shall be provided.

3.14 ADDITION OF WATER

To increase workability, adding water to the mix shall be limited to a one time addition of one (1) gallon of water per cubic yard of concrete (5 liters per cubic meter) and mixed with a minimum of 30 revolutions at a rate of 12 to 15 revolutions per minute. Addition of water shall be within the slump requirements.

3.15 CONCRETE DELIVERY TICKET

A ticket system shall be used for recording the transportation of concrete from the batching plant to point of delivery. This ticket shall be issued to the truck operator at the point of loading and given to the ENGINEER upon delivery. The ticket shall as a minimum indicate the time of mixer charging, quantity of concrete, type of mixture including amount of cement, and the plant where the concrete was batched.

3.16 CONCRETE DELIVERY REJECTION

Concrete not permitted for inclusion in the Work by the ENGINEER shall be removed from the site. Rejection of concrete will be determined through concrete testing and elapsed time from mixer charging to delivery.

3.17 CONCRETE TESTING AT PLACEMENT

Tests shall be made of fresh concrete for each 50 cubic yards (40 m^3), or whenever consistency appears to vary. The sampling and testing of slump, air content and strength will be performed at no cost to the CONTRACTOR.

Composite samples shall be secured in accordance with the Method of Sampling Fresh Concrete, ASTM C172.

A. SLUMP TEST

Slump Test shall be in accordance with ASTM C143. The CONTRACTOR shall use the least slump possible consistent with workability for proper placing of the various classifications of concrete.

A tolerance of up to 1-inch (25 mm) above the indicated maximum slump shall be allowed for individual batches provided the average for all batches or the most recent ten (10) batches tested, whichever is fewer, does not exceed the maximum limit.

B. AIR CONTENT

Air content of normal weight concrete will be determined in accordance with Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method, ASTM C231.

C. COMPRESSIVE STRENGTH

A set of cylinders for compressive strength tests will consist of four cylinders per each set.

Molding and curing specimens from each set shall be in accordance with Method of Making and Curing Concrete Test Specimens in the Field, ASTM C31. Any deviations from the requirements of this Standard shall be recorded in the test report.

Testing specimens will be in accordance with Method of Test for Compressive Strength of Cylindrical Concrete Specimens, ASTM C39. One (1) specimen shall be tested at seven (7) days for information and two (2) shall be tested at 28 days for acceptance. The acceptance test results shall be the average of the strengths of the two (2) specimens tested at 28 days. If one (1) specimen in a test manifests evidence of improper sampling, molding or testing, it shall be discarded and the strength of the remaining cylinder shall be considered the test result.

The strength level of the concrete will be considered satisfactory so long as the averages of all 28 day strength test results equal or exceed the specified 28-day strength and no individual strength test result falls below the specified 28-day strength by more than 500 psi (3.4 MPa).

If the strength test is not acceptable, further testing shall be performed to qualify the concrete.

The temperature of concrete sample will be determined for each strength test.

3.18 TESTING OF CONCRETE IN PLACE

Additional testing of materials or concrete occasioned by their failure by test or inspection to meet specification requirements shall be at the expense of the CONTRACTOR.

Testing by impact hammer, sonoscope, or other nondestructive device may be permitted by the ENGINEER to determine relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, shall not be used as a basis for acceptance or rejection.

When required by the ENGINEER, cores at least two (2) inches (50 mm) in diameter shall be obtained and tested in accordance with Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete, ASTM C42. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60 degrees to 80 degrees F (15° - 25° C), relative humidity less than 60%) for seven (7) days before test and shall be tested dry. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C42.

At least three (3) representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores shall be determined by the ENGINEER so as to least impair the strength of the structure. If, before testing, one or more of the cores shows evidence of having been damaged subsequent to or during removal from the structure, it shall be replaced.

Concrete in the area represented by a core test will be considered adequate if the average strength of the cores is equal to at least 85% of and if no single core is less than 75% of the specified 28-day strength.

Core holes shall be filled by low slump concrete or mortar.

3.19 RETENTION TESTING

Tanks or structures designed to hold or retain water, wastewater or other liquids shall be retention tested. To test a tank or structure for leakage, the CONTRACTOR shall clean, disinfect (if required) and fill the tank or structure with water to its maximum level. The water shall be allowed to remain 24 hours with all associated valves and appurtenances tightly closed. During this 24-hour period, the water level as measured by a hook gage shall show no measurable loss. If this test fails, the CONTRACTOR shall dewater the tank or structure, make such repairs as necessary to achieve a watertight tank or structure, clean, disinfect (if required), and retest. Any visible cracks, cold joints or construction joints that show signs of seepage or flowing water shall be repaired by the CONTRACTOR at no additional cost to the OWNER. Tests and repairs shall be repeated until the tank or structure is accepted by the ENGINEER.

3.20 DEFECTIVE CONCRETE

If, in the opinion of the ENGINEER, the defects in the concrete are of such a nature as to warrant condemnation, that portion of the pour may be ordered replaced in its entirety and the CONTRACTOR shall promptly replace same without additional compensation.

Defective concrete shall be repaired by cutting out the defective area and placing new concrete which shall be formed with keys, dovetails or anchors to attach it securely in place.

Table 1 - Concrete Mixtures

Concrete Grade	Fine Aggregate	Coarse Aggregate	Min Cement Content *				Minimum Compressive Strength At 28 Days (PSI/MPa)	Minimum Modulus of Rupture At 28 Days (PSI/MPa)	Air Content (% by vol)	Slump at point of placement (inches) **	Water/Cement Ratio (by weight, max)
			Type of Cement	Lbs. per C.Y.	Sacks per C.Y.	Kg per m^3					
5.0	2NS	6AA	II V	705	7.5	416	5,000/35.0	750 / 5.3	4-6	2-4	0.44
4	2NS	6AA or 17A	I, IA, IS, IS-A	611	6.5	362	4,000/28.0	700 / 4.8	4-6	2-4	0.44
3.5	2NS	6AA or 17A	IS, IS-A, IP, IP-A	564	6	335	3,500/24.0	650 / 4.5	4-6	2-4	0.44
3	2NS	6AA or 17A	IS, IA	517	5.5	305	3,000/20.0	600 / 4.1	4-6	3-5	0.58
CLSM	2NS	NA	I, IA, IS, IS-A	38-282	0.4-3	22-166	50-100/.34-0.67	NA	NA	NA	0.40-0.75

* For concrete with fly ash or GGBFS, values are total of cement plus pozzolan or GGBFS (except CLSM).

** For concrete containing HRWR admixture, slump shall not exceed 8 inches after addition of HRWR to verified 2-4 inches slump

*** concrete.

Where fibrous concrete is required, provide 1.5% -3%=1.5-4.5 pounds per cubic yard. Add per manufacturer's recommendations.

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END OF SECTION

SECTION 03600
MORTAR AND GROUT

PART I – GENERAL

1.01 SCOPE

This Section includes the preparation and installation of mortar and grout used for bond or primer coats, laying and grouting masonry units, filling the inside annular space of pipe joints, general patching, grout for riprap and flagstone slope protection, joints in precast structural members, spaces under leveling plates and equipment bases, supporting structures, grouting dowels and anchor bolts.

1.02 DEFINITIONS

Mortar is a plastic mixture of cementitious materials, admixtures where specified, fine aggregate and water. Grout is a mixture of sand, water, and fine aggregate mixed to like-fluid consistency.

1.03 REFERENCE STANDARDS

1. ACI - American Concrete Institute
2. ANSI- American National Standards Institute
3. ASTM - American Society for Testing and Materials
4. FDOT- Florida Department of Transportation Standard Specifications for Construction

1.04 REFERENCE SPECIFICATIONS

The latest or current ACI Standards, and the "Specifications for Masonry Structures," ACI-530.1, shall govern all mortar and grout work except where otherwise specified herein.

1.05 SUBMITTALS

Manufacturer's literature shall be submitted for premixed materials.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Materials shall be stored and handled as recommended in ACI 304.

B. When cement is stored in the open, a floor at least six (6) inches (150 mm) above the ground and a waterproof covering shall be provided and so placed as to insure runoff in case of rain. At the time of its use the cement shall be free from lumps. Cement sacks shall be thoroughly shaken when emptying sacks into the batch. Cement salvaged by the CONTRACTOR by cleaning sacks mechanically or otherwise, or from discarded sacks of cement shall not be used.

C. The aggregates are to be furnished, stocked and handled so that uniformity of grading will be obtained at the time of batching. The area on which stockpiles are to be built shall be thoroughly cleaned of all foreign materials and shall be firm, reasonably level, and well drained. No aggregates which have become intermixed prior to proportioning shall be used.

D. The premixed mortar or grout shall be stored and handled in strict accordance with the manufacturer's recommendations.

1.07 JOB CONDITIONS

Environmental requirements relative to temperature for mixing and placing mortar or grout shall be in accordance with Articles 2.08 and 3.08 of this Section.

PART 2 – PRODUCTS

2.01 PREMIXED MORTAR OR GROUT

Premixed mortar or grout shall be a complete packaged mixture to which water is to be added at the job site. Mortar and grout shall be nonshrink, nonstaining.

2.02 CEMENT

The type of cement to be used shall be as indicated on the Plans or as specified below:

Portland cement: Types I, IA or III: ASTM C150.

Masonry cement: Type N, S, or M: ASTMC91

Mortar: Type M or S: ASTM C270.

Hydrated lime: Type S: ASTM C207

2.03 AGGREGATE

Fine aggregate: Silica sand FDOT 902.

2.04 ADMIXTURES

Integral waterproofing compounds, accelerators, retarders or other admixtures not definitely mentioned in the Specifications shall not be used in mortar or grout without the approval of the DESIGN PROFESSIONAL. Use no admixtures containing calcium chloride.

2.05 WATER

Water shall be free from oil, acid, alkali, organic matter, and any other deleterious substances. Water approved by the State Board of Health may be used without testing. Water from other sources shall be tested before using.

2.06 MIXES

Water shall be added to premixed mortar or grout in strict accordance with manufacturer's recommendations to prepare a stiff or plastic mix, depending on workability needed for application.

For job mixed mortar or grout, a mixture of cement, aggregate, water and admixtures, if required, shall be combined in proportions meeting the requirements of FDOT 425 to produce mortar or grout for the use indicated on the Plans and as specified herein.

For job mixed mortar and grout the cement and aggregate shall be proportioned by weight for cubic yard (or cubic meter) batches or by volume for small batches. Shovel method of volume measuring will not be permitted. When materials are measured by volume, water shall be added in amounts necessary for the consistency required for the Work.

2.07 MIXING

The minimum mixing time shall be five (5) minutes. The consistency of mortar shall be adjusted to provide the best workability. If the mortar begins to stiffen from evaporation or absorption of a part of the mixing water, the mortar shall be re-tempered by adding water and remixing. The consistency of the grout shall be such that at the time of placement, it will completely fill all spaces intended to receive grout.

The mixing of water with prepackaged mortar or grout shall be in strict accordance with the manufacturer’s recommendations.

2.08 MIX TEMPERATURE

The temperature of the mix shall be between 40 degrees F and 120 degrees F (4º to 49º C).

2.09 ACCEPTABLE MANUFACTURERS

Acceptable manufacturers of premixed, nonshrink, nonmetallic grout include: Sonneborn "Sonogrout"; L and M Construction Chemicals "Duragrout"; Master Builders "Masterflow 713"; Five Star Products "Five Star Grout", or equal.

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

The CONTRACTOR shall verify the elevation of structural member or equipment bases to be grouted, and/or location of anchoring devices as indicated on the Plans or approved Shop Drawings.

3.02 PREPARATION

A. Surfaces to receive mortar or grout shall be prepared as follows, unless otherwise specified:

1. Remove laitance down to sound concrete.

2. Surface shall be properly wet cured, being free of chemical curing compound, oil, grease, dirt and loose particles.

3. Clean bolt and/or tie holes, anchor bolts and underside of bearing plates.

4. Saturate concrete including holes prior to grouting.

When a premixed mortar or grout is used, preparation of surfaces shall be in strict accordance with manufacturer's recommendations.

3.03 INSTALLATION – GENERAL

All mortar and grout shall be used within 2-1/2 hours of initial mixing. No mortar or grout shall be used after it has begun to set.

Premixed mortar or grout shall be used in strict accordance with the manufacturer's recommendations.

3.04 INSTALLATION OF MASONRY UNITS

Mortar joints to bond brick or block shall be no less than 3/8 inch (9 mm) and no greater than 1/2 inch (10 mm) thick. The surface of the joint shall be struck to be flush with the masonry units.

3.05 SURFACE FINISHING APPLICATIONS

Nonshrink mortar shall be thoroughly compacted into all voids, holes, honeycombs, or other defects in the finish surface of concrete. The mortar shall be flush with the surrounding concrete and matching in color and texture.

3.06 GROUTING ANCHORING DEVICES

Nonshrink, nonstaining mortar or grout shall be placed in the hole provided, then the anchoring device or dowel shall be set into the grout filled hole. The surface shall be flush with the surrounding concrete. No pressures or loads shall be applied to the anchoring device until the mortar or grout has attained its ultimate strength.

3.07 GROUTING PLATES AND STRUCTURAL MEMBERS

Thoroughly fill the area between the foundation and plate or member with nonshrink, nonmetallic grout. If required, immediately set shims and align plate or member as required. After the grout has set hard remove forms or shims and finish with a capping mortar.

3.08 COLD WEATHER WORK

A. No masonry units, mortar or grout Work shall be placed in contact with frozen surfaces. No mortar or grout Work shall be performed when the mean air temperature is below 40 degrees F (4º C) unless the materials are heated and/or the CONTRACTOR provides adequate protection of the Work. All Work shall be protected against freezing for no less than 48 hours after placement.

B. Application of heat to the materials shall be made in a manner which will keep these materials clean and free from injurious substances.

C. Air Temperature 40 degrees F to 32 degrees F (4° to 0° C)

Sand or mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F (4° to 49° C). Heating of either of the ingredients shall be to a minimum 70 degrees F and maximum 160 degrees F (21° to 71° C). The ideal mortar temperature should be 70 degrees F to 80 degrees F (21° to 27° C).

D. Air Temperature 32 degrees F to 25 degrees F (0° to -4° C)

Sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F (4° to 49° C). Maintain temperatures of mortar on boards above freezing. Heat sand and water to a minimum 70 degrees F and maximum 160 degrees F (21° to 71° C).

E. Air Temperature 25 degrees F to 20 degrees F (-4° to -7° C)

Sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F (4° to 49° C). Maintain mortar temperatures on boards above freezing. Salamanders or other sources of heat shall be used on both sides of interior bearing walls under construction and on the inside of all exterior walls. Windbreaks shall be employed when wind is in excess of 15 mph (24 kph).

F. Air Temperature 20 degrees F (-7° C) and below

Sand and mixing water shall be heated to provide mortar temperatures between 40 degrees F and 120 degrees F (4° to 49° C). Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F (0° C). Temperature of units when laid shall be not less than 20 degrees F (-7° C).

END OF SECTION

SECTION 04200
UNIT MASONRY

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Brick.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Wood nailers and blocking built into unit masonry are specified in Section 06600: Rough Carpentry.
2. Hollow metal frames in unit masonry openings are specified in Section 08112: Hollow Metal Doors and Frames.

1.03 SUBMITTALS

A. Product data for each different masonry unit, accessory, and other manufactured product specified.

B. Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.

C. Samples for verification of the following:

1. Full-size units for each different exposed masonry unit required showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.

2. Colored-masonry mortar samples for each color required showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on the Project. Label samples to indicate type and amount of colorant used.
3. Accessories embedded in the masonry.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the following, except where more stringent requirements are shown or specified.

1. A.C.I. 530-99: Building Code Requirements for Masonry Structures.
2. A.C.I. 530.1-99: Specifications for Masonry Structures.

B. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

C. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.

D. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Pre-Installation Meeting:

1. Convene meeting at project site within one week of scheduled start of installation with representatives of the following in attendance: Owner, Architect, General Contractor, Masonry Sub-Contractor and Manufacturer's Representative or Distributor.

2. Review substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.

3. Keep minutes of meeting including responsibilities of various parties and deviations from specifications and installation instructions.

4. Distribute minutes to attendees within 72 hours.

F. Mockup: Prior to installing unit masonry, construct sample wall panels to verify selections made under sample submittals and to demonstrate aesthetic effects as well as other qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockup on site in the location as directed by Architect.

2. Mockup shall be approximately 4'-0" high by 6'-8" long.

3. Build mockup of typical wall area comprised of 8" thick concrete block backup wythe, grout-filled collar joint, horizontal joint reinforcing, and 4" brick veneer including colored mortars.

4. Clean exposed faces of mockups with masonry cleaner indicated.

5. Notify Architect one week in advance of the dates and times when mockups will be constructed.

6. Protect accepted mockups from the elements with weather-resistant membrane.
7. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   a. Acceptance of mockups is for color, texture, and blending of masonry units; relationship of mortar colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
   b. Acceptance of mockups does not constitute approval of deviations from

the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.

c. When directed, demolish and remove mockups from Project site.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not install until they are in an air-dried condition.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.06 PROJECT CONDITIONS

A. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 48 inches down both sides and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.

D. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and above.

PART 2 – PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows for each form of concrete masonry unit required.

1. Provide special shapes for lintels, control joints (sash blocks), bonding, and other special conditions.

2. Provide square-edged units for outside corners.

B. Concrete Masonry Units: ASTM C 90 and as follows:

1. Weight Classification: Normal weight.

2. Size: Manufactured to the actual dimensions listed below (within tolerances specified in the applicable referenced ASTM specification) for the corresponding nominal sizes indicated on Drawings:
   a. 8 inch nominal: 7-5/8 inch actual.
   b. 12 inch nominal: 11-5/8 inch actual.

2. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

4. Compressive strength = 2000 psi, minimum, based on net area; f'm = 1500 psi minimum.

2.02 BRICK

Match existing brick-work pattern, color and texture to the greatest extent possible. The following specifications are for reference only. Confirm with the owner's representative prior to ordering.

A. Face Brick Standard: ASTM C 216 and as follows:

1. Grade SW.

2. Type FBS.

3. Size: Based upon standard modular dimensions of 2-1/4" x 3-5/8" x 7-5/8":
   a. Manufacturer: Tri-State Brick Company, Cunningham Brick Company, Inc., or Hanson Brick.

4. Color and Texture:
   a. Running bond units to be one of the following:
      i. "Red Wire Cut," Hanson Brick
      ii. "Spektra Wire Cut, " Pine Hall Brick
      iii. "Red Wire Cut," Palmetto Brick Company
      iv. "Red Wire Cut," Carolina Ceramics
   b. Soldier course units to be by same manufacturer as running bond units, and shall be one of the following:
      i. "Med Palomino Wire cut," Hanson Brick
      ii. "Spektra Oatmeal Wire Cut," Pine Hall Brick
      iii. "Ivorystone," Palmetto Brick Company

iv. "Empire Ivory Velour," Carolina Ceramics

c. Final color to be selected by the Owner's representative based upon sample panel submittals and review of field-constructed mock-up of typical exterior face brick cavity wall.

5. For sills and similar applications where brick surfaces are exposed to view which otherwise would be concealed, provide un-cored solid units with all exposed surfaces finished.

2.03 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C 91.

1. Provide colored pigmented mortars for brick work. Use premixed colored masonry cements of formulation required to produce colors indicated, or if not indicated, as selected from manufacturer's standard formulations. Two colors will be required to match exterior masonry units.

B. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch, use aggregate graded with 100 percent passing the No. 16 sieve.

C. Aggregate for Grout: ASTM C 404.

D. Water: Potable.

2.04 REINFORCING STEEL

A. Steel Reinforcing Bars: Material and grade as follows:

1. Billet steel complying with ASTM A 615.
   a. Grade 60.

B. Deformed Reinforcing Wire: ASTM A 496, with ASTM A 153, Class B-2 zinc coating.

2.05 JOINT REINFORCEMENT, TIES AND ANCHORING DEVICES

A. Materials: Comply with ASTM A 951 and requirements indicated below for basic materials and with requirements indicated under each item of joint reinforcement, tie and anchor, for size and other characteristics:

1. Hot-dip galvanized steel wire: ASTM A 82 for uncoated wire and with ASTM A 153, Class B-2 (1.5 oz. Per sq. ft. of wire surface) for zinc coating applied after prefabrication into units.

B. Provide welded wire units prefabricated in straight lengths of not less than 10', with matching corner and tee units. Fabricate from cold-drawn steel wire complying the ASTM A 82, with deformed continuous side rods and plain cross rods, into units with widths of approximately 2" less than nominal width of walls and partitions as required to position side rods for full embedment in mortar with mortar coverage of not less than 5/8" on joint faces exposed to exterior, and not less than ½" elsewhere.

Provide the following type of joint reinforcing unless otherwise indicated.

1. For single wythe walls, provide ladder type with cross rods spaced not more than 16” o.c.

2. For brick veneer-on-block walls, provide ladder type with cross rods spaced not more than 16” o.c. with adjustable wall tie eye sections welded on at 16” o.c. Provide rectangular adjustable wire wall tie pintle sections fitted into eye sections to extend within 1” of exterior face of brick veneer. Provide Dur-O-Wal “Ladur-Eye” multi-wythe wall system.

3. Wire size for side and cross rods: No. 9.

C. Dovetail Slots and Anchors: Maintain continuity of brick veneer anchoring system at all formed and poured reinforced concrete columns by providing dovetail slots and anchors.

1. Dovetail slots to be 22 gauge, hot-dipped galvanized steel, spaced 16” o.c. maximum. Slots shall extend the full height of the brick veneer. Provide Dur-O-Wal D/A 100 slots or equal.

2. Dovetail anchors to be triangular units, 3/16” diameter by 4-1/2” in length from dovetail or in length as required to position outside of anchor at approximate center of block veneer. Anchors shall be hot-dip galvanized. Provide Dur-O-Wal D/A 724 anchors or equal.

D. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

- AA Wire products Co.
- Dur-O-Wal, Inc.
- Heckman Building Products, Inc.
- Hohmann & Barnard, Inc.
- Masonry Reinforcing Corp. of America
- National Wire Products Corp.

2.06 MISCELLANEOUS TIES AND ANCHORS

A. Corrugated Wall Ties: Hot dipped galvanized steel, 7/8" wide by 7" long; 22 gage.

B. Anchor Bolts: Steel bolts complying with ASTM A 307; with ASTM A 563hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:

1. Headed bolts.
2. Nonheaded bolts, straight.
3. Nonheaded bolts, bent in manner indicated.

2.07 EMBEDDED FLASHING MATERIALS

A. Flexible, self-sealing wall flashing.

1. Description: Self-sealing, self-healing, fully adhering, composite flexible flashing consisting of 32 mil thick pliable and highly adhesive rubberized asphalt compound

bonded completely and integrally to 8 mil thick, high-density, four plies of cross-laminated polyethylene film to produce an overall 40 mil thickness in rolls 75 feet long; protected from contamination from dust or dirt by a silicone-coated release sheet, to be removed immediately before installation.

2. Width: 12, 18, or 36 inches as required by flashing conditions and details.

3. Manufacturer: W.R. Grace – "Perm-A-Barrier Wall Flashing."

B. Termination Mastic

1. Description: Rubberized asphalt-based mastic for use in sealing flashing membrane terminations and punctures.

2. Manufacturer: W.R. Grace – "Bituthene Mastic".

2.08 MISCELLANEOUS MASONRY ACCESSORIES

A. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

B. Weepholes: Wicking material to be cotton sash cord in length required for flush installation on exterior side of wall and 18" in cavity between wythes.

C. Cavity Drainage Material: 1 inch thick, free-draining mesh; made from polyethylene strands and shaped to avoid being clogged by mortar dropping. Provide one of the following:

1. Mortar Break; Advanced Building Products, Inc.
2. CavClear Masonry Mat; CavClear.
3. Mortar Net; Mortar Net USA, Ltd.
4. Mortar Stop; Polytite Manufacturing Corp.

2.09 MASONRY WALL INSULATION, SINGLE WYTHE WALLS

A. For single wythe masonry walls requiring thermal insulation, provide nontoxic foamed-in-place masonry wall insulation, R value of not less than 6.0 in 8" concrete masonry, with a density of 125 lbs. or greater. Insulation shall be non-combustible, shall have a Class A flame spread rating, shall be formaldehyde-free, and shall meet all applicable state and federal insulation standards.

1. Insulation shall be installed only by applicators that have been trained and certified by the insulation manufacturer.

2. Subject to compliance with specifications; provide insulation by one of the following:
   a. Tailored Chemical Products, Inc.: "Core-Fill 500".
   b. Thermco: "Thermco Foam".
   c. C.P. Chemical Co., Inc.: "Tripolymer Foam Insulation".

2.10 CAVITY WALL INSULATION

A. Extruded-Polystyrene Board Insulation: Rigid, cellular, 1" thick polystyrene thermal insulation with closed cells and integral high-density skin; formed by the expansion of polystyrene base

resin in an extrusion process to comply with ASTM C 578, Type IV; minimum aged R-Value of 5.0. Provide one of the following:

1. Dow “Cavitymate Plus”.
2. Owens Corning “Foamular CW 25”.
3. Tenneco “Amofoam”.

B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

C. Tape for Joints: Type recommended by insulation board manufacturer for application indicated.

2.11 MASONRY CLEANERS

Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

2.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for job-mixed mortar; and ASTM C 1142 for ready-mixed mortar, of types indicated below:

. 1. Use Type S mortar for all masonry applications.

2. Include admixture and follow admixture label instructions.

C. Grout for Unit Masonry: Comply with ASTM C 476. Use grout of consistency indicated or, if not otherwise indicated, of consistency at time of placement that will completely fill spaces intended to receive grout.

1. Minimum Compressive Strength: 2500 psi at 28 days.
2. Slump Range: 8" minimum - 11" maximum.
3. Aggregate size: 1/4" maximum for coarse grout.
4. Provide fine grout at collar joints of brick veneer-on-block walls.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

3.02 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections of the Specifications.

B. Leave openings for equipment to be installed before completion of masonry. After installing equipment, complete masonry to match construction immediately adjacent to the opening.

C. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.03 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces of columns, walls, and arrises, do not exceed 1/4 inch in 10 feet, nor 3/8 inch in 20 feet, nor 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet, nor 1/2 inch in 40 feet or more. For vertical alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet, nor 1/2 inch maximum.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet, nor 1/2 inch in 40 feet or more. For top surface of bearing walls, do not exceed 1/8 inch in 10 feet, nor 1/16 inch within width of a single unit.

C. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls, and partitions, do not exceed 1/2 inch in 20 feet, nor 3/4 inch in 40 feet or more.

D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4 inch nor plus 1/2 inch.

E. Variation in Mortar-Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 1/8 inch. Do not vary from head-joint thickness indicated by more than plus or minus 1/8 inch Do not vary head-joint thickness from adjacent head-joint thickness by more than 1/8 inch

3.04 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

B. Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern unless otherwise noted on drawings; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below.

D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

E. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond; do not tooth. Clean exposed surfaces of set masonry, and remove loose masonry units and mortar prior to laying fresh masonry.

F. Built-in Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

G. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

I. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

J. Build nonload-bearing interior partitions full height of story to underside of roof structure above and as follows:

3.05 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.

2. With webs fully bedded in mortar in grouted masonry, including starting course on footings.

3. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

5. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 3/8-inch joints.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

C. Cut joints flush for masonry walls that are to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.06 BRICK COLOR RANGE

A. Lay brick in strict accordance with manufacturer's printed instructions to assure even distribution of color range.

B. Mingle brick from two or more cubes unless otherwise directed by manufacturer.

3.07 BONDING OF MULTIWYTHE MASONRY

A. Use individual pintle ties installed in eyelets of horizontal joint reinforcing to bond wythes together. Provide ties spaced not to exceed 16" o.c. horizontally and 16" o.c. vertically. Stagger ties in alternate courses.

B. Collar joints between brick veneer and concrete block shall be 1" wide, actual, and shall be filled solid with fine grout. Do not "slush" collar joints with masonry mortar.

3.08 CAVITIES

A. Keep cavities clean of mortar droppings and other materials during construction.

B. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown. Tape all joints with tape recommended by insulation manufacturer. Seal penetrations with sealant recommended by insulation manufacturer.

C. Place cavity drainage material in cavities to comply with manufacturer's installation requirements.

3.09 HORIZONTAL JOINT REINFORCEMENT

A. General: Provide continuous horizontal-joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcing a minimum of 6 inches

1. Space reinforcement not more than 16 inches o.c.

2. Provide reinforcement in mortar joint 1 block course above and below wall openings and extending 12 inches beyond opening.
   a. Reinforcement above is in addition to continuous reinforcement.

B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.10 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.

2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.11 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in standard concrete masonry as follows:

1. Install preformed control-joint gaskets designed to fit standard sash block.

C. Form control joints in brick veneer as follows:

1. Form open joint of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 7 Section “Joint Sealants”. Keep joint free and clear of mortar.

3.12 LINTELS

A. Install galvanized steel lintels where indicated. Provide minimum of 8” bearing at each end of lintel.

B. Provide masonry lintels where shown and wherever openings of more than 1’-0” for brick size units and 2’-0” for block size units are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Cure precast lintels before handling and installation. Provide minimum of 8” bearing at each end of lintel.

3.13 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

C. Install flashing as follows:

1. At lintels and shelf angles, extend flashing a minimum of 4 inches into masonry at each end. At heads and sills, extend flashing 4 inches at ends and turn flashing up not less than 2 inches to form a pan.

3.14 INSTALLATION OF FILLED CELL MASONRY

A. All filled cell masonry shall be built to preserve the unobstructed vertical continuity of the cells to be filled with grout.

B. Units shall be laid with full face shell mortar beds. All head joints shall be continuously filled with mortar for a distance from the face of the wall or unit not less than the thickness of the longitudinal face shells. Cross webs adjacent to vertical cores to be filled shall be fully bedded with mortar to prevent leakage of grout.

C. All mortar fins or other obstructions or debris shall be removed from the insides of the walls of the cells to be filled with grout. All cells to be filled shall be filled solidly with grout.

D. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Do not exceed the following pour heights for coarse grout:
   a. For minimum widths of grout spaces of 1-1/2 inches or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches, pour height of 12 inches.
   b. For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 60 inches.
   c. For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 3 by 3 inches, pour height of 12 feet

2. Do not exceed the following pour heights for fine grout:
   a. For 1 inch wide collar joints between brick veneer and concrete block, pour height of 18 inches.

3. Provide saw-cut cleanout holes 4 inches by 4 inches for grout pours over 48 inches in height.
   a. Provide cleanout holes at each vertical reinforcing bar.

3.15 INSULATION FOR SINGLE-WYTHE WALLS

At single wythe masonry walls, pump foamed-in-place insulation into concrete block cores so as to fill void spaces completely. Limit lifts of insulation to one-story in height, but not-to-exceed 15’-0”.

3.16 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.

C. In-Progress Cleaning: Clean unit masonry at least daily as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain present on exposed surfaces.

3. Clean exposed brick surfaces as recommended by BIA Technical Notes 20 – "Cleaning Clay Products masonry."

END OF SECTION

SECTION 05500
METAL FABRICATIONS

PART I – GENERAL

1.01 SCOPE

This Section includes the shop fabricated steel and aluminum items.

1.02 RELATED SECTIONS

1. Section 03300: Cast-in-Place Concrete
2. Section 05510: Metal Stairs
3. Section 09900: Painting and Special Coatings

1.03 REFERENCES

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 1998.

B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2002.

C. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2005.

D. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2005.

E. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.

F. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

G. ASTM A 283/A 283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2003.

H. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength; 2004.

I. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2004b.

J. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2003a.

K. ASTM A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2001 (Reapproved 2005).

L. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2004.

M. ASTM B 210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2004.

N. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 1998.

O. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2006.

P. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

Q. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

R. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01300 for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

Design connections and components not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Florida.

PART 2 – PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A 316

B. Steel Tubing: ASTM A 316.

C. Plates: ASTM A 316.

D. Pipe: ASTM A 316.

E. Bolts, Nuts, and Washers: ASTM A 316.

F. Welding Materials: AWS D1.1; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B 221 (ASTM B 221M), 6061 alloy, T6 temper.

B. Aluminum-Alloy Drawn Seamless Tubes: ASTM B 210 (ASTM B 210M), 6061 alloy, T6 temper.

C. Bolts, Nuts, and Washers: Stainless steel.

D. Welding Materials: AWS D1.1; type required for materials being welded.

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Continuously seal joined members by continuous welds.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

A. Ladders: Stainless Steel; in compliance with ANSI A14.3; with mounting brackets and attachments;

1. Side Rails: Stainless Steel Bars - 1/2 x 2 1/2 inches members spaced at 18 inches (Widen to 24 inches at top for walk through ladders).

2. Rungs: one inch diameter solid round bar (Stainless Steel) spaced 12 inches on center.

3. Space rungs 7 inches from wall surface, or floor opening at top of ladder.

B. Telescopic Steel Columns: Stainless Steel pipe;

1. Diameter: 3 inch.
2. Height: 6 to 9 feet.

C. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

D. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: Stainless Steel or Aluminum as indicated on plans.

E. Lintels: As detailed; galvanized finish.

2.05 FINISHES - STEEL

A. Prime paint all carbon steel items.

1. Exceptions: Galvanize items to be embedded in concrete or masonry and lintels.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A 123/A 123M requirements.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A 123/A 123M requirements.

2.06 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I natural anodized.

B. Interior Aluminum Surfaces: Class I natural anodized.

C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.07 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation from Plane: 1/16 inch in 48 inches.

PART 3 – EXECUTION

3.01 EXAMINATION

Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated.

D. Perform field welding in accordance with AWS D1.1.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset from True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

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SECTION 05510
METAL STAIRS

PART I – GENERAL

1.01 SCOPE

This Section includes the stairs with grating treads, structural steel stair framing and supports, and handrails and guards.

1.02 RELATED SECTIONS

1. Section 03300: Cast-in-Place Concrete
2. Section 04200: Unit Masonry
3. Section 05500: Metal Fabrications
4. Section 09900: Painting and Coating

1.03 REFERENCES

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 1998.

B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2002.

C. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2005.

D. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2005.

E. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.

F. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

G. ASTM A 283/A 283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2003.

H. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength; 2004.

I. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2004b.

J. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2003a.

K. ASTM A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2001 (Reapproved 2005).L. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2004.

L. ASTM B 210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2004.

M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 1998.

N. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2006.

O. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

P. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

Q. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols.

2. Indicate net weld lengths.

3. Include the design engineer's stamp or seal on each sheet of shop drawings.

C. Welders' Certificates.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State of Florida, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 – PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.

1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, State, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.

2. Structural Design: Provide complete stair and railing assemblies complying with the following:
   a. Stair Capacity: Uniform live load of 100 lb/sq ft and a concentrated load of 300 lb with deflection of stringer or landing framing not to exceed 1/180

of span.
b. Railing Assemblies: Comply with ASTM E 985.

3. Dimensions: As indicated on drawings.

4. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.

5. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.

6. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:

1. Industrial: All joints made neatly.
a. Welded Joints: Welded on back side wherever possible.
b. Welds Exposed to Touch: Ground smooth.
c. Bolts Exposed to Touch in Travel Area: No nuts or screw threads exposed to touch.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required. Anchors for aluminum components shall be ASTM A316 stainless steel bolts, nuts and washers.

2.02 METAL STAIRS WITH GRATING TREADS

A. Jointing and Finish Quality Level: Industrial, as defined above.

B. Risers: Open.

C. Treads: Aluminum bar grating.

1. Grating Type: Aluminum I-bar with pressure locked cross bars.
2. Bearing Bar Depth: 1 ½ inch, minimum.
3. Nosing: Aluminum checkered plate.
4. Nosing Width: 1-1/4 inch, minimum.
5. Anchorage to Stringers: End plates welded to grating, bolted to stringers.

D. Stringers: Aluminum channels.

1. Stringer Depth: 10 inches (minimum, or as shown on drawings).
2. End Closure: Sheet aluminum of same thickness as risers welded across ends.

E. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity or as detailed.

F. Railings: Aluminum pipe railings.

G. Finish: Clear brushed anodized nosings of all stairs shall be painted safety yellow.

2.03 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: Round aluminum pipe rails unless otherwise indicated.

1. Outside Diameter: 1-1/2 inch.

B. Guards:

1. Top Rails: Round aluminum pipe rails unless otherwise indicated.
   a. Outside Diameter: 1 1/2 inch.

2. Infill at Pipe Railings: Pipe rails sloped parallel to stair.
   a. Pipe Outside Diameter: 1 1/2 inch.
   b. Material: Aluminum pipe, round.
   c. Vertical Spacing: Maximum 21 inches on center.
   d. Jointing: Welded and ground smooth and flush.

3. End and Intermediate Posts: Same material and size as top rails.
   a. Horizontal Spacing: As indicated on drawings.
   b. Mounting: 2-clip angles mounted to sides of stringers.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B 221 (ASTM B 221M), 6061 alloy, T6 temper.

B. Aluminum-Alloy Drawn Seamless Tubes: ASTM B 210 (ASTM B 210M), 6061 alloy, T6 temper.

C. Bolts, Nuts, and Washers: Stainless steel.

D. Gratings: Bar gratings complying with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes, and ASTM B221 for extruded bars, rods and shapes.

E. Steel Bolts, Nuts, and Washers: ASTM A 316 stainless steel.

F. Welding Materials: AWS D1.1; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.05 SHOP FINISHING

A. Exterior Aluminum Surfaces: Class I natural anodized.

B. Interior Aluminum Surfaces: Class I natural anodized.

C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 – EXECUTION

3.01 EXAMINATION

Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

END OF SECTION

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SECTION 06100
ROUGH CARPENTRY

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Framing with dimension lumber.
2. Wood furring, grounds, nailers, and/or blocking.
3. Plywood sheathing.

1.03 DELIVERY, STORAGE, AND HANDLING

Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

1.04 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product, indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservation used and net amount of preservative retained.

2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project Site.

3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.05 QUALITY ASSURANCE

A. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, “Principles and Criteria”.

1. Plywood.

PART 2 – PRODUCTS

2.01 LUMBER, GENERAL

. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard,"

and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

A. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

B. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

1. Provide dressed lumber, S4S, unless otherwise indicated.

2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

D. Rough carpentry provided in this section shall be obtained from forests certified by an FSC – accredited certification body to comply with FSC STD-01-001 “FSC Principals and Criteria for Forest Stewardship”.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.

B. Pressure treat above ground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

3. Wood floor plates installed over concrete slabs directly in contact with earth.

C. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft.

2.03 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.

B. Light-Framing (2”-4” thick, 2”-4” wide): construction grade.

C. Studs (2”-4” thick, 2”-6” wide, 12’ and shorter): No. 2 structural light framing grade, Southern Yellow Pine graded under WWPA, WCLIB, SPIB, or NLGS rules.

1. Fb (minimum extreme fiber stress in bending)…1,200 psi in single member.

2. E (minimum modules of elasticity)…….1,600,000 psi

D. Concealed Boards: Standard grade, any species graded under WWPA rules or No. 3 grade Southern Yellow Pine graded under SPIB rules.

E. Lumber for Miscellaneous Uses: Unless otherwise indicated, provide Standard grade lumber for support of other work, including cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members.

2.04 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.

B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

2.05 SHEATHING

A. Plywood for backing materials:

1. APA rated material, Type AB, Thickness: Not less than 1/2 inch.

2.06 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacturer.

1. For all rough carpentry related roof accessories, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

PART 3 – EXECUTION

3.01 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.

C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. CABO NER-272 for power-driven staples, P-nails, and allied fasteners.

2. Published requirements of metal framing anchor manufacturer.

3. "Table 2306.1--Fastening Schedule," of the Florida Building Code.

E. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

F. Use hot-dip galvanized or stainless-steel nails where rough carpentry is related to roof accessories, in ground contact, or in area of high relative humidity.

3.02 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

C. Provide pressure treated wood grounds in gypsum drywall and plaster partitions for support of plumbing fixtures, toilet accessories, fire extinguisher cabinets and brackets, wall-mounted fixtures and furnishings, and hardware.

3.01 WOOD FRAMING, GENERAL

A. Framing Standard: Comply with AF & PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Install framing members of size and at spacing indicated.

3.02 WOOD NAILERS, EDGING, AND BLOCKING FOR ROOF ACCESSORIES:

A. Provide wherever shown and where required for attachment of other work. Form to shapes, as shown, and cut as required for true line and level on work to be attached. Coordinate location with other work involved.

B. Where wood members are doubled, ends shall be lapped and thoroughly spiked to each other and to bearing members, maintaining structural integrity, using ring-shank nails.

C. Where wood members abut concrete, securely fasten to same by bolts or lag screws on

staggered centers. Heads of all bolts or lag screws shall be provided with large-head washers.

D. Round corners of wood plates where flashing occurs.

E. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

F. Holes drilled oversized or wallowed out shall be redrilled.

G. For fastening wood to:

1. Metal. Countersunk flat head No. 10 self tapping, self drilling, metal screws, at 4" o.c., staggered; utilizing appropriate size bolt and nut where possible.

2. Wood. Ring-Shank nails, 3/8" round heads at 12" o.c., staggered; 1-1/4" minimum substrate penetration.

3. Plywood. Annular thread nails, 3/8" round heads at 8" o.c. staggered with full penetration.

4. New Masonry or Concrete. 3/4" diameter by 12" long with 3" hook anchor bolts and Hughes WSH 1093 washers, spaced 2'-8" apart, staggered if nailer or blocking is wider than 6 inches.

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SECTION 06600
FIBERGLASS REINFORCED POLYMER PRODUCTS AND FABRICATIONS

PART I – GENERAL

1.01 DESCRIPTION

This section includes the following FRP Products & Fabrications:

A. Pultruded Gratings and Treads

B. Structural Shapes and Plate

C. Ladders and Cages

D. Building Panel System

E. Planks

1.02 SCOPE

Furnish all labor, materials, equipment and incidentals necessary to install the fiberglass reinforced polymer (FRP) products as specified herein.

1.03 QUALITY ASSURANCE

A. The material covered by these specifications shall be furnished by an ISO-9001:2000 certified manufacturer of proven ability who has regularly engaged in the manufacture and installation of FRP systems.

B. Substitution of any component or modification of system shall be made only when approved by the ENGINEER.

C. Fabricator Qualifications: Firm experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

D. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.04 DESIGN CRITERIA

A. The design of FRP products including connections shall be in accordance with governing building codes and standards as applicable.

B. Design live loads of FRP gratings and floor panels shall not be less than 100 PSF uniformly distributed unless specifically stated otherwise in drawings and/or supplementary conditions. Grating and floor panel deflection at the center of a simple span not to exceed 0.25".

C. Structural members shall be designed to support all applied loads. Deflection in any direction shall not be more than L/180 of span for structural members. Connections shall be designed to transfer the loads.

1.05 SUBMITTALS

A. Shop drawings of all fabricated pultruded gratings and treads, structural shapes and plate, building panel systems, planks, and appurtenances shall be submitted to the ENGINEER for approval in accordance with the requirements of Section 01300. Fabrication shall not start until receipt of ENGINEER's approval marked "Approved as Submitted" or "Approved as Noted".

B. Manufacturer's catalog data showing:

1. Dimensions, spacings, and construction of grating
2. Materials of construction

C. Detail shop drawings showing:

1. Dimensions
2. Sectional assembly
3. Location and identification mark
4. Size and type of supporting frames required
5. All connections showing rivet, bolts and surfaces to be adhered.

D. Samples of each type of product shall be submitted for approval prior to placement of purchase orders.

1.06 SHIPPING AND STORAGE

A. All systems, sub-systems and structures shall be shop fabricated and assembled into the largest practical size suitable for transporting.

B. All materials and equipment necessary for the fabrication and installation of pultruded gratings and treads, structural shapes and plate, building panel systems, planks, and appurtenances shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials or equipment, including damage due to over exposure to the sun. Any material which, in the opinion of the ENGINEER, has become damaged as to be unfit for use, shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.

C. Identify and match-mark all materials, items and fabrications for installation and field assembly.

PART 2 – PRODUCTS

2.01 GENERAL

A. Materials used in the manufacture of the FRP products shall be raw materials in conformance with the specification.

B. All materials shall be of the kind and quality specified.

C. All FRP products shall be manufactured using a pultruded process utilizing isophthalic polyester resin with flame retardant and ultraviolet (UV) inhibitor additives. A synthetic surface veil shall be the outermost layer covering the exterior surface. The flame retardant FRP shapes shall achieve a flame spread rating of 25 or less in accordance with ASTM test

method E-84.

D. If required, after fabrication, all cut ends, holes and abrasions of FRP shapes shall be sealed with a compatible resin coating.

E. FRP products exposed to weather shall contain an ultraviolet inhibitor. Should additional ultraviolet protection be required, a one mil minimum UV coating can be applied.

F. All exposed surfaces shall be smooth and true to form.

G. Manufacturers:

- Strongwell
- Or alternative manufacturer approved by ENGINEER or OWNER.

2.02 PULTRUDED GRATINGS AND TREADS:

A. General

1. Grating shall be shipped from the manufacturer, palletized and banded with exposed edges protected to prevent damage in shipment.

2. Each piece shall be clearly marked showing manufacturer's applicable drawing number.

3. Grating shall be DURADEK® as manufactured by Strongwell – Chatfield Division, Chatfield, MN.

B. Design

1. The panels shall be 1 ½ inches deep and sustain a deflection of no more than 0.25" under a uniform distributed load of 100 PSF for the span lengths shown on the plans.

2. The bearing bars shall be joined into panels by passing continuous length fiberglass pultruded cross rods through the web of each bearing bar. A continuous fiberglass pultruded bar shaped section shall be wedged between the two cross rod spacers mechanically locking the notches in the cross rod spacers to the web of the bearing bars. Continuous chemical bonding shall be achieved between the cross rod spacers and the bearing web and between the bar shaped wedge and the two cross rod spacers locking the entire panel together to give a panel that resists twist and prevents internal movement of the bearing bars.

3. Stair treads shall be capable of withstanding a uniform load of 100 PSF or a concentrated load of 300 lbs. on an area of 4 sq. inches located in the center of the tread, whichever produces greater stress.

4. The top surface of all panels shall have a non-skid grit affixed to the surface by an epoxy resin followed by a top coat of epoxy resin.

5. Panels shall be fabricated to the sizes shown on the drawings.

6. Hold down clamps shall be type 316L stainless steel saddle clips. Use 2 at each support with a minimum of 4 per panel.

7. Color shall be gray, stair nosings shall be painted safety yellow.

8. All bearing bars that are to be exposed to UV shall be coated with polyurethane coating of a minimum thickness of 1 mil.

A. Products

The FRP grating and stair treads shall be fabricated from bearing bars and cross rods manufactured by the pultrusion process. The glass fiber reinforcement for the bearing bars shall be a core of continuous glass strand rovings wrapped with continuous strand glass mat. A synthetic surface veil shall be the outermost layer covering the exterior surfaces.

2.03 FIBERGLASS GRATING AND STAIR TREADS

A. Fiberglass grating and stair treads shall be made from a chemical resistant, fire retardant polyester resin system with antimony trioxide added to meet the flame spread rating of 25 or less in accordance with ASTM E-84 testing and meet the self-extinguishing requirements of ASTM D-635. UV inhibitors shall be added to the resin.

B. All cut and machined edges, holes and abrasions shall be sealed with a resin compatible with the resin matrix used in the bearing bars and cross rods.

C. All panels shall be fabricated to the sizes shown on the approved shop drawings.

2.04 STRUCTURAL SHAPES AND PLATE:

A. Material

1. Structural shapes and plate shall be made from isophthalic polyester resin with fire retardant additives to meet a flame spread rating of less than 25 per ASTM E-84 and meet the self-extinguishing requirements of ASTM D-635. All structural shapes shall contain a UV inhibitor.

2. Structural shapes and plate shall be EXTREN® as manufactured by Strongwell – Bristol Division, Bristol, VA.

B. Process

1. Manufactured by the pultrusion process.

2. Structural FRP members' composition shall consist of a glass fiber reinforced polyester or vinyl ester resin matrix, approximately 50% glass by weight. A synthetic surface veil shall be the outermost layer covering the exterior surfaces. Glass strand rovings shall be used internally for longitudinal strength. Continuous strand glass mats or stitched reinforcements shall be used internally for transverse strength.

3. Mechanical properties shall meet or exceed the values listed in Table 1.

Table 1 – Fiberglass Pultruded Material Properties
Minimum Ultimate Coupon Properties (UN)

	ASTM		SERIES	SERIES	SERIES 500/525 PLATE⊗			SERIES 625 PLATE⊗		
PROPERTIES	TEST METHOD	UNITS/ VALUE	500/525 SHAPES	625 SHAPES	1/8" 3.175 mm	3/16" -1/4" 4.76-6.35 mm	3/8"-1" 9.5-25.4 mm	1/8" 3.175 mm	3/16"-1/4" 4.76-6.35 mm	3/8"-1" 9.5-25.4 mm
MECHANICAL										
Tensile Stress, LW	D638	psi	30,000	30,000	20,000	20,000	20,000	20,000	20,000	20,000
		N/mm2	207	207	138	138	138	138	138	138
Tensile Stress, CW	D638	psi	7,000	7,000	7,500	10,000	10,000	7,500	10,000	10,000
		N/mm2	48.3	48.3	51.7	68.9	68.9	51.7	68.9	68.9
Tensile Modulus, LW	D638	106 psi	2.5	2.6	1.8	1.8	1.8	1.8	1.8	1.8
		103N/mm2	17.2	17.9	12.4	12.4	12.4	12.4	12.4	12.4
Tensile Modulus, CW	D638	106 psi	.8	.8	.7	.9	1.4	1	1	1.4
		103N/mm2	5.52	5.52	4.83	6.21	9.65	6.89	6.89	9.65
Compressive Stress, LW	D695	psi	30,000	30,000	24,000	24,000	24,000	24,000	24,000	24,000
		N/mm2	207	207	165	165	165	165	165	165
Compressive Stress, CW	D695	psi	15,000	16,000	15,500	16,500	20,000	16,500	17,500	17,500
		N/mm2	103	110	107	114	138	114	121	121
Compressive Modulus, LW	D695	106 psi	2.5	2.6	1.8	1.8	1.8	1.8	1.8	1.8
		103N/mm2	17.2	17.9	12.4	12.4	12.4	12.4	12.4	12.4
Compressive Modulus, CW	D695	106 psi	1	1	1	1	1	1	1	1
		103N/mm2	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89
Flexural Stress, LW	D790	psi	30,000	30,000	35,000	35,000	30,000	35,000	35,000	30,000
		N/mm2	207	207	241	241	207	241	241	207
Flexural Stress, CW	D790	psi	10,000	10,000	13,000	15,000	18,000	13,000	15,000	18,000
		N/mm2	68.9	68.9	89.6	103	124	89.6	103	124
Flexural Modulus, LW	D790	106 psi	1.6	1.6	1.8	2	2	1.8	2	2
		103N/mm2	11.0	11.0	12.4	13.8	13.8	12.4	13.8	13.8
Flexural Modulus, CW	D790	106 psi	0.8	0.8	0.9	1.1	1.4	1	1.1	1.4
		103N/mm2	5.52	5.52	6.21	7.58	9.65	6.89	7.58	9.65
Modulus of Elasticity	full	106 psi	2.6	2.8						
	section	103N/mm2	17.9	19.3						
Modulus of Elasticity>4"	full	106 psi	2.5	2.5						
>102 mm	section	103N/mm2	17.2	17.2						
Parallel Compressive Shear	D3846	psi	3,000	3,000						
Stress, LW		N/mm2	20.7	20.7						
Shear Modulus, LW	—	106 psi	.425	.425						
		103N/mm2	2.93	2.93						
Short Beam Shear, LW	D2344	psi	4,500	4,500						
		N/mm2	31.0	31.0						
Ultimate Bearing Stress, LW	D953	psi	30,000	30,000	32,000	32,000	32,000	32,000	32,000	32,000
		N/mm2	207	207	220.6	221	221	221	221	221

Poisson's Ratio, LW∪	D3039	in/in	.33	.33	.31	.31	.31	.32	.32	.32
		mm/mm	.330	.330	.310	.310	.310	.320	.320	.320
Notched Izod Impact, LW	D256	ft-lbs/in	25	25	15	10	10	15	10	10
		J/mm	1.33	1.33	.988	1.07	1.07	.988	1.07	1.07
Notched Izod Impact, CW	D256	ft-lbs/in	4	4	5	5	5	5	5	5
		J/mm	.214	.214	.267	.267	.267	.267	.267	.267

Table 1 – Fiberglass Pultruded Material Properties
Minimum Ultimate Coupon Properties (UN) – cont'd

	ASTM		SERIES	SERIES	SERIES 500/525 PLATE⊗			SERIES 625 PLATE⊗		
PROPERTIES	**TEST METHOD**	**UNITS/ VALUE**	**500/525 SHAPES**	**625 SHAPES**	**1/8" 3.175 mm**	**3/16 -1/4" 4.76–6.35 mm**	**3/8"-1" 9.5-25.4 mm**	**1/8" 3.175 mm**	**3/16"-1/4" 4.76-6.35 mm**	**3/8"-1" 9.5-25.4 mm**
PHYSICAL										
Barcol Hardness⊕	D2583	—	45℘	45℘	40	40	40	40	40	40
24 HR Water Absorption∅	D570	% Max by wt	.6	.6	.6	.6	.6	.6	.6	.6
Density	D792	lbs/in3	.062-.070	.062-.070	.060-.068	.060-.068	.060-.068	.060-.068	.060-.068	.060-.068
		10-3g/mm3	1.72-1.94	1.72-1.94	1.66-1.88	1.66-1.88	1.66-1.88	1.66-1.88	1.66-1.88	1.66-1.88
Coefficient of Thermal	D696	10-5in/in/oF	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Expansion, LW∪		10-6in/in/oC	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Thermal Conductivity∪	C177	BTU-in/	4	4						
		ft2/hr/oF								
		W (m * ºK)	.58	.58						
ELECTRICAL										
Arc Resistance, LW∪	D495	seconds	120	120						
Dielectric Strength, LW∪	D149	KV/in	35	35	35	35	35	35	35	35
		KV/mm	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38
Dielectric Strength, PF□	D149	volts/mil	200	200	200	N.T.	N.T.	250	N.T.	N.T.
FLAMMABILITY ⊕										
Flammability Classification (1/16")	UL94	VO								
Tunnel Test	E-84	25 Max								
NBS Smoke Chamber	E-662	650-700 (typical)								
Flammability	D635	Self Extinguishing								
UL Thermal Index	Generic	130oC								
British Fire Test	BS 476-7	Class 1								

All values are minimum ultimate properties from coupon tests except as noted

ℵ This value is determined from full section simple beam bending of EXTREN® structural shapes.

ℑ The shear stress test results will change radically if the notched orientation is altered. The value in this chart represents the test configuration where the notches are machined parallel to the reinforcing mat. For notches machined perpendicular to the reinforcing mat, this value would be two to three times larger.

ℜ The Shear Modulus value has been determined from tests with full sections of EXTREN® structural shapes.

(See the Strongwell Design Manual for further information.)

℘ Value would be 50 if the surfacing veil were not there.

⊗ Plate compressive stress/modulus measured edgewise and flexural stress/modulus measured flatwise.

⊕ Values apply to Series 525 and 625.

∅ Measured as a percentage maximum by weight.								
∩ Span to depth ratio of 3:1; EXTREN® angles will have a minimum value of 4,000 psi and the I/W shapes are tested in the web.								
∪ Typical values because these are shape and composite dependent tests.								
□ This is a typical value which varies with composite thickness.								
LW = Lengthwise		PF = Perpendicular to laminate face						
CW = Crosswise		N.T. = Not Tested						

2.05 FRP BUILDING PANEL SYSTEM

A. Materials

1. Each panel shall be manufactured by the pultrusion process utilizing isophthalic polyester resin with flame retardant and UV inhibitor additives. A synthetic surface veil shall be the outermost layer covering the exterior surface. The FRP panel shall achieve a flame spread rating of 25 or less in accordance with ASTM test method E-84.

2. The 3-way connector, hanger, 45º connector, toggle connector and end cap required to install the building panel system shall be manufactured by the pultrusion process, and achieve a flame spread rating of 25 or less in accordance with ASTM test method E-84.

The following minimum mechanical properties shall apply:

Properties	ASTM Test Method	Units	Value
Flexural Strength, LW	D790	psi N/mm2	24,500 169
Flexural Strength, CW	D790	psi N/mm2	8,200 56.55
Flexural Modulus, LW	D790	106 psi 103 N/mm2	.885 .0061
Flexural Modulus, CW	D790	106 psi 103 N/mm2	.646 .00446
Tensile Strength	D638	psi N/mm2	31,100 214.5
Tensile Modulus	D638	106 psi 103 N/mm2	2.486 0.017
Short Beam Shear	D2344	psi N/mm2	3,190 22

3. Fiberglass panels shall be COMPOSOLITE® as manufactured by Strongwell – Bristol Division, Bristol, VA., or approved equal.

B. Connections

1. Panels utilize integrally molded longitudinal grooves into which a connector or toggle is inserted during assembly.

2. 3-way and 45º connectors are utilized in the system to turn corners and facilitate joining walls and sides.

3. Toggles are utilized to lock panels and connectors.

4. For permanent structures, adhesives are applied in the small grooves along the length of the panel. Toggles secure components (panels and connectors) and create even pressure until adhesive is cured.

C. Approved Fabricators:

- Strongwell
- Bristol Division (Bristol, VA)
- Highlands Division (Abingdon, VA)
- Chatfield Division (Chatfield, MN)
- Or approved alternative manufacturer

PART 3 – EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from infiltration of water and debris.

3.02 INSPECTION AND TESTING

A. The ENGINEER shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.

B. All labor, power, materials, equipment and appurtenances required for testing shall be furnished by the Contractor at no cost to the OWNER.

3.03 INSTALLATION - GENERAL

A. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as determined by the ENGINEER.

B. Cutting, fitting and placement: Perform cutting, drilling and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; measured from established lines and levels.

C. Provide temporary bracing or anchors in form work for items that are to be built into concrete masonry or similar construction.

3.04 ALL FRP INSTALLATION

A. If required, all field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer. The sealing of the edges shall prevent premature fraying at the field cut edges.

B. Install items specified as indicated and in accordance with manufacturer's instructions.

END OF SECTION

SECTION 07210
BUILDING INSULATION

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Concealed acoustical building insulation.
2. Rigid insulation applied over the wall exterior.
3. Faced mineral fiber insulation to underside of roof, trusses top chord.
4. Concealed building insulation.

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of insulation product specified.

1.04 REFERENCES

A. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Insulation Board.

B. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.

C. ASTM E 119 - Standard Test Methods for Fire Tests of Building Constructions and Materials.

D. FS HH-I-1972/1 - Insulation Board, Thermal, Polyurethane or Polyisocyanurate, Faced with Aluminum Foil on Both Sides of the Foam.

E. LTTR – Long Term Thermal Resistance, using techniques from CAN/ULC S770 based on ASTM C1303

F. UL 263 - Fire Tests of Building Construction and Materials.

G. UL 1256 - Fire Test of Roof Deck Constructions.

H. ASTM E 2114-01 – Standard Terminology for Sustainability Relative to the Performance of Buildings

I. ASTM 2129 –01 – Standard Practice for Data Collection for Sustainability Assessment of Building Product

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated on Drawings or specified elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.

3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide insulation products by one of the following:

1. Glass-fiber insulation:

- CertainTeed Corporation
- John’s Manville Corporation
- Owens Corning

2. Slag-Wool-/Rock-Wool-Fiber Insulation:

- Fibrex Inc.
- Partek Insulations, Inc.
- USG Interiors, Inc.
- Owens Corning

3. Rigid Board Insulation:

- Dow Chemical

- Johns Manville
- Owens Corning
- CertainTeed

2.02 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

B. Cellular Glass Insulation: ASTM C552 Type I

C. Faced and un-faced Mineral-Fiber Blanket Insulation: Sound attenuation insulation combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665, Type I (blankets with and/or without membrane facing).

1. Mineral-Fiber Type: Fibers manufactured from slag wool or rock wool.

2. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

3. Thickness: As indicated on drawings.

2.03 AUXILIARY INSULATING MATERIALS

Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

PART 3 – EXECUTION

3.01 EXAMINATION

Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Apply single layer of insulation to produce thickness indicated.

3.03 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with

adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:

1. Use blanket widths and lengths that fill cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

END OF SECTION

SECTION 07411
METAL ROOF PANELS

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Standing-seam metal roof panels installed on metal deck.

B. Related Sections:

1. Section 07620: Sheet Metal Flashing and Trim, for field-formed fascias, copings, flashings, gutters, downleaders, and other sheet metal work not part of metal roof panel assemblies.

1.03 DEFINITIONS

Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight roofing system.

1.04 PERFORMANCE REQUIREMENTS

A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design metal roof panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at the following test-pressure difference:

1. Test-Pressure Difference: Positive and negative 1.57 lbf/sq. ft.

2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.

3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

D. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:

1. Test-Pressure Difference: Not less than 7.36 lbf/sq. ft. and not more than 12.0 lbf/sq. ft.

2. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.

3. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 110.

F. Provide panels that comply with the requirements of the Florida Building Code and which carry Florida Product Approval numbers.

G. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

1. Wind Loads: Determine loads using ASCE -7 based upon the following minimum design wind pressures for the locations indicated:
   a. Main Sloped Roofs and Overhangs
      i. Refer to structural drawings for design winds loads.

H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

I. Energy Performance: Provide roof panels with solar reflectance index not less than 79 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of roof panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
   a. Flashing and trim.

C. Samples for Initial Selection: For each type of metal roof panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Roof Panels: 12 inches long by actual panel width. Include fasteners, clips, closures, and other metal roof panel accessories.

2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.

3. Accessories: 12-inch- long Samples for each type of accessory.

E. Delegated-Design Submittal: For metal roof panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified Florida professional engineer responsible for their preparation.

F. Qualification Data: For qualified Installer.

G. State of Florida Product Approval number.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

I. Field quality-control reports.

J. Maintenance Data: For metal roof panels to include in maintenance manuals.

K. Warranties: Samples of special warranties.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1. Panel installer shall have a minimum of three (3) years experience in the installation of concealed clip architectural standing seam metal roofing and show evidence of successful completion of at least three (3) projects of similar size, scope, and complexity.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations: Obtain each type of metal roof panels from single source from single manufacturer.

D. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, metal roof panel installer, metal roof panel manufacturer's representative, lightning protection system installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories and roof-mounted equipment.

2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

3. Review methods and procedures related to metal roof panel installation, including

manufacturer's written instructions.

4. Examine deck substrate conditions for compliance with requirements, including flatness and attachment to structural members.

5. Review structural loading limitations of deck during and after roofing.

6. Review flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.

7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.

8. Review temporary protection requirements for metal roof panel assembly during and after installation.

9. Confirm schedule for roof inspections (minimum of three) to be made by roof panel manufacturer.

10. Review roof observation and repair procedures after metal roof panel installation.

11. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.09 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal roof panels with rain drainage work, flashing, trim, and construction of decks, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including rupturing, cracking, or puncturing.
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Twenty years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: Twenty years from date of Substantial Completion.

C. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: Twenty years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: 40 mils thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
3. Products: Subject to compliance with requirements:
   a. Grace Construction Products; a unit of W. R. Grace & Co.; Grace Ice & Water Shield.
   b. Approved Substitute.

2.02 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

B. Products:

1. Roof panel shall be the factory roll-formed VSR roof system panel as manufactured by Butler Manufacturing Company; 16" wide with 2 major corrugations 2" high, 16" on center and optional minor corrugations 4" on center between and parallel to the major corruga-tions. 24 gage steel (45,000 psi yield), galvanized (G-90 coating), per ASTM Specifica-tion A653, and painted with standard exterior colors of Butler-Cote® finish system, a full strength, 70% Kynar 500®* or Hylar 5000®* fluoropolymer coating. Manufacturer war-rants that coating shall not blister, peel, crack, chip, or experience material rust through for 25 years. For a period of 25 years chalking shall not exceed #8 - ASTM and fading shall be 5DE Color Difference Units or less.

2. Approved substitution: matching the existing Admin Bldg. Roof System and color.

2.03 ACCESSORIES

A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.

2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible.

3. Closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from same material as roof panels, prepainted with coil coating, minimum 0.040 inch thick. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

2.04 FABRICATION

A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional

and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal roof panel side laps with a bead of elastomeric sealant that provides a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

4. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

2.05 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.

B. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

C. Examine roughing-in for components and systems penetrating metal roof panels to verify

actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

3.03 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

1. Entirety of roof area.

B. Install flashings to cover underlayment to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

3.04 METAL ROOF PANEL INSTALLATION, GENERAL

A. Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

B. Thermal Movement. Rigidly fasten metal roof panels to structure at one and only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction. Predrill panels for fasteners.

1. Point of Fixity: Fasten each panel along a single line of fixing located at ridge.
2. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.

C. Install metal roof panels as follows:

1. Commence panel installation and complete at least 10% but no more than 20% of the installation for initial inspection by a facility-authorized representative of the panel manufacturer.

2. Field cutting of metal panels by torch is not permitted.

3. Locate and space fastenings in uniform vertical and horizontal alignment.

4. Provide metal closures at rake edges rake walls and each side of ridge and hip caps.

5. Flash and seal metal roof panels with weather closures at eaves, rakes, and perimeter of all openings.

6. Install ridge and hip caps as metal roof panel work proceeds.

7. End Splices: Not allowed.

8. Install metal flashing to allow moisture to run over and off metal roof panels.

D. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

E. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.

F. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

1. Prepare joints and apply sealants to comply with panel manufacturer’s requirements.

3.05 METAL ROOF PANEL INSTALLATION

A. The panel shall be attached to the supporting structural by means of a seamed in clip device. The clip shall occur at the panel major corrugation.

B. The panel sidelap shall be designed to form a interlocking seam with a return leg on the lower edge of the female rib. Sidelap sealant shall be factory applied.

C. The panel endlap, when required, shall be at least 6" and sealed with field applied sealant. One panel end shall be "swaged" to ensure nestible, watertight endlap. A backing plate with factory welded studs shall be used and will occur directly over structural support members.

D. Fasteners:

1. Connections of the VSR roof system panel to structural member shall be made with con-cealed clip. The clip may be either the fixed type (when it is not necessary to consider thermal expansion/contraction) or movable type which contains a movable tab. A thermal block may be used with the movable clip.

2. Panel-to-panel connections shall be made with a positive field formed lock seam, formed by a electrical seaming machine.

E. Provision for Expansion/Contraction

1. Provision for thermal expansion/contraction movement of the VSR roof system panel shall be accomplished by the use of clip with a movable tab. The tab shall be factory centered on the roof clip to insure full movement in either direction.

2. The roof shall provide for thermal expansion/ contraction without detrimental effect on the roof panel when there is a ±100 F temperature difference between the interior structural framework of the building and the roof panel.

3.06 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.07 ERECTION TOLERANCES

Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.08 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.09 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation

B. Instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

C. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07460
CEMENTITIOUS PLANK SIDING

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Fiber-cement siding.
2. Fiber-cement soffit.

B. Related Sections:

1. Section 06100: Rough Carpentry, for wood furring, grounds, nailers, and blocking.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For siding and soffit including related accessories.

C. Samples for Verification: For each type, color, texture, and pattern required.

1. 12-inch- (300-mm-) long-by-actual-width Sample of siding.
2. 24-inch- (600-mm-) wide-by-36-inch- (900-mm-) high Sample panel of siding assembled on plywood backing.
3. 12-inch- (300-mm-) long-by-actual-width Sample of soffit.
4. 12-inch- (300-mm-) long-by-actual-width Samples of trim and accessories.

D. Qualification Data: For qualified vinyl siding Installer.

E. Product Certificates: For each type of siding and soffit, from manufacturer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

G. Maintenance Data: For each type of siding and soffit and related accessories to include in maintenance manuals.

H. Warranty: Sample of special warranty.

1.04 QUALITY ASSURANCE

A. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.

B. Source Limitations: Obtain each type, color, texture, and pattern of siding and soffit, including related accessories, from single source from single manufacturer.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.

2. Build mockups for siding and soffit including accessories.
   a. Size: 48 inches long by 60 inches.
   b. Include outside corner on one end of mockup and inside corner on other end.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at project site.

1.05 DELIVERY, STORAGE, AND HANDLING

Store materials in a dry, well-ventilated, weathertight place.

1.06 COORDINATION

Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

1.07 WARRANTY

A. Special Warranty: Standard form in which manufacturer agrees to repair or replace siding and soffit that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including cracking, deforming and fading.
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, as measured according to ASTM D 2244.

3. Warranty Period: 20 years from date of Substantial Completion.

1.08 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish full lengths of siding and soffit including related accessories, in a quantity equal to 2 percent of amount installed.

PART 2 – PRODUCTS

2.01 FIBER-CEMENT SIDING

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings "James Hardie" or comparable product by one of the following:

- James Hardie.
- Cemplank.
- CertainTeed Corp.
- GAF Materials Corporation.
- MaxiTile, Inc; a California corporation.

3. Horizontal Pattern: Boards 6-1/4 to 6-1/2 inches; 7-1/4 to 7-1/2 inches; 8-1/4 to 8-1/2 inches plain beaded-edge.
   a. Texture: [Smooth] [Rough sawn] [Wood grain] Match existing Admin. Bldg.

4. Shingle Pattern: 48-inch- (1200-mm-) wide, [straight-edge notched] [staggered-edge notched] sheets with wood-grain texture.

5. Panel Texture: 48-inch- (1200-mm-) wide sheets with [smooth] [stucco] [wood-grain]

6. Factory priming is generally offered as an optional feature by manufacturers listed.

7. Factory Priming: Manufacturer's standard acrylic primer.

2.02 FIBER-CEMENT SOFFIT

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings "James Hardie" or comparable product by one of the following:

- Cemplank.
- CertainTeed Corp.

- GAF Materials Corporation.
- James Hardie.

B. Pattern: 12-inch- 16-inch- 24-inch-X wide sheets with [smooth] [wood-grain] texture.

C. Ventilation: Provide unperforated soffit unless otherwise indicated.

D. Factory Priming: Manufacturer's standard acrylic primer.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of [siding] [and] [soffit] and related accessories.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

Clean substrates of projections and substances detrimental to application.

3.03 INSTALLATION

A. General: Comply with [siding] [and] [soffit] manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.

2. Center nails in elongated nailing slots without binding siding to allow for thermal movement.

B. Install fiber-cement [siding] [and] [soffit] and related accessories.

1. Install fasteners no more than 24 inches o.c. Follow the manufacturer’s recommendations for NOA compliance and secure cladding to the CMU wall base support; typical.

C. Install joint sealants as specified in Division 7 Section "Joint Sealants" and to produce a weathertight installation.

3.04 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION

SECTION 07552
SBS-MODIFIED BITUMINOUS SHEET ROOFING

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Two-ply modified bituminous membrane roofing with mineral granule surfacing.
2. Modified bituminous sheet flashing.
3. Roof insulation.
4. Roofing asphalt.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 6 Section "Rough Carpentry" for treated wood nailers, curbs, and wood cants.
2. Division 7 Section "Flashing and Sheet Metal" for metal counter flashings, edge metal, scuppers, copings, etc.

1.03 DEFINITIONS

Roofing Terminology: Refer to ASTM D 1079 for definitions of terms related to roofing work not otherwise defined in this Section.

1.04 PERFORMANCE REQUIREMENTS

A. General: Install a watertight, modified bituminous membrane roofing and base flashing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather without failure.

B. UL Listing: Provide modified bituminous sheet roofing system and component materials that have been tested for application and slopes indicated and are listed by Underwriters Laboratories, Inc. (UL) for Class A external fire exposure.

C. FM Listing: Provide modified bitumen sheet roofing system and component materials that have been evaluated by Factory Mutual System for fire spread, wind uplift, and hail damage and that are listed in "Factory Mutual Approval Guide" for Class I construction.

1. Roofing system shall comply with the following:
   a. Fire/Windstorm Classification: Class 1A-90.

2. Refer to structural drawings for gross wind loads on roofing materials in roof zones 1, 2, and 3.

D. Insulation Fire-Performance Characteristics: Provide insulation materials that are identical to materials whose fire-performance characteristics have been determined for the assemblies of which the insulation materials are a part, per test method listed below, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Surface Burning Characteristics: ASTM E 84.
2. Fire Resistance Ratings: ASTM E 119.

E. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ATM E 1980 based on testing identical products by a qualified testing agency.

1.05 SUBMITTALS

A. Product data for each type of product specified. Include data substantiating that materials comply with requirements.

1. For asphalt bitumen, provide label on each container or certification with each load of bulk bitumen, indicating flash point (FP), finished blowing temperature (FBT), softening point (SP), and equiviscous temperature (EVT).

B. Shop Drawings: Include plans, sections, details, and attachments to other work, for the following:

1. Base flashings, cants, and membrane terminations.

2. Tapered and flat rigid insulation, including slopes and fastening patterns including corner areas and perimeters.

3. Crickets, saddles, and tapered edge strips, including slopes.

C. Samples of the following:

1. 12-by-12-inch-square samples of modified, bituminous, aluminum foil surface cap sheets to be exposed as finished roof surface.
2. 12 x 12 inch square samples of modified, bituminous flashing sheets.
3. 12 x 12 inch square samples of walkway pads.
4. 2 insulation fasteners of each type, length, and finish.

D. Installer Certification: Submit written certification from manufacturer of modified bituminous sheet roofing system certifying that Installer is approved by manufacturer to install specified roofing system. Provide copy of certification to Architect before award of roofing work.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain primary products, including each type of roofing sheet, bitumen, and membrane flashings, from a single manufacturer. Provide secondary products as recommended by manufacturer of primary products for use with roofing system specified.

B. Installer Qualifications: Engage an experienced Installer (Roofer) who is certified by modified bituminous sheet roofing system manufacturer as qualified to install

manufacturer's roofing materials.

1. Installer's Field Supervision: Require Installer to maintain a full-time supervisor/foreman on job site during times that modified bituminous sheet roofing work is in progress and who is experienced in installation of roofing systems similar to type and scope required for this Project.

C. Preapplication Conference: Before installing roofing system, conduct conference at Project site. Notify participants at least 5 working days before conference.

1. Meet with Owner; Architect; Owner's insurer, if applicable; testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck Installer; lightning protection system installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and attachment to structural members.

4. Review loading limitations of deck during and after roofing.

5. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.

6. Review governing regulations and requirements for insurance, certifications, and inspection and testing, if applicable.

7. Review temporary protection requirements for roofing system during and after installation.

8. Review roof observation and repair procedures after roofing installation.

9. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

D. Submit certification by the manufacturer of the system materials used that these Specifications and the Drawing Details are acceptable to them for the deck and surfacing to which they are to be applied.

1. If details for any manufacturer's systems proposed in the Contract Documents are not acceptable to the manufacturer, submit corresponding details proposed for the particular application, together with the manufacturer's reasons for not accepting the conditions depicted in the Specifications or Drawings. No alternate details will be considered without evidence of valid objections on the part of the manufacturer to the contract requirements.

E. Inspection: Prior to, during installation and at completion of the installation, an inspection shall be made by a representative of the manufacturer in order to ascertain that the roofing system has been installed according to their published specifications, standards and details.

1. Warranty will be issued upon approval of the installation.

2. Manufacturer's inspection reports shall be forwarded to the Architect concurrently with Applications for Payment for the periods during which they occurred.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store and handle roofing sheets in a dry, well-ventilated, weathertight place to ensure no possibility of significant moisture pickup. Store rolls of felt and other sheet materials on end on pallets or other raised surface.

B. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather or other moisture sources.

C. Handle and store materials or equipment in a manner to avoid significant or permanent deflection of deck.

D. Protect roofing insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

1.08 PROJECT CONDITIONS

Weather Condition Limitations: Proceed with roofing work only when existing and forecasted weather conditions will permit unit of Work to be installed in accordance with manufacturers' recommendations and warranty requirements.

1.09 ROOFING MEMBRANE WARRANTY AND MEMBRANE FLASHING ENDORSEMENT

A. Furnish written warranties with membrane flashing endorsements which shall extend from the Date of Substantial Completion as certified by the Architect for a period set forth below, and which shall cover any and all necessary labor and material for repair or replacement work required to keep and maintain the roofing membrane and membrane flashing work in a watertight and first class condition, at no additional cost to the Owner. Warranties and endorsements shall not be pro-rated by design or inflation. These warranties and endorsements shall be limited to cover ordinary wear and tear caused by the elements (including windstorms producing up to FM 1-135 wind uplift forces) and to defects due to faulty materials or workmanship.

These warranties shall be furnished independently by each of the following:

1. For a period of two (2) years after the Date of Substantial Completion of the project, by:
   a. The roofing installer.

2. For a period of twenty (20) years after the Date of Substantial Completion of the project (20 year no-dollar-limit warranty), by:
   a. The manufacturer of the roofing products.

3. For a period of two (2) years after the Date of Substantial Completion of the Project, by:
   a. The Contractor.

B. Damages to the building or to its contents during construction and prior to the date of completion of the roofing work shall be borne by the responsible individuals (or firms), excepting the manufacturer, if caused by defects in workmanship. This includes the Contractor and the Roofing Installer.

C. Damages to the building or to its contents due to defect in workmanship after the Date of Substantial Completion and for a period of two (2) years thereafter shall be severally borne by the responsible firm(s) (Contractor, Roofing Installer), excepting the manufacturer.

D. The above described warranties and endorsements shall be delivered to the Owner (via the Architect) by the Contractor prior to any obligation of the Owner to reduce the retainage on payments due the Contractor.

E. No lesser terms of the "standard" warranties or guarantees by the manufacturer shall apply to this Contract if less stringent than the requirements of this Section. The requirements set forth herein shall be set forth in writing in the signed warranties provided to the Owner under this Contract.

PART 2 – PRODUCTS

2.01 ROOF INSULATION

A. General

1. Two layer insulation system with a cover board is required, consisting of polyisocyanurate board as the base layer and the top layer, with a 1/4 "thick figerglass-faced, moisture-resistant gypsum core cover board. Provide tapered top layer on areas where roof structure is level, and at crickets.
   a. Over metal decks, screw base layer to deck. Mop top layer to base layer. Mop cover board to top layer.

2. Polyisocyanurate-foam board insulation: flat and tapered rigid boards of minimum 2.0 pcf density polyisocyanurate-based foam core, bonded to Type II roofing felt facer sheets, complying with ASTM C 1289. Provide in thickness indicated. Provide in manufacturer's standard sizes.
   a. Provide 1-1/2 inch thick boards, minimum.
   b. Provide tapered system to maintain a constant slope of ¼ inch per foot, minimum, in directions indicated on drawings.
   c. Provide tapered crickets and saddles where indicated on drawings with a minimum slope of 1/4" per foot.
   d. Tapered system fill shall consist of polyisocyanurate boards.

3. Glass Mat-Faced Gypsum Cover Boards: Flat, rigid, 1/4" thick, moisture-resistant gypsum core boards.
   a. Provide G-P Gypsum "DensDeck DuraGuard Roof Board."

2.02 MODIFIED BITUMINOUS SHEET ROOFING SYSTEM

A. Insulated-Deck, Modified Bitumen membrane/Fully Adhered (IMBF):

1. General:
   a. Performance: provide roofing materials recognized to be of generic type and manufacturer indicated and tested to show compliance with indicated

performances.

2. Membrane Manufacturer:
   a. General: Only the modified bitumen roofing manufacturers listed herein may provide the products specified.
   b. For all applications, provide a 2-ply SBS modified bitumen elastomeric roofing system for mop-down and torch-down installation over rigid insulation. The materials of the membrane roofing shall conform to the following requirements:
      i. Base Sheet (for plywood decks only): smooth, fiberglass scrim reinforced/polyester mat composite impregnated with SBS modified bitumen. Minimum thickness 91 mils: minimum weight per square 60 lbs.
      ii. First Ply-smooth SBS fiberglass or polyester reinforced, 90 mils minimum thick membrane, weight 72 lbs. per 100 sq. ft. (average).
      iii. Cap Ply - SBS fiberglass reinforced, 114 mils minimum (average) thickness with white granular, “cool roof” surface. Weight 96 lbs. per 100 sq. ft. minimum (average).
      iv. Flashings - SBS fiberglass reinforced, 146 mils (minimum) cap thickness with aluminum foil surface. Weight 96 lbs. per 100 sq. ft. (minimum) cap weight.
   c. Modified Bitumen Roofing Manufacturers: Subject to conformance to specifications including warranty requirements, provide one of the following systems:
      i. Siplast Paradiene 20/30 CR FR TG, consisting of a base sheet of Siplast Paradiene 20 PR mechanically fastened to deck substrate (plywood decks only), an inter ply of Paradiene 20 Base; and a cap ply of Paradiene 30 CR FR TG Cap, with Veral aluminum-surfaced flashing system applied over Paradiene 20 flashing base ply.
      ii. Soprema – Elastophene 180 PS Base and Soprastar Flam Granules Cap, with Sopralast 50 TV ALU cap flashing applied over Sopralene Flam 180 base flashing.

   d. The Contractor shall immediately, upon application of roofing membrane cap plies, install loose white granules into exposed black asphalt. Professional workmanship shall be required to keep the roof’s white cap sheet and flashing looking aesthetically pleasing upon completion of Project.
      Voids, air pockets, ridges, and wrinkles are not acceptable as a finished product.

3. Related Materials:
   a. Pipes or vents shall be jacketed. Jackets shall be formed from minimum 4 lb. Lead sheet with minimum 4 in. flanges and extend into the vent a minimum of 1-1/2 in.

2.03 MISCELLANEOUS MATERIALS

A. Wood Members: Comply with requirements of Division 6 Section "Rough Carpentry" for wood members indicated as roofing system work.

B. Cants: Perlite board, ASTM C 728.

C. Tapered Edge Strips: Rigid perlite board, ASTM C 728.

D. Walkway Protection Boards: Mineral-surfaced ½" thick bituminous composition panels, or

5/16" thick chopped rubber composition panels, manufactured specifically for hot bituminous application on modified bitumen sheet roofing as a protection course for foot traffic. Subject to compliance with requirements, provide one of the following:

1. Carey-Tread, Celotex Corp.
2. White Walk, W. R. Meadows, Inc.
3. Paratread, Siplast.
4. Soprawalk, Soprema.

E. Substrate Joint Tape: 6 or 8 inch wide, coated, glass-fiber joint tape.

F. Mastic Sealant: Polyisobutylene (plain or bituminous modified), nonhardening, nonmigrating, nonskinning, and nondrying.

G. Asphalt Primer: ASTM D41.

PART 3 – EXECUTION

3.01 EXAMINATION

A. With installer present, examine substrate surfaces to receive modified bitumen sheet roofing system and associated work and conditions under which roofing will be installed. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

1. Verify that flatness and fastening of metal roof decks comply with installation tolerances specified in Division 5 Section “Steel Deck.”

2. Verify that roof openings and penetrations are in place and set and braced and that roof drains are properly clamped into position.

3. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at roof penetrations and terminations and match the thicknesses of insulation required.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install modified bituminous membrane roofing system according to roofing system manufacturer’s written instructions and applicable recommendations of NRCA/ARMA’s “Quality Control Recommendations for Polymer Modified Bitumen Roofing.”

B. Start installation of modified bituminous membrane roofing in presence of roofing system manufacturer’s technical personnel.

C. Cooperate with inspection and test agencies engaged or required to perform services in connection with installing modified bitumen sheet roofing system.

D. Protect other work from spillage of modified bitumen roofing materials, and prevent liquid materials from entering or clogging drains and conductors. Replace or restore other work damaged by installation of modified bituminous sheet roofing system work.

E. Coordinate installing roofing system components so that insulation and roofing plies are not exposed to precipitation or left exposed overnight. Provide cut offs at end of each day's work to cover exposed ply sheets and insulation with a course of coated felt with joints and edges sealed with roofing cement. Remove cut offs immediately before resuming work.

F. Asphalt Bitumen Heating: Heat and apply bitumen according to EVT Method as

recommended by NRCA. Do not raise temperature above minimum normal fluid-holding temperature necessary to attain EVT (plus 25 deg F, at point of application) more than 1 hour prior to time of application. Determine flash point, finished blowing temperature, EVT, and fire-safe handling temperature of bitumen either by information from manufacturer or by suitable tests. Do not exceed recommended temperature limits during bitumen heating. Do not heat bitumen to a temperature higher than 25 deg F below flash point. Discard bitumen that has been held at temperature exceeding finished blowing temperature (FBT) for more than 3 hours. Keep kettle lid closed except when adding bitumen.

G. Bitumen Mopping Weights: For interply mopping, apply bitumen at the rate of 25 lb of asphalt per roof square (plus or minus 25 percent on a total-job average basis).

H. Substrate Joint Penetrations: Prevent bitumen from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction. Where mopping is applied directly to substrate, tape substrate joints or, where steep asphalt is used, hold asphalt back 2 inches from both sides of the joint.

I. Cutoffs: At end of each day's roofing installation, protect exposed edge of incomplete work, including ply sheets and any insulation. Provide temporary covering of two plies of No. 15 roofing felt set in full moppings of hot bitumen; remove at beginning of next day's work.

3.03 BASE-SHEET INSTALLATION ON PLYWOOD DECKS

A. Install lapped base-sheet course, extending sheet over and terminating as shown on drawings. Attach base sheet as follows:

1. Mechanically fasten to substrate. Space fasteners as required by specified wind uplift pressure.

3.04 ROOF INSULATION INSTALLATION

A. Mechanical Fastening System for Roof Insulation:

1. Provide an FM-approved highly corrosion-resistant screw-and-plate mechanical fastening system for attachment of base layer of rigid board roof insulation to corrugated steel roof decking substrates, as acceptable to roof membrane system manufacturer, and as specified herein.

2. Self-drilling type screw fasteners shall be designed to provide maximum pullout resistance with minimum driving torque, and to prevent fastener backout during installation. Provide stainless steel, zinc alloy or acceptable coated fastener in combination with metal or thermoplastic plate for entire assembly, and as standard for selected fastening system; zinc-plated fasteners are not acceptable.

B. Install second (top) layer of insulation in a solid mopping of hot Type IV asphalt, applied with an EVT of 400 to 450 degrees F. and at a rate of 25 pounds per 100 square feet minimum. Joints of second layer shall be staggered from joints of first layer a minimum of 12 inches in each direction.

C. Install cover board in a solid mopping of hot Type IV, applied with an EVT of 400 to 450 degrees F. and at a rate of 25 pounds per 100 square feet minimum. Joints of cover board shall be staggered from joints of top insulation layer by a minimum of 6 inches in each direction.

1. Install boards with long joints in continuous straight lines, perpendicular to roof

slopes with end joints staggered between rows. Tightly butt cover boards together.

D. Protection During Application:

1. Do not leave installed insulation exposed to the weather. Cover and waterproof at once. Edges exposed at the end of the work day shall be temporarily sealed with an appropriate water cut off.
2. Should installed insulation get wet, replace panels with dry insulation. Completed insulation and roofing shall be protected carefully against damage from roof traffic.

3.05 ROOF MEMBRANE BASE PLY INSTALLATION

A. Shingling Plies: Install membrane with ply sheets shingled uniformly to achieve required number of membrane plies throughout. Shingle in proper direction to shed water on each large area of roofing, where slope is significant (over 2 inch per foot).

B. Cant Strips/Tapered Edge Strips: Install preformed 45-degree cant strips at junctures of modified bituminous sheet roofing system membrane with vertical surface. Provide preformed, tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

C. Base Sheet: Install one lapped course of base sheet. Mop to substrate with hot roofing asphalt, applied at rate required by roofing system manufacturer.

D. All laps and seams must be tight and properly sealed.

1. Seal natural voids (the area just inside the lap line of top sheet).

2. Fully adhere the lap surface and bead to form a smooth transition.

3. Bond and seal bridging seams.

4. Asphalt flow at side and head laps must be 3/8 in. maximum.

5. Extend all plies of roofing membranes plies continuous and uncut beneath scuppers. Mop strip plies into scupper.

6. Utilize minimum 3 inch side and end laps. Stagger end laps a minimum of 3 feet.

3.06 ROOF MEMBRANE CAP PLY INSTALLATION

A. Once the base ply has been completed and does not show any defects, install the cap ply.

B. Unroll top ply starting from the low point of the roof. Care must be taken to insure good alignment of the first roll (parallel with the edge of the roof). A 45-degree cut shall be made on the selvage edge of underlying membrane prior to application to insure a good seal between the membrane.

C. Torch weld cap ply in accordance with recommendations of roof system manufacturer, onto the base ply membrane.

1. During this application, simultaneously melt both surfaces forming an asphalt bead that pushes out in front of the top sheet.

D. Do not burn the membrane's and their respective reinforcements.

E. Stagger base ply and cap ply seams a minimum of twelve (12) inches.

F. Cap ply shall have side laps of three (3) inches and end laps of six (6) inches.

G. Ensure the two membranes are perfectly welded, without air pockets, wrinkles, fish mouths or tears.

H. After installation of the cap ply, check all lap seams on the top ply using the edge of a hot trowel. Correct any defect.

I. During installation, avoid asphalt seepage greater than ¼ inch at seams.

1. Cover any asphalt seepage with a sprinkling of loose mineral granules in color to match membrane.

J. Stage all work to move off the completed cap ply. Do not allow material or foot traffic over completed cap ply.

3.07 MEMBRANE FLASHING AND STRIPPING

A. Install modified bituminous aluminum foil surfaced flashing at cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof. Torch apply modified bituminous base flashing system to substrate. Extend flashing a minimum of 6 inches onto modified bituminous sheet roofing.

B. Install modified bituminous stripping where metal flanges are set on roofing according to roofing manufacturer's instructions.

C. Counter-Flashings: Counter-flashings, cap flashings, expansion joints, and similar work to be coordinated with modified bitumen roofing work are specified in other Sections.

3.08 ROOF WALKWAYS

Composition Board Walkways: Provide walkway protection boards at locations shown, using units of size shown or, if size not shown, using units of manufacturer's standard size. Set units in additional pour coat of hot bitumen.

3.09 LIGHTNING ARRESTOR BASE ATTACHMENT

Provide 9" x 9" pads at each point of attachment for lightning rod bases and cable bases to roofing membrane. Pads shall be cap sheet or walkway material as required by roof manufacturer. Install in accordance with roof manufacturer's instructions.

3.10 PROTECTING ROOFING

A. Protect roofing during remainder of construction period. At end of construction period, or at a time when remaining construction will in no way affect or endanger roofing, inspect roofing and prepare a written report, with copies to Architect and Owner, describing nature and extent of deterioration or damage found.

B. Repair or replace (as required) deteriorated or defective work found at time of above inspection to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

END OF SECTION

SECTION 07620
SHEET METAL FLASHING AND TRIM

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section included the following:

1. Aluminum flashing and counterflashing components.
2. Aluminum copings and edge metal.
3. Fascia components
4. Gutters and downspouts.

1.03 QUALITY ASSURANCE

The Architectural Sheet Metal Manual as published by the Sheet Metal and Air Conditioning Contractors National Association, Inc., latest edition, and hereinafter referred to as “The SMACNA Manual” shall be used as the standard reference of quality.

1.04 SUBMITTALS

A. Product Data: Manufacturer’s technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

B. Samples: Submit samples of the following flashing, sheet metal, and accessory items:

1. 8-inch-square samples of specified sheet materials to be exposed as finished surfaces.
2. 12-inch-long samples of factory-fabricated products exposed as finished work. Provide complete with specified factory finish.

C. Shop Drawings: Showing layout, profiles, methods of joining, and anchorage details, including major counterflashings, trim/fascia units, gutters and downspouts. Provide layouts at 1/4-inch scale and details at 3-inch scale.

1.05 WARRANTY

A. Furnish a written warranty from the Date of Substantial Completion of the project for a period of time set forth and which shall cover any and all necessary repair or replacement work required to keep and maintain metal flashing materials in a watertight and first class condition, at no additional cost to the Owner. Such warranty shall be limited to cover ordinary wear and tear caused by the elements (including storm weather) and/or deficient or faulty materials or workmanship. This warranty shall be furnished independently by each of the following:

1. For a period of two (2) years after the Date of Substantial Completion of the project by:
   a. The fabricator of the sheet metal work.

b. This Roofing Contractor.

2. For a period of one (1) year after the Date of Substantial Completion by:
   a. The General Contractor.

B. Damages to the building or to its contents during construction and prior to the Date of Substantial Completion, shall be severally borne by the responsible individuals or firms listed above (excepting the manufacturer), if caused by defects in workmanship.

C. Damages to the building or to its contents due to defects in workmanship for a period of two (2) years after the Date of Substantial Completion shall be severally borne by the responsible firms listed above (excepting the manufacturer).

D. The obligations and liabilities under the terms of these warranties shall be extended to the obligations of the General contractor's Performance Bond for a period of time not less than the terms of the Performance Bond nor in any event for a time period of one (1) year following the Date of Substantial Completion, whichever is longer.

E. The above described warranty shall be delivered to the Owner (via the Architect) by the Contractor.

F. Sheet Metal Coating: Metal manufacturer shall warrant fluorocarbon coating against peeling, blistering, checking, or cracking; against chalking in excess of numerical rating of 8 when measured in accordance with ASTM D659; and against fading in excess of 5 NBS units.

1. Warranty Period: 20 years from the date of Substantial Completion.

1.06 PROJECT CONDITIONS

Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 – PRODUCTS

2.01 METAL MATERIALS

A. Metal material used in flashing and sheet metal work including gutters and downspouts shall be .050" aluminum sheet, ASTM B 209, alloy 3003 or 3105, Temper H-14 with Kynar 500 fluoropolymer coating unless specifically designated otherwise on the Drawings.

1. Cleats used to secure copings and edge metal shall be .063" aluminum sheet, mill finish.

2. Flashing that is completely concealed can be mill finish in lieu of Kynar 500 coating.

3. Isolate aluminum from other materials, including wood, concrete, masonry and dissimilar metals by a protective bituminous coating, SSPC – Paint 12, containing no asbestos or sulfur not less than 15 mils dry film thickness; or, by elastomeric underlayment, rubber or other techniques approved by the Architect.

B. Where galvanized steel sheet metal is required on the Drawings, provide 24 gauge, zinc

coated sheet steel, hot dipped galvanized carbon steel with 0.2% copper, complying with ASTM A 525 and ASTM 526 G90 hot dip galvanized, of American manufacturer.

2.02 MISCELLANEOUS MATERIALS

A. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

1. Nails and screws shall have sufficient length to penetrate all metal and fabric materials and into wood support by ¾" minimum and shall be capable of 40 lb. each minimum initial withdrawal.

B. Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry-film-thickness per coat.

C. Sealant Compound:

1. For sealing joints in metal flashings, copings, etc., One-Part Silicone Building Sealant conforming to ASTM C920, Type S, Grade NS, Class 40. Provide one of the following:
   a. Dow Corning 795 Silicone Building Sealant.
   b. General Electric Silpruf Sealant.
   c. Tremco Spectrem 2 Silicone Sealant.

2. Sealant color shall be selected by Architect from manufacturer's full range of standard colors.

D. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning, non-drying, non-migrating sealant.

E. Epoxy Seam Sealer: 2-part non-corrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior non-moving joints including riveted joints.

F. Elastomeric Underlayment: 40 mil thick polyethylene bodied synthetic rubber-based adhesive membrane. Provide Bituthene Ice and Water Shield, W.R. Grace and Co.

G. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gage required for performance.

1. Aluminum Copings: Provide continuous aluminum cleats as indicated on Drawings.

H. Roofing Cement: Asbestos free, asphaltic complying with ASTM D4586.

2.03 METAL FINISHES

A. Fluoropolymer Coating: Manufacturer's standard two-coat, thermo-cured, full-strength 70 percent "Kynar 500" coating consisting of a primer and a minimum 0.75 mil dry film thickness top coat with a total minimum dry film thickness of 0.9 mil and 30 percent reflective gloss when tested in accordance with ASTM D523.

1. Durability: Provide coating that has been field tested under normal range of

weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of No. 8 in accordance with ASTM D659; and without fading in excess of 5 NBS units.
a. Applications: All exposed aluminum components.

2. Applicator: Approved licensee of coating manufacturer.

3. Color: As selected by Architect from manufacturer's full range of standard colors.

2.04 FABRICATION

A. Fabrication, General: Shop fabricate to greatest extend possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

B. Fabricate non-moving seams in sheet metal with flat-lock seams. Seal aluminum seams with epoxy metal seam cement and, where required for strength, rivet seams and joints.

C. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA Standards.

D. Coat back-side of fabricated sheet metal with 15-mil sulfur-free bituminous coating, SSPC-Paint 12, where required to separate metals from corrosive substrates including cementitious materials or absorbent materials; or provide other permanent separation.

E. Provide for thermal expansion of running sheet metal work, by overlaps of expansion joints in fabricated work. Where required for watertight construction, provide hooked flanges filled with polyisobutylene mastic for 1 inch embedment of flanges. Space joints at intervals of not more than 30 feet for aluminum. Conceal expansion provisions where possible.

PART 3 – EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Anchor work securely in place with noncorrosive fasteners, adhesives, setting compounds, tapes and other materials and devices as recommended by manufacturer of each material or system. Provide for thermal expansion and building movements. Comply with recommendations of the manufacturer, approved jurisdiction having authority and the "Architectural Sheet Metal Manual" by SMACNA.

B. Underlayment: Where aluminum is to be installed directly on elastomeric, cementitious or wood substrates, install underlayment.

C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

D. Install reglets to receive counterflashing in manner and by methods indicated on Drawings.

E. Install counterflashings in reglets, either by snap-in seal arrangement or by welding in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.

F. At roof fascia, drip edges and copings, install concealed splice plates, min. 6” wide, matching fascia/drip edge finish and color. Seal with two beads of elastomeric sealant leaving a ¼” gap between abutting coping/fascia ends over the splice plate to allow for thermal movement.

G. Performance: Watertight and weatherproof performance of flashing and sheet metal work is required.

3.02 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Protection: Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than normal weathering at time of Substantial Completion.

END OF SECTION

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SECTION 07920
JOINT SEALANTS

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes joint sealants for the following locations:

1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below:
   a. Control joints in unit masonry including brick work.
   b. Perimeter joints between materials listed above and frames of doors and windows.
   c. Control and expansion joints in ceiling and overhead surfaces.
   d. Other joints as indicated.

2. Exterior joints in horizontal traffic surfaces as indicated below:
   a. Control and isolation joints in cast-in-place concrete slabs.
   b. Other joints as indicated.

3. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints of exterior openings where indicated.
   c. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
   d. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
   e. Other joints as indicated.

4. Interior joints in horizontal traffic surfaces as indicated below:
   a. Control and expansion joints in cast-in-place concrete slabs.
   b. Other joints as indicated.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 7 Section “Flashing and Sheetmetal” for sealants used in sheetmetal work.
2. Division 8 Section “Glass and Glazing” for sealants used in glazing.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract.

B. Product data from manufacturers for each joint sealant product required.

C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

D. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

E. Provide and maintain a file of manufacturer’s instructions for each of the products used.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.07 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
2. When joint substrates are wet.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.08 SEQUENCING AND SCHEDULING

Sequence installation of joint sealants in existing interior concrete pavement to occur prior to application of clear concrete sealing compound where indicated or scheduled on drawings.

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors: Provide color of exposed joint sealants to comply with the following:

1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2.02 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants that comply with ASTM C 920, including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses.

B. Products: Subject to compliance with requirements, provide one of the products specified in color selected by Architect from manufacturer’s full color range.

C. Single Part, Nonsag, Silyl-Terminated Polyether Sealant for use in sealing hollow metal door frames to adjoining wall surfaces, roof flashing and edge metal installations, and general purpose exterior sealing except where silicone is specified:

1. “Sonolastic 150”; BASF Construction Chemicals.
2. “Novalink”; ChemLink.

D. Single Part Pourable Urethane Sealant for use in horizontal joints in floor slabs, sidewalks, and concrete pavement. Provide one of the following:

1. “Vulkem 45"; Mameco International, Inc.
2. “NR-201 Urexpan”; Pecora Corp.
3. “Sonolastic SL1"; BASF Construction Chemicals.

E. Medium-Modulus Neutral-Curing Silicone Sealant for use in all exterior masonry control and expansion joints, and for perimeter sealing of aluminum windows and storefronts.

1. 791; Dow Corning (accommodates joint movement of ±50 percent).
   a. Apply to masonry and concrete with Dow Corning 1200 Primer.

2.03 LATEX JOINT SEALANTS

A. Acrylic-Emulsion Sealant: Manufacturer’s standard, one part, nonsag, mildew-resistant, acrylic-emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent. Provide at intersections of interior door and window frames and adjoining wall surfaces.

1. “AC-20"; Pecora Corp.
2. “Sonolac”; Sonneborn Building Products.

2.04 ACOUSTICAL JOINT SEALANT

A. Acoustical sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2. Install at perimeter joints around all electrical boxes in acoustically-rated walls and all drywall ceilings throughout Music Building 1 and Building 1 Addition, and elsewhere as indicated on drawings.

B. Manufacturer – Provide one of the following:

- AC-20FTR Acoustical and Insulation Sealant; Pecora Corporation
- Sheetrock Acoustical Sealant; USG Corp.

2.05 MILDEW – RESISTANT SILICONE SEALANT

A. One-part mildew-resistant interior sealant designed to seal nonporous interior building surfaces including tubs, sinks, lavatories, and urinals at perimeter intersection with finished walls.

B. Manufacturer – Provide one of the following:

- Dow Corning 786 Mildew-Resistant Silicone Sealant.
- Sanitary SCS1700 Sealant; G.E. Silicones

2.06 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of either material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.

2. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf (40 kg/cu. m) and tensile strength of 35 psi (240 kPa) per ASTM D 1623, and with water absorption less than 0.02 g/cc per ASTM C 1083.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.07 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 – EXECUTION

3.01 EXAMINATION

Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form release agents from concrete.

4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   a. Do not leave gaps between ends of joint fillers.
   b. Do not stretch, twist, puncture, or tear joint fillers.
   c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

E. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.04 CLEANING

Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 08112
HOLLOW METAL DOORS AND FRAMES

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Hollow-metal doors.
2. Hollow-metal frames.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 04200: Unit Masonry, for building anchors into and grouting frames in masonry construction.
2. Section 08211: Flush Wood Doors, for solid-core wood doors installed in steel frames.
3. Section 08800: Glazing, for glass in steel doors and sidelights.
4. Section 09900: Painting, for field painting primed doors and frames.
5. Division 8 Section for door hardware and weatherstripping.

1.03 DEFINITIONS

Minimum Thickness: Minimum thickness of base metal without coatings.

1.04 SUBMITTALS

A. Approval Numbers: Provide State of Florida Product Approval Numbers for exterior door assemblies.

B. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and finishes for each type of steel door and frame specified.

C. Shop Drawings:

1. In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:
   a. Elevations of each door design.
   b. Details of doors, including vertical and horizontal edge details.
   c. Frame details for each frame type, including dimensioned profiles.
   d. Details and locations of reinforcement and preparations for hardware.
   e. Details of each different wall opening condition.
   f. Details of anchorages, accessories, joints, and connections.

2. State of Florida Product Approval, or NOA certificate must be applicable to actual door and frame sizes indicated on drawings.

3. Shop drawings shall indicate hardware locations for doors and frames.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.

1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.07 PROJECT CONDITIONS

Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.08 COORDINATION

Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- Amweld International, LLC
- Ceco Door Products
- CURRIES Company; an ASSA ABLOY Group Company.
- Hollow Metal, Inc.
- Republic Builders Products Company.
- Steelcraft; an Ingersoll-Rand Company.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.

D. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.

2.03 HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.

1. Design: As indicated on Drawings.

2. Core Construction: Manufacturer's insulated door core: polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.

3. Vertical Edges for Single-Acting Doors: Beveled edge
   a. Beveled Edge: 1/8 inch in 2 inches.

3. Top and Bottom Edges: Closed with flush (at top), inverted (at bottom), 0.042-inch-thick end closures or channels of same material as face sheets

5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Interior Doors: Face sheets fabricated from A-60 galvannealed steel sheet. Provide doors complying with requirements indicated below by referencing SDI A250.8 for level and model and SDI A250.4 for physical-performance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless), 16 gage (.053 inch).

C. Exterior Doors (Hurricane Resistant): Face sheets fabricated from A-60 galvennealed steel sheet. Provide doors complying with requirements indicated below by referencing SDI A250.8 for level and model and SDI A250.4 for physical level:

1. Level 4 and Physical Performance Level A (Maximum Duty), Model 2 (Seamless), 14 gage (.067 inch).

2. Exterior doors shall be hurricane-resistant and tested to the following windstorm or severe weather performance standards:
   a. ANSI A250.13
   b. ASTM E330
   c. TAS201, TAS202, TAS203

3. Exterior doors shall be rated to resist the following minimum pressures:
   a. Single Doors: min. (+38.6 psf; -47.6 psf) please confirm with structural wind pressures.

D. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:

1. Hinges: Minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
2. Pivots: Minimum 0.167 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick.
4. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.04 HOLLOW METAL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Interior Frames: Fabricated from A-60 galvannealed steel sheet.

1. Fabricate frames with mitered or coped and continuously welded face corners.
2. Frames for Level 3 Steel Doors: 16 gage (.053 inch) thick steel sheet.

C. Exterior Frames: Fabricated from A-60 galvannealed steel sheet.

1. Fabricated frames with mitered or coped continuously welded face corners.
2. Frames for Level 4 Steel Doors: 14 gage (.067 inch) thick steel sheet.

D. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:

1. Hinges: Minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
2. Pivots: Minimum 0.167 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick.
4. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.

E. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

F. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long.

G. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

H. Plaster Guards: Formed from same material as frames, not less than 0.016-inch thick.

2.05 FABRICATION

A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

C. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.

3. Plaster Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete or masonry.

4. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. Provide three anchors per jamb.

5. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.

1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware.

2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware according to ANSI A250.8.

2.06 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish standard steel door and frames after assembly.

B. Galvannealed Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory.

B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install standard steel frames for doors of size and profile indicated. Comply with A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   b. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Hollow Metal Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.

B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

D. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08311
ACCESS DOORS AND FRAMES

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Access doors and frames for ceilings.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, materials, individual components and profiles, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 – PRODUCTS

2.01 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

- Access Panel Solutions.
- Acudor Products, Inc.
- Alfab, Inc.
- Babcock-Davis.
- Cendrex Inc.
- Jensen Industries; Div. of Broan-Nutone, LLC.
- J. L. Industries, Inc.; Div. of Activar Construction Products Group.
- Karp Associates, Inc.
- Larsen's Manufacturing Company.
- Milcor Inc.

- Nystrom, Inc.
- Williams Bros. Corporation of America (The).

C. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

D. Flush Access Doors with Concealed Flanges:

1. Basis-of-Design Product: Where indicated on Drawings.
2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
3. Locations: Ceiling.
4. Door Size: 20” x 20”. Min.
5. Metallic-Coated Steel Sheet for Door.
a. Finish: Factory finish.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Manufacturer's standard.
8. Hardware: Lock.

2.02 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.

2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.

3. Provide mounting holes in frames for attachment of units to metal or wood framing.

4. Provide mounting holes in frame for attachment of masonry anchors.

2.03 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

2. Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry-film thickness of 1 mil (0.025 mm) for topcoat.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.03 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

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SECTION 08331
OVERHEAD COILING DOORS

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following types of overhead coiling doors:

1. Service doors.

1.03 DEFINITIONS

Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components.

1. Wind Load: For exterior doors, provide overhead coiling door system, including anchorage, capable of withstanding wind-load design pressures calculated according to the requirements of the current ASCE 7 volume and as indicated on structural drawings.
   a. Positive pressure = Refer to structural drawings for design pressures.
   b, Negative pressure = Refer to structural drawings for design pressures.

2. Missile Impact Loads: Provide sectional overhead door system including anchorage to building capable of withstanding large and small missile impact loads in accordance with the Florida Building Code, Section 1626 – Impact Tests for Windborne Debris.

3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

C. Operation-Cycle Requirements: Design overhead coiling door components and operator to operate for not less than 100,000 cycles.

1. Provide tamperproof cycle counter.

1.05 SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory. Include

details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:

1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.

1. Drawings must include details for anchorage of door tracks to building to meet wind and impact load requirements. Indicate fastener or weld type, size, and spacing for attachment to concrete columns between doors and to masonry walls as applicable.

2. Shop drawings shall be signed and sealed by a Florida registered professional engineer.

3. Shop drawings shall include Dade County, Florida product certification indicating that the doors comply with the South Florida Building Code (or Florida Building Code) and have been approved by the Product Control Division of the Dade County Building Code Compliance Office. Indicate acceptance number.

4. Wiring diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer’s finish charts showing full range of colors and textures available for units with factory-applied finishes.

D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1. Curtain Slats: 12-inch length.
2. Bottom Bar: 6-inch length.
3. Guides: 6-inch length.

E. Qualification Data: For qualified installer.

F. Maintenance Data: For overhead coiling doors and operators to include in maintenance manuals.

G. State of Florida Product Approval Number documentation.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling door manufacturer for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors through a single source manufacturer.

1. Obtain operators and controls from the overhead coiling door manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Specifications are based upon Overhead Door Corporation's 620 Series Rolling Door with Model RDB Motor Operator. Subject to compliance with requirements, equivalent products by one of the following may also be considered upon receipt of a properly submitted substitution request not less than 10 days prior to bid opening. Such requests must be accompanied by a copy of a shop drawing reflecting State of Florida Product Approval and compliance with the wind load pressures as noted for the specified door size.

- Alpine Overhead Doors, Inc.
- The Cookson Company.
- Cornell Iron Works Inc.
- Dynamic Closures (1995) LTD.
- Mahon Door Corp.
- McKeon Rolling Steel Door Company, Inc.
- Raynor Garage Doors.
- Southwestern Steel Rolling Door Co.
- Windsor Door; A United Dominion Company.

2.02 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtain: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of material thickness recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Structural-quality, cold-rolled steel sheets complying with ASTM A 653, with G90 zinc coating.
   a. Galvanized Steel Sheet Thickness: Not less than 22 gage.
   b. Profile: Flat, 2 5/8" wide.

B. Endlocks and Windlocks: Malleable-iron castings galvanized after fabrication, secured to curtain slats with galvanized rivets, or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Bottom Bar: Consisting of 2 angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick, galvanized steel to match type and finish of curtain slats.

1. Bottom Seal: Provide a replaceable, adjustable, continuous, compressible gasket of rubber, or neoprene, between angles or fitted to shape, as a cushion bumper for door bottom.

D. Retain paragraph above for service doors. Verify and retain paragraph below for counter doors of most manufacturers. Revise paragraphs if both types of doors are required.

E. Curtain Jamb Guides: Fabricate curtain jamb guides of galvanized steel angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16-inch- thick, galvanized steel sections complying with ASTM A 36, and ASTM A 123. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain and a continuous bar for holding

windlocks.

1. Exposed finish shall be powder coat to match slats.

2.03 HOODS AND ACCESSORIES

A. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head and act as weather-seal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.

1. Fabricate steel hoods, for steel doors, of not less than 0.028-inch (24 gage) thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653.
2. Shape: Round or square.
3. Finish: Galvanized with powder coat finish to match slats.

B. Weather-seals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and at top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch- thick, replaceable, continuous sheet secured to inside of curtain coil hood.

1. In addition, provide replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weather-tight installation.

C. Locks: Provide interior slide bold lock for electric operation with interlock switch.

2.04 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to door curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

2.05 FINISHES, GENERAL

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.06 STEEL AND GALVANIZED STEEL FINISHES

A. Powder-Coat-Applied Finish: Apply manufacturer's standard powder-coat-applied finish consisting of primer and topcoat(s) according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.

1. Color and Gloss: As selected by Architect from manufacturer's full range of colors and glosses.

2.07 ELECTRICAL DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Usage classification: heavy duty.
2. Comply with NFPA 70.
3. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac, or dc.

B. Usage classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each floor.

C. Door Operator Location(s): Operator location indicated for each door.

1. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.

D. Electric Motors: Provide open-drip-proof type motor and controller with NEMA ICS 6, Type 1 enclosure.

1. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.

2. Motor Size: 1/2 H.P., minimum. Operator shall start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec and not more than 12 in./sec. without exceeding nameplate ratings or service factor.

3. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer’s standard unless otherwise indicated.

4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor

controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and re-verses downward door travel. Provide both of the following:

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction is door opening without contact between door and obstruction.
   a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained pressure on close button.

2. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
   a. Self-monitoring Type: Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.

G. Remote-Control Station: Momentary-contact, three button control station with push-button controls labeled "Open", "Close", and "Stop".

1. Interior units, full-guarded, surface-mounted, heavy-duty, with general purpose NEMA ICS 6, Type 1 enclosure, three per door as indicated on drawings.

H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual chain hoist operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit -switch adjustment and without affecting emergency manual operation.

K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with regulatory requirements for accessibility.

L. Radio control system: Provide universal radio control system. Provide one UHF radio receiver for each door operator. Provide two, two-channel portable transmitters. Program transmitters in accordance with Owner's directions at time of installation.

1. Provide one coaxial antenna per door installed below soffitt and centered on door opening with stainless steel brackets, as indicated on drawings.

PART 3 – EXECUTION

3.01 INSTALLATION

General: Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings,

manufacturer's written instructions, and as specified.

3.02 ADJUSTING

Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

3.03 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   a. Test door closing when activated by detector or alarm connected fire-release system. Reset door-closing mechanism after successful test.

2. Adjust seals to provide weathertight fit around entire perimeter.

3. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.

4. Review data in the maintenance manuals.

5. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION

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SECTION 08411
ALUMINUM FRAMED ENTRANCES & STOREFRONTS

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Exterior entrance doors (hurricane-resistant).

B. Related sections include the following:

1. Section 07920: Joint Sealants, for sealing between framing and masonry.
2. Division 8 for lock cylinders.

1.03 SYSTEM DESCRIPTION

A. General: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:

1. Air infiltration and water penetration exceeding specified limits.

2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Glazing: Physically and thermally isolate glazing from framing members.

C. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding the indicated wind-load design pressures calculated according to the requirements of the Florida Building Code and ASCE 7 current adopted version.

1. Positive pressure = Refer to structural drawings for design pressures.

2. Negative pressure = Refer to structural drawings for design pressures.

3. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch, whichever is smaller, unless otherwise indicated.

4. Static-Pressure Test Performance: Provide entrance and storefront systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.
   a. Test Pressure: 150 percent of inward and outward wind-load design pressures.
   b. Duration: As required by design wind velocity; fastest 1 mile of wind for

relevant exposure category.

D. Hurricane-Resistance Test Performance: Provide entrance and storefront systems that pass large and small missile-impact tests, as required by systems' location above grade, and cyclic-pressure tests according to The Florida Building Code, Sections 1606 and 1626.

E. Dead Loads: Provide entrance- and storefront-system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.

1. Provide a minimum 1/8-inch clearance between members and top of glazing or other fixed part immediately below.

2. Provide a minimum 1/16-inch clearance between members and operable windows and doors.

F. Live Loads: Provide entrance and storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.

G. Engineering Responsibility: Storefront subcontractor shall engage a Florida registered structural engineer to design connections, member reinforcements, and fastening to building structure, and prepare design calculations and engineering data.

H. Air Infiltration: Provide entrance and storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft

I. Water Penetration: Provide entrance and storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft.

J. Thermal Movements: Provide entrance and storefront systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 100 deg F ambient; 150 deg F material surfaces.

K. Structural-Support Movement: Provide entrance and storefront systems that accommodate structural movements including, but not limited to, sway and deflection.

L. Dimensional Tolerances: Provide entrance and storefront systems that accommodate dimensional tolerances of building frame and other adjacent construction.

1.04 SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: For entrance and storefront systems, show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work. Show elevations at ½" scale and details at 3" scale.

1. Shop drawings shall include large-scale anchorage details indicating attachment to slabs, walls, and overhead structure.

2. Submit calculations, structural properties, connection information and product information to verify that the system performance and anchorage can successfully resist wind loads. Entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations.

3. Shop drawings shall include State of Florida Product Approval applicable to actual sizes of doors indicated.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.

1. Engineering Responsibility: Prepare data for entrance and storefront systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Source Limitations: Obtain each type of entrance and storefront system through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of entrance and storefront systems and are based on the specific systems indicated.

1. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.06 PROJECT CONDITIONS

Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 – PRODUCTS

2.01 ENTRANCE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- EFCO, Inc., Series 525, 2 ½" x 5" Non-thermal Storefront Framing
- Approved substitute.

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Bars, Rods, and Wire: ASTM B 211.

B. Steel Reinforcement: Complying with ASTM A 36 for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 for hot-rolled sheet and strip.

C. Glazing shall be provided by aluminum entrance manufacturer as follows:

1. Glass must be laminated glass product of the type as tested by manufacturer for impact resistance.

2. Outer lite of grey glass, a PVB plastic interlayer, and an inner lite of clear glass with a Low-E coating on the number 4 surface.

D. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

1. Provide silicone sealant in lieu of glazing gasket if required by entrance manufacturer for hurricane-resistant construction.

E. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

2.03 COMPONENTS

A. Doors: Provide manufacturer's standard 1-3/4-inch- thick glazed doors with minimum 0.125-inch thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.

1. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.

2. Stile Design: Medium stile; 3-1/2-inch nominal width.

B. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Reinforce members as required to retain fastener threads.

2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

D. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:

1. Compression Weather Stripping: Molded neoprene complying with ASTM D 2000 requirements or molded PVC complying with ASTM D 2287 requirements.

2. Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing complying with AAMA 701 requirements.

2.04 HARDWARE

A. General: Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for entrances indicated.

B. Ball-Bearing Butts: ANSI/BHMA A156.1, Grade 1, 5 knuckle, 4 1/2-by4-inch ball-bearing butts. Provide nonremovable pins at hinges exposed to door outside and provide nonferrous hinges for applications exposed to weather. Provide 3 hinges at each leaf for doors up to 36 inches wide and 80 inches tall; provide 4 hinges at each leaf for taller doors.

C. Closers, General: Comply with manufacturer's recommendations for closer size, depending on door size, exposure to weather, and anticipated frequency of use.

1. Closing Cycle: Comply with Florida Accessibility code for Building construction or the Americans with Disabilities Act (ADA), whichever is more stringent.

2. Opening Force: Comply with the following maximum opening-force requirements for locations indicated:
   a. Exterior Doors: 8.5 lbs.

3. Hold Open: Adjustable.

D. Surface-Mounted Overhead Closers: ANSI/BHMA A156.4, Grade 1.

E. Door Stops: ANSI/BHMA A156.16, Grade 1, floor- or wall-mounted door stop, as appropriate for door location indicated, with integral rubber bumper.

F. Mortise Cylinders: Cylinders are specified in Section 08710 - Door Hardware.

G. Deadlatch Locks: Manufacturer’s standard mortise deadlatch with minimum 2 inch long latch bolt and auxiliary bolt located below latch bolt and complying with ANSI/BHMA A156.5, Grade 1 requirements.

H. Radius Face Strikes: Manufacturer's standard stainless-steel, radiused face strike with steel mounting plate and black-plastic dustbox.

I. Vertical-Rod Exit Devices: At all doors, provide concealed, vertical-rod exit device complying with UL 305 requirements, with 2-point top and bottom latching that is released by a full-width crash bar or when locked down (dogged) by lock cylinder or retracting screws beneath housing.

1. Device shall comply with hurricane-resistant entrance system requirements.

J. Pull Handles: As selected by Architect from manufacturer's full range of pull handles and plates.

K. Thresholds: At exterior doors, provide manufacturer's standard threshold with cutouts coordinated for operating hardware, with anchors and jamb clips, and not more than 2-inch- high, with beveled edges providing a floor level change with a slope of not more than 1:2, and in the following material:

1. Material: Aluminum, mill finish.

L. Weather Sweeps: Manufacturer's standard weather sweep for application to exterior door bottoms and with concealed fasteners on mounting strips.

2.05 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

B. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

C. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

D. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete, hurricane-resistant system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

1. Frame dimensions to be 2-1/2" x 5" maximum.

E. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.

1. Provide compression weatherstripping at fixed stops.

2.06 ALUMINUM FINISHES

A. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finiah: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and flouropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
   a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.07 STEEL PRIMING FOR STEEL REINFORCEMENT

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.

B. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.

C. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

PART 3 – EXECUTION

3.01 EXAMINATION

Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 ADJUSTING AND CLEANING

A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.

B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.03 PROTECTION

Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

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SECTION 08800
GLAZING

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Aluminum windows and storefront systems.
2. Vision lites in interior and exterior doors.

B. This Section includes impact-resistant glass.

1.03 DEFINITIONS

Manufacturer is used in this Section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced glazing standard.

1.04 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.

B. Glass Design: Glass thicknesses indicated are for detailing only. Confirm specified glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat-treated) to meet or exceed the following criteria:

1. Minimum glass thickness, nominally, of lites in exterior walls is 1/4 inch.

2. Tinted and heat-absorbing glass thicknesses for each tint to be the same throughout Project.

3. Minimum glass thicknesses of lites, whether composed of annealed or heat-treated glass, are selected so the worst-case probability of failure does not exceed the following:
   a. 8 lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E 1300. For other than monolithic annealed glass, determine thickness per glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E 1300 based on type of glass.

A. Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass-framing members and glazing components. Base engineering calculation on materials' actual surface temperatures due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 120 F deg, ambient; 180 F deg, material surfaces.

D. Glazing as required to conform to listed (Miami-Dade) NOA at exterior opening systems.

1.05 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for each glass product and glazing material indicated.

C. Samples for verification purposes of 12-inch square samples of each type of glass indicated except for clear monolithic glass products, and 12-inch long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative in color of the adjoining framing system.

D. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.

1. Separate certifications are not required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.

1.06 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. FGMA Publications: "FGMA Glazing Manual."

B. Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.

1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

C. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.

D. Single-Source Responsibility for Glass: Obtain glass from one source for each product indicated.

1. Primary glass of each (ASTM C 1036) type and class indicated.

2. Heat-treated glass of each (ASTM C 1048) condition indicated.

E. Single-Source Responsibility for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.08 PROJECT CONDITIONS

Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes

PART 2 – PRODUCTS

2.01 HEAT-TREATED FLOAT GLASS FOR INTERIOR INSTALLATION

B. Uncoated, Clear, Heat-Treated Float Glass: ASTM C 1048, condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind as indicated below, 1/4" thick:

1. Kind FT (fully tempered) in the following locations:
   a. Interior windows, vision panels and doors in non fire-rated openings.

C. Manufacturers: Subject to compliance with requirements, provide heat-treated glass by one of the following companies.

- Cardinal IG.
- Saint-Gobain.
- Falconer Glass Industries.
- Glasstemp, Inc.
- Guardian Industries Corp.
- HGP Industries.
- PPG Industries, Inc.
- Tempglass.
- Viracon, Inc.

2.02 IMPACT-RESISTANT, LAMINATED GLASS, ASTM C 1172

A. VIRACON StormGuard laminated glass as manufacturered by VIRACON, INC. 800 Park Drive, Owatonna, MN 55060

B. Glass shall be 5/8” thick consisting of a ¼” thick, heat strengthened outer lite tinted, a .090” thick Saflex HP interlayer, and a ¼” thick heat strengthened inner-lite. NOA # 02-0916.04. Match tint in existing window units.

2.03 ELASTOMERIC GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

2. Suitability: Comply with sealant and glass manufacturer's recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation.

3. Colors: Provide color of exposed joint sealants to comply with the following:
   a. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

B. Elastomeric Glazing Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants that comply with ASTM C 920 requirements.

2.04 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent, non-staining and non-migrating in contact with nonporous surfaces, with or without spacer rod as recommended by tape and glass manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with AAMA 800.

B. Expanded Cellular Glazing Tape: Closed-cell, polyvinyl chloride foam tape, factory coated with adhesive on both surfaces, packaged on rolls with release liner protecting adhesive, and complying with AAMA 800 for product 810.5.

2.05 GLAZING GASKETS

A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542, black.

B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.
5. Any material indicated above.

C. Soft Compression Gaskets: Extruded or molded closed-cell, integral-skinned gaskets of material indicated below, complying with ASTM C 509, Type II, black, and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

2.06 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).

2.07 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 – EXECUTION

3.01 EXAMINATION

E. Examine glass framing, with glazier present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.

2. Presence and functioning of weep system where required.

3. Minimum required face or edge clearances.

4. Effective sealing between joints of glass-framing members.

F. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.02 PREPARATION

Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.03 GLAZING, GENERAL

F. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

G. Glazing channel dimensions as indicated on Drawings provide necessary bite on glass,

minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

H. Protect glass from edge damage during handling and installation as follows:

D. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.

E. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

F. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

G. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

H. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Square cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.04 TAPE GLAZING

A. Position tapes on fixed stops so that when compressed by glass their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously but not in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each lite is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.05 LOCK-STRIP GASKET GLAZING

Comply with ASTM C 716 and gasket manufacturer's printed recommendations. Provide supplementary wet seal and weep system unless otherwise indicated.

3.06 PROTECTION AND CLEANING

F. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

G. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

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SECTION 09220
PORTLAND CEMENT PLASTER

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

. This Section includes the following:

1. Metal lath and accessories.
2. Metal accessories.
3. Portland cement plaster.
4. Stucco finishes.

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each product specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver cementitious materials to Project site in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.

B. Store materials inside, under cover, and dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes.

1.06 PROJECT CONDITIONS

A. Environmental Requirements, General: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.

B. Warm-Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

C. Exterior Plaster Work: Do not apply plaster when ambient temperatures is below 40 deg F.

D. Protect contiguous work from soiling and moisture deterioration caused by plastering. Provide temporary covering and other provisions necessary to minimize harmful spattering of plaster on other work.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Expanded-Metal Lath:

- Alabama Metal Industries Corp. (AMICO).
- Dale//Incor Industries, Inc.
- Dietrich Industries, Inc.
- National Gypsum Co.
- Unimast, Inc.
- United States Gypsum Co.

2. Metal Accessories:

- Alabama Metal Industries Corp. (AMICO).
- Dale//Incor Industries, Inc.
- Delta Star, Inc.
- Fry Reglet Corporation.
- Gordon, Inc.
- Metalex (Keene Products).
- National Gypsum Co.
- Pittcon Industries.
- Stockton Products.
- Unimast, Inc.
- United States Gypsum Co.

3. Stucco:

- Florida Stucco Corp.
- Highland Stucco.
- IPA Systems, Inc.
- United States Gypsum Co.

2.02 LATH

A. Expanded-Metal Lath: Comply with ASTM C 847 for material, type, configuration, and other characteristics indicated below.

1. Material: Fabricate expanded-metal lath from sheet metal conforming to the following:
   a. Galvanized Steel: Structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653, G60 (ASTM A 653M, Z180) minimum coating designation, unless otherwise indicated.

2. Diamond-Mesh Lath: Comply with the following requirements:
   a. Configuration: Self-furring.
      i. Weight: 3.4 lb/sq.yd.

B. Paper Backing: Where paper-backed lath is indicated, provide the following material

factory bonded to back of lath. Comply with FS UU-B-790, Type I, grade and style as indicated below:

1. Vapor-Permeable Paper: Grade D, Style 2.

2.03 ACCESSORIES

A. General: Comply with material provisions of ASTM C 1063 and the requirements indicated below; coordinate depth of accessories with thicknesses and number of plaster coats required.

1. Zinc-Alloy Components: ASTM B 69, 99 percent pure zinc.

B. Corner beads: Small nose corner beads fabricated from the following metal, with expanded flanges of large-mesh diamond-metal lath allowing full plaster encasement.

1. Zinc Alloy: Minimum 0.0207 inch thick.

C. Casing Beads: Square-edged style, with expanded flanges of the following material:

1. Zinc Alloy: Minimum 0.0207 inch thick.

D. Control Joints: Prefabricated, of material and type indicated below:

1. Zinc Alloy: Minimum 0.0207 inch thick.

E. Reveals, Drip Screeds, Control Screeds, and Channel Screeds: Shapes as indicated on drawings, of material indicated below.

1. Zinc Alloy: Minimum 0.0207 inch thick.

F. Lath Attachment Devices: Material and type required by ASTM C 1063 for installations indicated.

2.04 PLASTER MATERIALS

A. Base-Coat Cements: Type as indicated below:

1. Portland cement, ASTM C 150, Type I.

B. Stucco Finish Coat: Manufacturer's standard factory-packaged stucco, including portland cement, aggregate, and other proprietary ingredients.

C. Sand Aggregate for Base Coats: ASTM C 897.

2.05 MISCELLANEOUS MATERIALS

A. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, ½ inch long, free of contaminates, manufactured for use in portland cement plaster.

B. Water for Mixing and Finishing Plaster: Potable.

C. Bonding Agent: ASTM C 932.

D. Acid-Etching Solution: Muriatic acid (10 percent solution of commercial hydrochloric acid) mixed 1 part to not less than 6 nor more than 10 parts water.

E. Steel drill screws complying with ASTM C 1002 for fastening metal lath to wood or steel members less than 0.033 inch thick.

F. Steel drill screws complying with ASTM C 954 for fastening metal lath to steel members 0.033 to 0.112 inch thick.

2.06 PLASTER MIXES AND COMPOSITIONS

A. General: Comply with ASTM C 926 for base- and finish-coat mixes as applicable to plaster bases, materials, and other requirements indicated.

B. Base-Coat Mixes and Compositions: Proportion materials for respective base coats in parts by volume per sum of cementitious materials for aggregates to comply with the following requirements for each method of application and plaster base indicated. Adjust mix proportions below within limits specified to attain workability.

C. Fiber Content: Add fiber to following mixes after ingredients have mixed at least 2 minutes. Comply with fiber manufacturer's written instructions but do not exceed 1 lb/cu. ft. of cementitious materials. Reduce aggregate quantities accordingly to maintain workability.

D. Two-Coat Work Over concrete unit masonry: 5/8" total thickness; base-coat proportions as indicated below:

1. Base Coat: 1 part Portland cement, 3/4 to 1-1/2 parts lime, 3 to 4 parts aggregate; 3/8" thickness.

E. Job-Mixed Finish Coats: Proportion materials for finish coats in parts by volume for cementitious materials and parts by volume per sum of cementitious materials to comply with the following requirements:

1. Proportions using sand aggregates as indicated below:
   a. 1 part Portland cement, 3/4 to 1-1/2 parts lime, 3 parts sand; 1/8" thickness.

F. Stucco Finish Coat: (May be used in lieu of above described job mixed finish coat). Add water only; comply with stucco manufacturer’s written instructions; 1/8" thickness.

2.07 MIXING

Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

PART 3 – EXECUTION

3.01 PREPARATIONS FOR PLASTERING

D. Clean plaster bases and substrates for direct application of plaster, removing loose material and substances that may impair the Work.

E. Etch concrete and concrete unit masonry surfaces indicated for direct plaster application. Scrub with acid-etching solution on previously wetted surface and rinse thoroughly with clean water. Repeat application, if necessary, to obtain adequate suction and mechanical

bond of plaster (where dash coat, bonding agent, or additive is not used).

F. Apply bonding agent on concrete and concrete unit masonry surfaces indicated for direct plaster application; comply with manufacturer's written instructions for application.

G. Install temporary grounds and screeds to ensure accurate rodding of plaster to true surfaces; coordinate with scratch-coat work.

3.02 INSTALLATION OF PLASTERING ACCESSORIES

A. General: Comply with referenced lathing and furring installation standards for provision and location of plaster accessories of type indicated. Miter or cope accessories at corners; install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and in alignment during plastering. Install accessories of type indicated at following locations:

1. External Corners: Install corner reinforcement at external corners.

2. Terminations of Plaster: Install casing beads, unless otherwise indicated.

3. Control Joints: Install at locations indicated or, if not indicated, at locations complying with the following criteria and approved by Architect:
   a. Where an expansion or contraction joint occurs in surface of construction directly behind plaster membrane.
   b. Distance between Control Joints: Not to exceed 18 feet in either direction or a length-to-width ratio of 2-1/2 to 1.
   c. Wall Areas: Not more than 144 sq. ft.
   d. Horizontal Surfaces: Not more than 100 sq. ft. in area.
   e. Where plaster panel sizes or dimensions change, extend joints full width or height of plaster membrane.

3.03 PLASTER APPLICATION

A. Plaster Application Standard: Apply plaster materials, composition, and mixes to comply with ASTM C 926.

B. Do not use materials that are frozen, caked, lumpy, dirty, or contaminated by foreign materials.

C. Do not use excessive water in mixing and applying plaster materials.

D. Flat Surface Tolerances: Do not deviate more than plus or minus 1/8 inch in 10 feet from a true plane in finished plaster surfaces, as measured by a 10-foot straightedge placed at any location on surface.

E. Sequence plaster application with installation and protection of other work so that neither will be damaged by installation of other.

F. Plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where interior plaster is not terminated at metal frame by casing beads, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.

G. Corners: Make internal corners and angles square; finish external corners flush with corner beads on interior work, square and true with plaster faces on exterior work.

H. Finish Coats: Apply finish coats to comply with the following requirements:

1. Float Finish: Apply finish coat to a minimum thickness of 1/8 inch to completely cover base coat, uniformly floated to a true even plane with “sand float” finish.

2. Prepared Finish: Apply factory-prepared finish coats according to manufacturer's written instructions.

I. Moist-cure plaster base and finish coats to comply with ASTM C 926, including written instructions for time between coats and curing in "Annex A2 Design Considerations."

3.04 CUTTING AND PATCHING

Cut, patch, replace, repair, and point up plaster as necessary to accommodate other work. Repair cracks and indented surfaces. Point-up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

3.05 CLEANING AND PROTECTING

I. Remove temporary covering and other provisions made to minimize spattering of plaster on other work. Promptly remove plaster from door frames, windows, and other surfaces not to be plastered. Repair surfaces stained, marred or otherwise damaged during plastering work. When plastering work is completed, remove unused materials, containers, equipment, and plaster debris.

J. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure plaster work is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 09651
RESILIENT TILE FLOORING

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Vinyl composition floor tile.

B. Related Sections include the following:

1. Section 09653: Resilient Wall Base and Accessories, for resilient wall base, reducer strips and other accessories installed with resilient floor tiles.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract.

B. Product data for each type of product specified.

C. Samples for verification purposes in full-size tiles of each different color and pattern of resilient floor tile specified, showing full range of variations expected in these characteristics.

D. Maintenance data for resilient floor tile.

1.04 QUALITY ASSURANCE

A. Single-Source Responsibility for Floor Tile: Obtain each type, color, and pattern of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

B. Fire Performance Characteristics: Provide resilient floor tile with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Critical Radiant Flux: 0.45 watts per sq cm or more per ASTM E 648.
2. Smoke Density: Less than 450 per ASTM E 662.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver tiles and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store flooring materials in dry spaces protected from the weather with ambient

temperatures maintained between 50 deg F and 90 deg F.

C. Store tiles on flat surfaces. Move tiles and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.06 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70 deg F in spaces to receive tiles for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F.

B. Do not install tiles until they are at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during tile installation.

1.07 SEQUENCING AND SCHEDULING

A. Install tiles and accessories after other finishing operations, including painting, have been completed.

B. Do not install tiles over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as determined by tile manufacturer's recommended bond and moisture test.

1.08 EXTRA MATERIALS

Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

Products: Subject to compliance with requirements, provide one of the products specified in each Product Data Sheet at end of this Section.

2.02 RESILIENT TILE

A. Vinyl Composition Floor Tile: Products complying with ASTM F 1066, Composition 1 (nonasbestos formulated).

1. Class: Class 2 (through pattern tile).
2. Wearing Surface: Smooth.
3. Thickness: 1/8 inch
4. Size: 12-by-12 inches
5. Color and Pattern: To be determined; Armstrong World Industries. Solid color.
6. Approved substitute.

2.03 ACCESSORIES

B. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by tile manufacturer for applications indicated.

C. Adhesives (Cements): Water-resistant type recommended by tile manufacturer to suit resilient floor tile products and substrate conditions indicated.

D. On existing concrete slabs, (which may not have a vapor barrier), provide an epoxy-based adhesive.

PART 3 – EXECUTION

3.01 EXAMINATION

B. General: Examine areas where installation of tiles will occur, with Installer present, to verify that substrates and conditions are satisfactory for tile installation and comply with tile manufacturer's requirements and those specified in this Section.

C. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by tile manufacturer.

2. Finishes of subfloors comply with tolerances and other requirements specified in Division 3 Section "Cast-In-Place Concrete" for slabs receiving resilient flooring.

3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.

D. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Comply with manufacturer's installation specifications to prepare substrates indicated to receive tile.

B. Use trowelable leveling and patching compounds per tile manufacturer's directions to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

D. Broom or vacuum clean substrates to be covered by tiles immediately before tile installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

3.03 INSTALLATION

A. General: Comply with tile manufacturer's installation directions and other requirements indicated that are applicable to each type of tile installation included in Project.

B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths at perimeter that equal less than one-half of a tile. Install tiles square with room axis, unless otherwise indicated.

C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.

Lay tiles in basket weave pattern with grain direction alternating between reversed in adjacent tiles.

D. Scribe, cut, and fit tiles to butt tightly to vertical surfaces, permanent fixtures, built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

E. Extend tiles into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.

G. Install tiles on covers for telephone and electrical ducts, and similar items occurring within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly adhere edges to perimeter of floor around covers and to covers.

H. Adhere tiles to flooring substrates without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed tile installation.

I. Use full spread of adhesive applied to substrate in compliance with tile manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times.

J. Hand roll tiles where required by tile manufacturer.

3.04 INSTALLATION OF ACCESSORIES

Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at edges of flooring which would otherwise be exposed.

3.05 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing tile installation:

1. Remove visible adhesive and other surface blemishes using cleaner recommended by tile manufacturers.

2. Sweep or vacuum floor thoroughly.

3. Do not wash floor until after time period recommended by resilient floor tile manufacturer.

4. Damp-mop tile to remove black marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended by tile manufacturer.

1. Apply protective floor polish to tile surfaces that are free from soil, visible adhesive, and surface blemishes.
   a. Use commercially available, non-slip type, metal, cross-linked acrylic product acceptable to tile manufacturer.

2. Do not move heavy and sharp objects directly over tiles. Place plywood or hardboard panels over tiles and under objects while they are being moved. Slide or roll objects over panels without moving panels.

C. Clean and polish tiles not more than 4 days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean and polish tiles using method recommended by manufacturer.

D. All Resilient Tile shall be cleaned and finished as follows:

Machine scrub floor, apply one (1) coat of sealer and apply four (4) coats of finish wax to all vinyl composition tile (VCT) prior to substantial completion and occupancy by the Owner.

END OF SECTION

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SECTION 09653
RESILIENT WALL BASE AND ACCESSORIES

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Resilient wall base.
2. Resilient edge strips.

B. Related Sections include the following:

1. Section 09651: Resilient Tile Flooring
2. Section 09680: Carpet

1.03 SUBMITTALS

A. Product Data: For each type of product specified.

B. Samples for Initial Selection: Manufacturer's standard sample sets consisting of sections of units showing the full range of colors and patterns available for each type of product indicated.

C. Samples for Verification: In manufacturer's standard sizes, but not less than 12 inches long, of each product color and pattern specified.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.

2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg. F.

C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.06 PROJECT CONDITIONS

A. Do not install products until they are at the same temperature as the space where they are to be installed.

B. For resilient products installed on traffic surfaces, close spaces to traffic during installation and for time period after installation recommended in writing by manufacturer.

C. Coordinate resilient product installation with other construction to minimize possibility of damage and soiling during remainder of construction period. Install resilient products after other finishing operations, including painting, have been completed.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Furnish not less than 10 linear feet for each 500 linear feet for fraction thereof, of each different type, color, pattern, and size of resilient product installed.

2. Deliver extra materials to Owner.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

Products: Subject to compliance with requirements, provide one of the products indicated for each designation.

2.02 RESILIENT WALL BASE

A. Rubber Wall Base: Products complying with FS SS-W-40, Type II and with requirements specified: Basis of specification is Johnsonite.

1. Color: 18 – NAVY BLUE.
2. Style: Cove with top-set toe.
3. Minimum thickness: 1/8 inch.
4. Height: 4 inches.
5. Lengths: Coils in lengths standard with manufacturer.
6. Outside Corners: Formed on job.
7. Surface: Smooth.

8. Approved Manufacturers:
   - Armstrong World Industries
   - Azrock Industries, Inc..
   - Flexco

- Roppe Corporation
- Approved Substitute

2.03 RESILIENT TILE AND CARPET ACCESSORIES

Vinyl Accessories: Edge Strips: 1/8” thick, minimum; homogenous composition; tapered or bullnose edge, unless otherwise indicated; color as selected by Architect from manufacturer’s standard color line; minimum 1” width.

2.04 INSTALLATION ACCESSORIES

Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 – EXECUTION

3.01 EXAMINATION

Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements, including those for maximum moisture content. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Comply with manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Broom and vacuum clean substrates to be covered immediately before installing resilient products. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. General: Install resilient products according to manufacturer's written installation instructions.

B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

3. Do not stretch base during installation.

4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.

5. Form outside corners on job, from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.

6. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

C. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive. Install resilient edge strips at edges of flooring that would otherwise be exposed.

D. Apply resilient products to stairs as indicated and according to manufacturer's written installation instructions.

3.04 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.

2. Sweep or vacuum horizontal surfaces thoroughly.

3. Do not wash resilient products until after time period recommended by resilient product manufacturer.

4. Damp-mop or sponge resilient products to remove marks and soil.

B. Protect resilient products against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by resilient product manufacturer.

C. Clean resilient products not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

END OF SECTION

SECTION 09900
PAINTING AND SPECIAL COATINGS

PART I – GENERAL

1.01 DESCRIPTION OF WORK

A. The CONTRACTOR shall furnish all materials, labor, equipment, and incidentals required to provide a protective coating system for the 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 of exterior exposed items and surfaces such as posts, pipes, fittings, valves, equipment, and all other work obviously required to be painted unless otherwise specified herein or on the Drawings. The omission of minor items in the schedule of work shall not relieve the CONTRACTOR of his obligation to include such items where they come within the general intent of the Specifications as stated herein.

C. "Paint" as used herein means all coating systems, materials, including primers, emulsions, enamels, epoxies, sealers and fillers, and other applied materials whether used as a prime, intermediate, or finish coats.

D. The following items will not be painted unless otherwise noted:

1. Any code-requiring labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

2. Any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts, unless otherwise indicated.

3. Traffic stripes on paving are specified in Section 2580, Pavement Markings

4. Aluminum or fiberglass handrails, walkways, toeboards, windows, louvers, grating, checker plate, hatches, and stairways.

5. Stainless steel angles, tube, pipe, etc.

6. Products with polished chrome, aluminum, nickel, or stainless steel finish.

7. Stainless steel, brass, bronze, and aluminum other than exposed utility tubing.

8. Flexible couplings, lubricated bearing surfaces, insulation, and plastic pipe or duct interiors.

9. Plastic switch plates and receptacle plates.

10. Signs and nameplates.

11. Finish hardware.

12. Packing glands and other adjustable parts, unless otherwise indicated.

13. 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.

14. Unexposed and covered plant PVC piping as approved by the ENGINEER.

1.02 RELATED WORK

Paint piping and equipment for identification purposes in accordance to Section 09905, Piping, Valve, and Identification System.

1.03 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. Work shall be done in a safe and workmanlike manner.

D. Standards:

1. ASTM - American Society for Testing Materials
2. OSHA - Federal Occupational Safety and Health Act
3. NFPA - National Fire Protection Association
4. SSPC - Society for Protective Coatings
5. NACE - National Association of Corrosion Engineers
6. NSF - National Sanitation Foundation
7. AWWA - American Water Works Association

E. Acceptable Manufacturers:

1. Carboline Company., Tnemec Company, Inc., and/or ENGINEER approved equal

1.04 SUBMITTALS

A. Materials and Shop Drawings: Submit to the ENGINEER, as provided in the General Conditions and Section 01300: Submittals, shop drawings, manufacturer's specifications and data on the proposed paint systems and detailed surface preparation, application procedures and dry film thickness (DFT).

B. Color Samples: Manufacturer's standard color charts for color selection by OWNER.

C. 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. Such samples when approved in writing shall constitute a standard, as to color and finish only, for acceptance or rejection of the finish work.

4. Rejected samples shall be resubmitted until approved.

D. The CONTRACTOR shall submit to the OWNER, immediately upon completion of the job, certification from the manufacturer indicating that the quantity of each coating purchased was sufficient to coat all surfaces, in accordance with the requirements or this Section. Such certification shall make reference to square footage figures provided to the manufacturer by the CONTRACTOR.

1.05 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: Material and Equipment.

1. Provide labels on each container with the following information:
   a. Name or title of material.
   b. Fed. Spec. number if applicable.
   c. Manufacturer's stock number, date of manufacture and expiration date (shelf life).
   d. Manufacturer's formula or specification number.
   e. Manufacturer's batch number.
   f. Manufacturer's name.
   g. Generic type.
   h. Contents by volume, for major pigment and vehicle constituents.
   i. Application instructions: thinning, ambient conditions, etc.
   j. Color name and number.

2. 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.

B. All containers shall be handled and stored in such a manner as to prevent damage or loss of labels or containers.

C. The OWNER shall designate areas for storage and mixing of all painting materials. Store only acceptable product materials on project site. Restrict storage to paint materials and related equipment. Storage of paint materials and related equipment shall comply with the requirements or 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.

D. Used rags shall be removed from the buildings every night and every precaution taken against spontaneous combustion.

1.06 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 in Paragraph 1.03E., herein, and shall be their highest grade of paint.

B. The following coating system descriptions includes product by name to establish a standard of quality. Other products of the same generic types may be submitted to the ENGINEER for approval as described in Paragraph 1.04., herein. 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.

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. Emulsion and alkyd paints shall contain a mildewcide and both the paint and mildewcide shall conform to OSHA and Federal requirements, including Federal Specification TT-P-19.

E. Finish coats containing lead shall not be allowed. Oil shall be pure boiled linseed oil.

F. Rags shall be clean painter's rags.

2.02 COATING SYSTEMS

A. Class 1 Exposures - Concrete and Masonry, Exterior, Non-Immersion

1. Class 1 exposures consist of exposed exterior concrete and masonry surfaces subjected to normal exterior elements and not subjected to wastewater immersion or contact.

2. Surface Preparation: As specified in Paragraph 3.02 herein and in addition the following:
   a. Masonry surfaces shall be prepared by filling cracks, voids and other surface imperfections, removing mortar droppings, cleaning and high pressure water blasting. Consult with the coating supplier for acceptable repair patching materials.
   b. Concrete surfaces shall be prepared as required for Class 2 exposure surface preparation specified in Paragraph 2.02.B.2 below or as designated per the coating manufacturer’s surface preparation requirements for concrete.

3. Class 1 Coating System

a. Prime Coat for Concrete Structures: Cement base waterproofing.
Thoro Systems Thoroseal or ENGINEER approved equal: One (1) coat, 2 lbs per square yard.

b. Prime Coat for Masonry Structures: Heavy duty waterborne acrylic block filler.
Carboline Sanitile 100 or ENGINEER approved equal: 1st coat at 72 ft^2 (2nd coat if required at 144 ft^2). Actual coverage is dependent upon the porosity of the substrate to be coated.

c. Finish Coats: Heavy duty waterborne acrylic finish
Carboline Sanitile 155 or ENGINEER approved equal: Two (2) coats, 2.0-3.0 mils DFT per coat.

d. Total minimum system finish coating thickness shall be 16.0 mils DFT.

B. Class 2 Exposures - Metals, Non-Immersion, Interior/Exterior

1. Class 2 exposures consist of interior and exterior metal surfaces that do not come in direct contact with wastewater or corrosive atmospheres and shall include the following:
   a. Aboveground piping, fittings, valves, and metal electrical conduit.
   b. Miscellaneous steel plates, shapes, hardware, etc.
   c. Galvanized steel surfaces.
   d. Other surfaces obviously requiring field coating or as specified to be field coated in Division 11 or in Section 09905: Piping, Valve, and Identification System.

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 in compliance with SSPC-SP1 for solvent cleaning unless otherwise designated by the coating manufacturer’s surface preparation requirements.

3. Class 2 Coating System
   a. Prime Coat for Ferrous Metals: Two-part epoxy polyamide primer.
   Carboline Carboguard 893SG or an ENGINEER approved equal: One (1) coat, 3.0-5.0 mils DFT per coat.
   b. Prime Coat for Non-Ferrous Metals: Polymeric epoxy amine.
   Carboline Rustbond or an ENGINEER approved equal: One (1) coat, 1.0-2.0 mils DFT.
   c. Intermediate Coat: Two-part epoxy polyamide primer:
   Carboline Carboguard 893SG or an ENGINEER approved equal: One (1) coat, 3.0-5.0 mils DFT.
   d. Finish Coats: Aliphatic acrylic polyurethane
   Carboline Carbothane 134HG or an ENGINEER approved equal: One coat, 2.0-2.5 mils DFT.
   e. Total minimum system finish coating thickness shall be 8.0 mils DFT for

ferrous metals and 6.0 mils DFT for non-ferrous metals.

NOTE: MAXIMUM ELAPSED TIME BETWEEN COATS, AS STATED BY THE COATING MANUFACTURER, SHALL NOT BE EXCEEDED.

C. Class 3 Exposures - Plastic Piping, Valves, Fittings, and Conduit

1. Class 3 exposures consist of PVC or fiberglass piping 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. Class 3 Coating System:
   a. Primer coat: Single coat, waterborne acrylic primer.
      Carboline Carbocrylic 120 or an ENGINEER approved equal:
      One (1) coat, 1.0-2.0 mils DFT.
   b. Finish Coats: Single component, water-borne acrylic topcoat.
      Carboline Carbocrylic 3359 or an ENGINEER approved equal: One (1) coat, 2.0-3.0 mils DFT.
   c. Total minimum system finish coating thickness shall be 3.0 mils DFT.

D. Class 11 Exposures – Interior Floors (Painted)

1. Class 11 exposures consist of interior concrete floors.

2. Surface Preparation: As specified in Section 3.02F in addition to the following:
   a. Abrasive blast clean to remove laitance and roughen the surface equivalent to the surface of No. 80 grit or as designated per the manufacturer's surface preparation requirements.

3. Class 11 Coating System
   a. For non-skid areas add 287-300C skid resistant sand to the mixed material or broadcast into the wet primer to achieve the desired non-slip finish.
   b. Topcoat: Waterborne Epoxy-Amine
      Tnemec Series 287 Enviro-Tread applied at 3.0 mils DFT.
      OR
      Primer: Self leveling epoxy
      Carboline Sanitile 945 applied at 10.0 mils DFT

E. Class 14 Exposures – Exposed Concrete Floors, Equipment Pads

1. Class 14 exposures consist of exterior concrete surfaces that are exposed to the weather elements and occasional immersion of water and receive light foot traffic.

2. Surface Preparation: As specified in Section 3.02F in addition to the following:

a. Abrasive blast clean to remove laitance and roughen the surface equivalent to the surface of No. 80 grit.

3. Class 14 Coating System.
   a. Primer: Tnemec Series 69 Hi-Build Epoxoline II. Two coats at 3 – 5 mils DFT.
      OR
      Primer: Self leveling epoxy
      Carboline Sanitile 945 applied at 10.0 mils DFT
   b. Topcoat: Tnemec series 291 Enhanced Aliphatic Polyester Polyurethane. One coat at 2-3 mils DFT.
      OR
      Primer: Self leveling epoxy
      Carboline Sanitile 945 applied at 10.0 mils DFT
   c. Minimum DFT for the three coats is 10.0 mils (Carboline system – 20 mils).

F. Exposure – Concrete surfaces, process tanks (chlorine contact chamber)

1. The entire interior concrete surfaces of the chlorine contact tank structure, including all walls, floor slabs, and roof slabs, as applicable.

2. The entire interior concrete surfaces of the first anoxic, pre-aeration, second anoxic, and membrane bioreactor tanks, including all walls, floor slabs, and roof slabs, as applicable.

3. Surface preparation – Reference the coating manufacturer's product data sheet.

4. System – Vinyl Ester
   a. Carboline Plasite 4006 or ENGINEER approved equal, applied at 30 mils DFT in two coats

G. Exposure – Concrete surfaces, secondary containment (sodium hypochlorite and magnesium hydroxide)

1. The entire interior of the containment area including the horizontal surfaces and vertical curbing.

2. Surface preparation – Reference the coating manufacturer's product data sheet.

3. System – Vinyl Ester (aggregate filled system)
   a. Verticle surfaces:
      i. Primer – Semstone 800 Vinyl Ester or ENGINEER approved equal at 8.0-10.0 mils
      ii. Form void filler – Semstone 800 series primer blended with Part "D" Cab-O- Sil (TS-720) and 80-120 mesh silica
      iii. Topcoat – Semstone 870 vinyl ester blended with 80-120 mesh DuPont Starblast and part "D" Cab-O-Sil (TS-720) at 40 mils
   b. Horizontal Surfaces:
      i. Primer – Semstone 800 primer or ENGINEER approved equal at 8.0-10.0 mils
      ii. Basecoat – Semstone 870 or ENGINEER approved equal at 30.0 mils
      iii. Aggregate fill – 20/40 mesh DuPont Starblast or ENGINEER approved equal

iv. Topcoat – Semstone 870 or ENGINEER approved equal at 20.0 mils

H. Exposure – Concrete surfaces, secondary containment (alum/aluminum ammonia sulfate and methanol)

1. The entire interior of the containment area including the horizontal surfaces and vertical curbing.

2. Surface preparation – Reference the coating manufacturer's product data sheet.

3. System – Epoxy (aggregate filled system)
   a. Vertical surfaces:
      i. Primer – Semstone 110 or ENGINEER approved equal at 8.0-10.0 mils
      ii. Form void filler – Semstone 100 or ENGINEER approved equal blended with fine silica and Part "D" Cab-O- Sil or ENGINEER approved equal
      iii. Topcoat – Semstone 140 or ENGINEER approved equal blended with 80-120 mesh silica and part "D" Cab-O-Sil (TS-720) or ENGINEER approved equal at 30.0 mils
   b. Horizontal Surfaces:
      i. Primer – Semstone 110 or ENGINEER approved equal at 8.0-10.0 mils
      ii. Basecoat – Semstone 140 or ENGINEER approved equal at 30.0 mils
      iii. Aggregate fill – 20/40 mesh "rounded" silica
      iv. Topcoat – Semstone 140 or ENGINEER approved equal at 15.0-20.0 mils

I. Exposure – Concrete surfaces, immersion services (applications-equalization tanks, waste sludge storage)

1. Surface preparation – Reference the coating manufacturer's product data sheet.

2. System – Elastomeric polyurethane
   a. Primer- Consult Carboline technical service
   b. Topcoat-Carboline Polibrid 705 or ENGINEER approved equal applied at 60.0 mils

J. Exposure – Interior stainless steel surfaces, headworks box

1. The entire interior surface of the headworks box shall be coated with Carboline coal tar epoxy, Bitomatic 300M or ENGINEER approved equal. including the horizontal surfaces and vertical curbing.

2. Surface preparation – The stainless steel substrate shall receive an abrasive blast prior to product application due to immersion service.

3. Coating thickness shall be 16 mils DFT in one or two coats.

K. Exposure – Stems, Stem hardware, metal surfaces exposed to corrosive gases

1. The entire exterior surface of the metal shall be covered with Protecto 401 coating in such a way as to protect the exposed hardware from the corrosive

gases without hindering performance.

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 unless specified otherwise within the text of the coating manufacture's surface preparation requirements noted on the designated primer product data sheets. 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.

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. 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.

4. 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.

5. Equipment manufacturer or supplier shall provide touch-up paint for items with shop applied finish coats.

6. 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 SURFACE PREPARATION

A. All dirt, rust, scale, splinters, loose particles, disintegrated paint, grease, oil, and other deleterious substances shall be removed from all surfaces which are to be coated.

B. Hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items and surfaces not to be painted which are in contact with or nearby surfaces to be painted shall be removed, masked, or otherwise protected prior to surface preparation and painting operations. Refer to Paragraph 3.09B.

C. Before commencing work, the painter must make certain that surfaces to be covered are in perfect condition and must obtain ENGINEER's approval to proceed. Should the painter find such surfaces impossible of acceptance, he shall report such fact to the ENGINEER. The application of paint shall be held as an acceptance of the surfaces and working conditions and the painter will be held responsible for the results reasonably expected from the materials and processes specified.

D. Program the cleaning and painting so contaminants from the cleaning process will not fall onto wet, newly-painted surfaces.

E. Ferrous Metal Surfaces:

1. Remove any oil or grease from surfaces to be coated with clean rags soaked in toluol or other solvent recommended by coating manufacturer in accordance with SSPC specifications. Any chemical contamination shall be eliminated by means of neutralization or flushing or both prior to additional surface preparation. Clean rags shall be changed each 100 square feet.

2. For immersion service, all sharp edges and welds shall be ground smooth to a rounder contour, all weld splatter shall be removed, and all pits and dents shall be filled, and all imperfections shall be corrected prior to sandblasting.

3. For non-immersion service, all sharp edges and welds shall be ground, all weld splatter shall be removed, all pits and dents shall be filled, and all imperfections shall be corrected prior to sandblasting.

4. For immersion service, all surfaces to be coated shall be sandblasted to white metal in accordance with Steel Structures Painting Council Specification SP-5 of National Association of Corrosion ENGINEERs Specification NACE-2 or as designated per the coating manufacturer’s surface preparation requirements. A white metal blast is defined as removing all rust, scale, paint, etc., to a clean white metal which has a uniform gray-white appearance. No streaks or stains or rust or any other contaminants are allowed. The proper abrasive to obtain the specified surface profile (anchor pattern) designated in the coating manufacturer's most recent printed application instructions shall be used. After sandblasting, dust and spent sand shall be removed from the surfaces by brushing or vacuum cleaning. The prime coat shall be applied as soon as possible after the blasting preparation is finished and always before the surface starts to rust. No sandblasted surface shall stand overnight before coating.

5. For non-immersion service, or wherever specified in the coating manufacturer's most recent printed application instructions for other services, all surfaces to be coated shall be sandblasted to near white metal in accordance with Steel Structures Painting Council Specification SP-10 or National Association of Corrosion ENGINEERs Specification NACE-2. A near white metal blast is defined as removing all rust, scale, paint, etc., except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or slight, tight residues of paint or coatings that may remain. The proper abrasive to obtain the specified surface profile (anchor pattern) designated in the coating manufacturer's most recent printed Application Instructions shall be used. After sandblasting, dust and spent sand shall be removed from the surfaces by brushing or vacuum cleaning. The prime coat shall be applied as soon as possible after the blasting preparation is finished and always before the surface starts to rust. No sandblasted surface shall stand overnight before coating. (This is 95 percent of any given surface area blasted to white metal).

6. For non-immersion service surfaces to be coated shall be sandblasted where specified to a commercial sandblast in accordance with Steel Structures Painting Council Specification SP-6 or National Association of Corrosion Engineers Specification NACE-3. A commercial sandblast is defined as removing all rust, scale, paint, etc., except for slight shadows, streaks or discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint or coating that may remain; if the surface is pitted, slight residues or paint or rust, may be found in the bottom of pits. The proper abrasive to obtain the specified surface profile (anchor pattern) designated in the coating manufacturer's most recent printed Application Instructions shall be used. After sandblasting, dust and spent sand shall be removed from the surfaces by brushing or vacuum cleaning. The prime coat shall be applied as soon as possible after the blasting preparation is finished and always before the surface starts to rust. No sandblasted surface shall stand overnight before coating (this is 2/3 of any given surface area blasted to white metal).

7. Ferrous metal surfaces previously exposed to sulfides shall be sandblasted, flame cleaned, and sandblasted again in accordance with the recommended surface preparation for the particular service in question.

8. Where blast cleaning is done in the field, only "virgin" sand, grit, or abrasive will be used.

F. Concrete Surfaces:

1. All efflorescence, laitance, chalk, dust, dirt, oils, grease, concrete curing agents, form release agents, sealers, old coatings and other chemical contaminants shall be removed either by steam cleaning with detergent, by scrubbing with a hot trisodium phosphate solution consisting of 2 pounds of trisodium phosphate to each gallon of hot water (160°F), or by high pressure water blasting (3,000 psi or higher) or as designated per the coating manufacturer’s surface preparation requirements. Multiple cleaning operations may be required to remove all contaminants. Repeat the cleaning operation until the contamination is removed and flush the area with clean water to remove residual cleaning solution. Allow to dry thoroughly before coating.

2. All concrete surfaces to be coated shall be clean and dry. Prior to coating application, moisture content of concrete shall meet manufacturer’s recommendations. Moisture content of concrete shall be determined by using

both of the following methods.

a. The presence of moisture shall be checked by taping a one-foot square piece of 20 mil thick minimum plastic film on the surface. Pieces of test plastic film should be placed at various locations that are likely to be slow drying out, such as below grade, low spots in floors, inside corners and lower wall areas. The plastic film should be carefully sealed with tape to prevent the escape of any moisture or vapor that would be trapped behind the film. The film should be left in place over night or longer to allow sufficient time for moisture migration. After 16 hours minimum remove and examine the backside for moisture condensation and inspect the concrete surface for darkened areas. The source of the moisture, if present, shall be located, and the cause corrected prior to coating.

b. The presence of moisture shall also be determined with a moisture detection device such as a Delmhorst Model DLM2E. Moisture determined by this method shall be less than 14 percent moisture content before coating operations shall be allowed to proceed.

3. Old paint and unremoved tar stains shall be solvent cleaned with naphtha, trichloroethylene, or perchloroethylene. Proper safety precautions shall be observed if this step is necessary. The surface shall be flushed with fresh water and dried.

4. Do not use form oils incompatible with coating, concrete curing agents, or concrete hardeners on concrete surfaces to be coated.

G. Galvanized Steel and Non-Ferrous Metal:

1. Galvanized steel and aluminum will only be coated when so specified.

2. Surfaces shall be clean and dry. Remove dust and dirt by blowing off the surface with high pressure air or wiping clean with dry rags. Oil, grease and protective mill coatings should be removed by solvent cleaning in accordance with SSPC-SPl.

3. White rust should be removed from galvanized steel or aluminum by hand or power brushing. Care should be taken not to damage or remove the galvanizing. Rust should be removed from old galvanized steel by Hand or Power Tool Cleaning in accordance with SSPC-SP2 or SP3.

4. Other surface preparation as outlined in the coating manufacturer's latest written Application Instructions shall be observed for more demanding exposures.

H. Stainless Steel:

1. Stainless steel will only be coated when so specified, or when it is adjacent to areas to be coated such as piping supports, anchor bolts or flange bolts.

2. Stainless steel requires only solvent cleaning prior to coating using any one of the methods in SSPC-SP1. Only solvents and cleaning solutions containing less than 200 ppm of halogens should be used to prevent stress corrosion cracking.

3. Stainless steel may be whip-blasted to provide a surface profile to increase the mechanical bond of the coating system. The height of the profile and the texture required should be defined for the operator and as a standard for the acceptance of the work. Pictorial standards for the surface cleanliness of carbon steel are not

applicable to stainless steel, since there are no corrosion products or mill scale to remove from the surface.

4. Abrasive blast cleaning procedures outlined by Steel Structures Painting Council for carbon steel may also be used for stainless steel. Only very hard silica sand or other abrasive media should be used for a fast cutting action and to obtain a sharp angular profile.

I. PVC or Other Plastic Piping or Ductwork:

1. Solvent clean surfaces to be coated.

2. If recommended by coating manufacturer, lightly abrade surfaces to be coated with medium grade sandpaper. Remove dust by wiping surfaces to be coated with clean rags.

3.03 MATERIALS PREPARATION

A. 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.

B. Except where otherwise specified, thinning shall be done only if necessary for the workability of the coating material and then, only in accordance with the coating manufacturer's most recent printed Application instructions. Use only thinner provided by coating manufacturer. 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.

3.04 APPLICATION

A. Paint all exposed surfaces in rooms scheduled for painting whether or not colors are designated in schedules, except where the natural finish of material is obviously intended and specifically noted as a surface not be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color of finish is not designated, the ENGINEER will select these from standard colors available for the materials systems as specified.

B. Color Selection

1. Colors for Multi-coat Systems: Each coat shall be applied in a different color or shade from the preceding coat to aid in determining the uniformity and coverage of the coating. The finish coat color shall be selected by the OWNER or ENGINEER. When a white finish coat is specified, the last two (2) coats shall be white.

2. Color Coding Piping: All exposed piping shall be identified as specified in Section 09905: Piping and Equipment Identification System. Pipe identification system shall include color coding or banding, legends, and arrows.

3. All interior walls of buildings shall have a Wainscot from the floor to the highest elevation for that floor. Color of Wainscot shall be selected by OWNER.

C. All painting shall be done by skilled and experienced craftsmen and shall be of highest quality workmanship.

D. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied. All equipment shall be maintained in good working order and shall be comparable to that described in the coating manufacturer's most recent Application Instructions. It shall be thoroughly cleaned and inspected daily. Worn spray nozzles, tips, etc., shall be replaced regularly. Effective oil and water separators shall be used and serviced on all air lines.

E. All paints and coating 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.

F. 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.

G. 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. Allow each coat to dry thoroughly before applying the next coat; follow manufacturer's recommendations taking into account temperature and relative humidity.

H. All interior surfaces of structures shall be finish coated prior to installation of equipment, conduit, and other exposed items by Mechanical, Electrical, or Instrumentation.

I. Finish exterior doors on tops, bottoms, and side edges the same as the exterior faces, unless otherwise indicated.

J. Sand lightly between each succeeding enamel or varnish coat.

K. Omit the first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise specified.

L. Retouching Existing Painted Surfaces: Existing painted surfaces damaged by the modification work or other operations of the CONTRACTOR shall be retouched to conform to the above coating systems and blend in with the new and existing work. Damaged surfaces shall be repainted with not less than two (2) coats, and other existing surfaces that are listed shall be repainted with the coating system specified.

M. The prime and intermediate coats as specified for the various coating systems may be applied in the shop by the manufacturer. The shop coats shall be of the type specified and shall be compatible with the field coat or coats. Such items as pumps, motors, equipment, electrical panels, etc. shall be given at least one touch-up coat with the intermediate coat material and one complete finish coat in the field.

3.05 APPLICATION RESTRICTIONS

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 or will be generated during application through full cure.

3. All exterior painting shall be done only in dry weather.

4. Spray application shall occur only when wind velocities, including gusts, are less than 10 miles per hour. All materials, equipment, etc.in the vicinity of spray application shall be protected from overspray.

B. Application of materials shall be done only on properly prepared surfaces as herein specified. Between any two coats of material, unless specifically covered in the coating manufacturer's most recent printed application instructions, if more than one (1) week passes between subsequent coats, the coating manufacturer will be contacted for his recommended preparation of the surface prior to application of the next coat. This preparation might include brush-off blasting, steam cleaning, or solvent wiping (with an indicated solvent) and shall be specified in writing by the material supplier and followed by the applicator. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the OWNER or ENGINEER.

C. In no case shall paint be applied to surfaces which show a moisture content greater that 14 percent. The presence of moisture shall be determined prior to coating by testing with a moisture detection device such as a Delmhorst Model DLM2E.

3.06 MINIMUM COATING THICKNESS

A. Coating thickness shall meet or exceed the specified minimum DFT in all areas. The average coating thickness as determined by multiple representative DFT measurements shall meet or exceed the mid-point of DFT range. If below this DFT value, the surface shall be recoated with at least the minimum DFT until the total DFT meets or exceeds the mid-point DFT.

B. Coverage rates are theoretical as calculated by the coating manufacturer and are, therefore, the maximum allowable.

C. Apply a prime coat to material which is required to be painted or finished, and which has not been prime coated by others.

D. 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.

E. Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

3.07 FINISHES

A. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

B. Complete Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specific requirements.

3.08 FIELD QUALITY CONTROL

The CONTRACTOR shall request acceptance of each coat by the ENGINEER before applying the next coat; and the CONTRACTOR shall provide the necessary properly calibrated gauges. All nonferrous surfaces shall be checked for number of coats and thickness by use of a Tooke gauge. All ferrous surfaces shall be checked for film thickness by use of an Elcometer or Micro-Test magnetic dry film gauge properly calibrated. In addition, submerged tank linings and metals shall be tested for freedom from holidays and pinholes by use of a Tinker-Rasor or K-D Bird Dog Holiday Detector. All defects shall be corrected to the satisfaction of the OWNER.

3.09 PROTECTION

A. All other surfaces shall be protected while painting.

B. Protection of furniture and other movable objects, equipment, fittings, and accessories shall be provided throughout the painting operation. Remove all electric plates, surface hardware, etc., before painting; protect and replace when completed. Mask all machinery nameplates and all machined parts not to receive paint. Lay drop cloths in all area where painting is being done to adequately protect flooring and other work from all damage.

3.10 CLEANING

A. The CONTRACTOR shall perform the work under this Section while keeping the premises free from accumulation of dust, debris, and rubbish and shall remove all scaffolding, paint cloths, paint, empty paint containers, and brushes from buildings and the project site when completed.

B. Cleaning: All paint brushed, splattered, spilled, or splashed on any surface not specified to be painted shall be removed.

C. The CONTRACTOR shall insure that all glass throughout that portion of the facility in which he worked is cleaned of dirt and paint before he leaves the job site. Further, the CONTRACTOR shall insure that all glass in this area is thoroughly washed and polished.

D. Upon completion of the project, the job site shall be left neat and clean.

3.11 EXTRA STOCK

Upon completion of painting work, the OWNER shall be furnished at no additional cost, unopened containers providing a minimum of one (1) gallon of each type and color of finish paint for touching up. Multi-component coatings shall have each component supplied in separate containers boxed together. Paint container labels shall be complete with manufacturer's name, generic type, number, color, and location where used.

END OF SECTION

SECTION 09901
ARCHITECTURAL PAINTING

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes surface preparation and field painting of the following:

1. Exposed exterior items and surfaces.
2. Exposed interior items and surfaces.
3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from paint manufacturer's standard colors and finishes available.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.03 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.

2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.

3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.

4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.

5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.04 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

LEED Submittals:

1. Product data for credit EQ 4.2: For paints and coatings, including printed statement of VOC content.

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5.

1. The Architect will select one room surface to represent surfaces and conditions for each type of coating and substrate to be painted.
   a. Wall Surfaces: Provide samples on at least 100 sq. ft. of wall surface.
   b. Small Areas and Items: The Architect will designate an item or area as required.

2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.

3. Final approval of colors will be from job-applied samples.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.07 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.

C. Do not apply paint in rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Unless otherwise specified, paint materials and systems specified herein are those of Porter Paint Co. (Porter). Subject to compliance with requirements, equivalent materials and systems by one of the following manufacturers are also acceptable:

- Devoe and Reynolds Co.
- Benjamin Moore and Co.
- Pratt and Lambert (P & L).
- Glidden.
- Sherwin Williams
- Pittsburg Paints

2.02 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

C. Colors: Provide color selections made by the Architect.

2.03 LEAD CONTENT

The paint shall comply with the latest requirements of the Federal Government for maximum allowable lead content. Such compliance shall be stated on the MSDS and container clearly identifying the product.

2.04 VOC COMPLIANCE

The paint shall comply with the latest requirements of Federal, Florida State, City or Local Government requirements for the maximum allowable VOC content at the time of purchase. Such compliance shall be stated on the MSDS and container clearly identifying the product.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Materials: Prepare concrete and concrete masonry surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
   a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
   b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
   a. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
   a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the schedule.

2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

3. Provide finish coats that are compatible with primers used.

4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.

5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. Omit primer on metal surfaces that have been shop primed and touchup painted.

3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give

special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions. All metal surfaces shall be sprayed except that piping, conduit, and ductwork may be brushed or rolled.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Electrical items to be painted include, but are not limited to, the following:

1. Exposed conduit and fittings.
2. Exterior switchgear.

F. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

G. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

H. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

I. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

1. Provide satin finish for final coats.

J. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no

evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:

1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.

2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:
   a. Quantitative material analysis.
   b. Abrasion resistance.
   c. Apparent reflectivity.
   d. Flexibility.
   e. Washability.
   f. Absorption.
   g. Accelerated weathering.
   h. Dry opacity.
   i. Accelerated yellowness.
   j. Recoating.
   k. Skinning.
   l. Color retention.
   m. Alkali and mildew resistance.

3. The Owner may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

3.05 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.07 PAINT SCHEDULE

The number of coats set forth in the following paragraphs shall be considered the minimum number of coats required subject to coverage, DFT, manufacturer's recommendations, and end result necessitating a greater number of coats.

A. Exterior Surfaces

1. Concrete Block Surfaces:
   a. 2 coats of Block Filler. When dry, block filler shall be filled all voids, pores and holes in the concrete block with a uniform film.
   b. 2 coats of 100% Acrylic Latex Satin Exterior Coating to full opacity of 2.0 mils minimum DFT per coat.

2. Stucco Surfaces:
   a. 1 coat of 100% Acrylic Primer, 1.5 mils minimum DFT
   b. 2 coats of 100% Acrylic Latex Satin Exterior Coating to full opacity to achieve 2.0 mils minimum DFT per coat.

3. Galvanized Metal:
   a. Shop applied primer and field applied finish
   b. Surface Preparation – SSPC-SP-1 Solvent Cleaning - Removal of all detrimental foreign matter such as oil, grease, dirt, soil, salts, drawing and cutting compounds, and other contaminants from steel surfaces by the use of solvents, emulsions, cleaning compounds or other similar materials and methods which involve a solvent or cleaning action.
   c. Shop Primer – 1 coat of 2 part high build epoxy rust inhibitive primer applied to achieve a 4.0 mils minimum DFT.
   d. Field Shop Primer Touch Up – Touch up all film breaches after proper surface preparation SSPC-SP-2 and/or SSPC-SP-3 with a part high build epoxy rust inhibitive primer so that all surfaces have the proper 4.0 mils minimum DFT per coat.

4. Ferrous Metal:
   a. Shop applied primer and field applied finish:
      i. Surface Preparation – SSPC-SP-1 Solvent Cleaning - Removal of all detrimental foreign matter such as oil, grease, dirt, soil, salts, drawing and cutting compounds, and other contaminants from steel surfaces by the use of solvents, emulsions, cleaning compounds or other similar materials and methods which involve a solvent or cleaning action.

      ii. Surface Preparation – SSPC-SP-6 Commercial Blast Cleaning – Removal of mill scale, rust, rust scale, paint or foreign matter by the

use of abrasives propelled through nozzles of by centrifugal wheels, to the degree specified. Commercial Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, rust scale, and foreign matter have been completely removed except for slight shadows, streaks, or discoloration caused by rust stain, mill scale oxides or slight tight residues of paint or coating that may remain; if the surface is pitted slight residues of rust or paint may be found in the bottom of the pits; at least two-thirds of each square inch of surface area shall be free of visible residues and the remainder shall be limited to light discoloration, slight staining or tight residues mentioned above.

iii. Shop Primer – 1 coat of 2 part high build epoxy rust inhibitive primer applied to achieve a 6.0 mils minimum DFT.

iv. Field Shop Primer Touch Up – Touch up all film breaches after proper surface preparation SSPC-SP-2 with a 2 part high build epoxy rust inhibitive primer so all surfaces have the proper 6.0 mils minimum DFT.

v. Field Primer – 1 coat of 2 part high build epoxy rust inhibitive primer applied to achieve 2.0 mils minimum DFT.

vi. Field Finish– 2 coats of acrylic urethane gloss to full opacity to achieve 2.0 mils minimum DFT per coat.

6. Non-Ferrous Metal:

a. Shop applied primer and field applied finish:

i. Surface Preparation – SSPC-SP-1 Solvent Cleaning - Removal of all detrimental foreign matter such as oil, grease, dirt, soil, salts, drawing and cutting compounds, and other contaminants from steel surfaces by the use of solvents, emulsions, cleaning compounds or other similar materials and methods which involve a solvent or cleaning action.

ii. Shop Primer – 1 coat of 2 part high build epoxy rust inhibitive primer applied to achieve a 4.0 mils minimum DFT.

iii. Field Shop Primer Touch Up – Touch up all film breaches after proper surface preparation SSPC-SP-2 and/or SSPC-SP-3 with a 2 part high build epoxy rust inhibitive primer so all surfaces have the proper 4.0 mils minimum DFT.

iv. Field Primer – 1 coat of 2 part high build epoxy rust inhibitive primer applied to achieve 2.0 mils minimum DFT.

v. Field Finish– 2 coats of acrylic urethane gloss to full opacity to achieve 2.0 mils minimum DFT per coat.

B. Interior Surfaces:

1. Galvanized Metal:

a. Shop applied primer and field applied finish:

i. Surface Preparation – SSPC-SP-1 Solvent Cleaning - Removal of all detrimental foreign matter such as oil, grease, dirt, soil, salts, drawing and cutting compounds, and other contaminants from steel surfaces by the use of solvents, emulsions, cleaning compounds or other similar materials and methods which involve a solvent or cleaning action.

ii. Shop Primer – 1 coat of 2 part high build epoxy rust inhibitive

primer applied to achieve a 4.0 mils minimum DFT per coat.

iii. Field Shop Primer Touch-Up – Touch up all film breaches after proper surface preparation SSPC-SP-2 and/or SSPC-SP-3 with a 2 part high build epoxy rust inhibitive primer so that all surfaces have the proper 4.0 mils minimum DFT per coat.

iv. Field Tie Primer – 1 coat of 2 part high build epoxy rust inhibitive primer applied to achieve 2.0 mils minimum DFT.

v. Field Finish – 2 coats of acrylic urethane gloss applied to achieve 2.0 mils minimum DFT.

2. Ferrous Metal:

a. Shop applied primer and field applied finish:

i. Surface Preparation – SSPC-SP-1 Solvent Cleaning - Removal of all detrimental foreign matter such as oil, grease, dirt, soil, salts, drawing and cutting compounds, and other contaminants from steel surfaces by the use of solvents, emulsions, cleaning compounds or other similar materials and methods which involve a solvent or cleaning action.

ii. Surface Preparation – SSPC-SP-6 Commercial Blast Cleaning – Removal of mill scale, rust, rust scale, paint or foreign matter by the use of abrasives propelled through nozzles of by centrifugal wheels, to the degree specified. Commercial Blast Cleaned Surface Finish is defined as one from which all oil, grease, dirt, rust scale, and foreign matter have been completely removed except for slight shadows, streaks, or discoloration caused by rust stain, mill scale oxides or slight tight residues of paint or coating that may remain; if the surface is pitted slight residues of rust or paint may be found in the bottom of the pits; at least two-thirds of each square inch of surface area shall be free of visible residues and the remainder shall be limited to light discoloration, slight staining or tight residues mentioned above.

iii. Shop Primer – 1 coat of 2 part high build epoxy rust inhibitive primer applied to achieve 6.0 mils minimum DFT per coat.

iv. Field Shop Primer Touch-Up – Touch up all film breaches after proper surface preparation SSPC-SP-2 and/or SSPC-SP-3 with a 2 part high build epoxy rust inhibitive primer so that all surfaces have the proper 6.0 mils minimum DFT per coat.

v. Field Primer – 1 coat of 2 part high build epoxy rust inhibitive primer applied to achieve 2.0 mils minimum DFT.

vi. Shop Finish – 2 coats of acrylic urethane gloss applied to full opacity to achieve 2.0 mils minimum DFT.

3. Non-Ferrous Metal:

a. Shop applied primer and field applied finish:

i. Surface Preparation – SSPC-SP-1 Solvent Cleaning - Removal of all detrimental foreign matter such as oil, grease, dirt, soil, salts, drawing and cutting compounds, and other contaminants from steel surfaces by the use of solvents, emulsions, cleaning compounds or other similar materials and methods which involve a solvent or cleaning action.

ii. Shop Primer – 1 coat of 2 part high build epoxy rust inhibitive

primer applied to achieve 4.0 mils minimum DFT.

iii. Field Shop Primer Touch-up – Touch up all film breaches after proper surface preparation SSPC-SP-2 and/or SSPC-SP-3 with a 2 part high build epoxy rust inhibitive primer so that all surfaces have the proper 4.0 mils minimum DFT.

iv. Field Primer – 1 coat of 2 part high build epoxy rust inhibitive primer applied to achieve 2.0 mils minimum DFT.

v. Field Finish – 2 coats of acrylic urethane gloss applied to full opacity to achieve 2.0 mils minimum DFT per coat

4. Gypsum Wall Board:
   a. 1 coat of 100% Acrylic Primer, 1.5 mils minimum DFT.
   b. 2 coats of 2 part acrylic egg shell interior coating to full opacity to achieve 2.0 mils minimum DFT per coat.

5. Concrete Block Surfaces: Interior:
   a. 2 coats minimum of Block Filler.
   b. 2 coats of 2 part acrylic semi-gloss interior coating to full opacity to achieve 2.0 mils minimum DFT per coat.

6. Concrete Poured-In-Place and Pre-Formed As Shown On Drawings:
   a. 1 coat of 100% Acrylic Primer, 1.5 mils minimum DFT.
   b. 2 coats of 2 part acrylic semi-gloss interior coating to full opacity to achieve 2.0 mils minimum DFT per coat.

C. General: Provide the following paint systems for the various substrates, as indicated.

1. Exterior and Interior Hollow Metal Doors, Door Frames, and Window Frames: Semi-Gloss Acrylic Enamel Finish.
   a. Prime Coat: Spot Prime Scratched or Abraded Areas Only – Rust Inhibitive Alkyd Metal Primer.
      i. PPG: 6-208 Speedhide Rust Inhibitive Steel Primer.
   b. First and Second Finish Coats: Semi-Gloss Acrylic Enamel.
      i. Porter: 919 Advantage 900 Interior/Exterior Semi-Gloss Acrylic Enamel.

2. Exterior Galvanized Metal: Acrylic Gloss Exterior Paint.
   a. Preparation: Wipe down with naptha; apply Porter: 5 Galva-Prep; wash clean.
   b. Prime Coat: Rust Inhibitive Primer.
      i. PPG: 90-712 Pitt-Tech DTM Primer Acrylic.
   c. First and Second Finish coats: High-Sheen Gloss Acrylic Enamel.
      i. Porter: 619 Acri-Shield Gloss Exterior Acrylic Paint.

3. Exterior Aluminum; Satin Acrylic Enamel Finish.
   a. Preparation: Acid Etch with Porter: 33 Aluma-Prep.
   b. Prime Coat:
      i. PPG: 90-712 Pitt-Tech DTM Primer Acrylic.
   c. First Finish Coat: Satin Acrylic Exterior Paint.
      i. Porter: 739 Acri-Shield Satin Exterior Acrylic paint.

4. Exterior, Exposed Structural Steel: Gloss Epoxy Siloxane Coating.
    a. Surface Preparation: SSPC – SP6 Commercial Blast Cleaning.
    b. Prime Coat:
        i. Amercoat 68HS Zinc Rich Epoxy Primer.
    c. First and Second Finish Coats
        i. Amercoat PSX 700 Engineered Siloxane Coating.

5. Interior Concrete Block, and Portland Cement Plaster: Semi-Gloss Acrylic Epoxy.
    a. Prime Coat: Block Filler.
        i. PPG: 6-15 Speedhide Acrylic Block Filler.
    b. First and Second Finish Coats: Semi-Gloss Acrylic Epoxy.
        i. PPG: 16-551 Pitt-Glaze WB Acrylic Epoxy.

6. Interior and Exterior Portland Cement Plaster Ceilings and Soffits.
    a. Prime Coat: Block Filler.
        i. PPG: 6-15 Speedhide Acrylic Block Filler.
    b. First and Second Finish Coats: Semi-Gloss Acrylic Epoxy.
        i. PPG: 16-551 Pitt-Glaze WB Acrylic Epoxy.

7. Interior Drywall Walls: Semi-Gloss Acrylic Epoxy.
    a. Prime Coat: Latex Sealer.
        i. PPG: 6-2 Speedhide Latex Sealer.
    b. First and Second Finish Coats: Semi-Gloss Acrylic Epoxy.
        i. PPG: 16-551 Pitt-Glaze WB Acrylic Epoxy.

8. Interior Gypsum Drywall Ceilings; Eggshell Acrylic Latex Paint.
    a. Prime Coat: Latex Sealer
        i. PPG: 6-2 Speedhide Latex Sealer.
    b. Fist and Second Finish Coats: Eggshell Acrylic Latex Paint.
        i. PPG Pittsburgh Paints: 9-300 Series Pure Performance Eggshell Latex.

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SECTION 09905
PIPING, VALVE AND IDENTIFICATION SYSTEM

PART I – GENERAL

1.01 WORK INCLUDED

The work included under this Section consists of providing an identification system for piping systems and related equipment.

1.02 QUALITY ASSURANCE

Standards: ANSI Standard A13.1, Scheme for the Identification of Piping Systems

1.03 SUBMITTALS

Submit manufacturer's descriptive literature, illustrations, specifications and other pertinent data.

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 manufacturer’s recommendations.

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 equal.

1. Lettering shall be:
   a. 2 1/4-inches high for pipes 3 inches diameter and larger.
   b. 1 1/8-inches high for pipes less than 3 inches diameter.

2. Flow arrows shall be:
   a. 2 1/4-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 or wire installed over the centerline of the pipelines.

1. Identification Tape for Plastic or Non-Magnetic Pipe: Identification tape shall be manufactured of reinforced inert plastic film with a minimum overall thickness of 9.7-mils and shall have a 0.5-mil thick magnetic metallic foil core. The tape shall be highly resistant to alkalies, acids, and other destructive agents found in soil. 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 1350, or approved equal.

2. Tape background colors and imprints shall be as follows:

Imprint	Pipe Service	Background Color
"Caution- Wastewater Line Buried Below"	SS, GS , FM	Green
"Caution- Reclaimed Water Line Buried Below"	RWM	Purple
"Caution- Potable Water Line Buried Below"	WM	Blue

3. Identification tape shall be "Terra Tape" as manufactured by Reef Industries, Inc., Houston, TX, (800) 231-6074; Allen Systems, Inc., Wheaton, IL (800) 323-1749; or approved equal.

4. Identification Wire or Tracer Wire shall be manufactured in accordance with Article 339 of the National Electric Code. The conductor shall be soft drawn bare copper of gauge size 14 thru 8. The insulator shall be high quality PVC for systems applications above 600 volts and LDPE for system applications up to 600 volts.

E. Aboveground Valve Identifications: On all valves, the CONTRACTOR shall provide a coded and numbered tag attached with brass chain and/or brass "S" hooks.

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 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 be by equipment abbreviation if associated with a particular piece of equipment. Valve numbering, shall be as approved by the ENGINEER and/or OWNER.

F. Buried valves shall have valve boxes protected by a concrete pad. The concrete pad for the valve box cover shall have a 2 1/2-inch diameter, bronze disc embedded in the surface as shown on the Drawings. The bronze disc shall have the following information neatly stamped on it:

1. Size of valve, inches
2. Type of valve: Valve numbers shall be as approved by the ENGINEER and/or OWNER and valve number shall follow the valve type as listed below:
   a. GV - Gate Valve
   b. BFV - Butterfly Valve
   c. PV - Plug Valve
3. Number of turns to fully open
4. Direction to open
5. Year of installation

PART 3 – EXECUTION

3.01 FABRICATED EQUIPMENT

A. Unless otherwise indicated or specifically approved, all fabricated equipment shall be shop primed and finished.

B. The CONTRACTOR shall be responsible for and take necessary steps to properly protect the shop prime and finish coats against damage from weather or any other cause.

C. Where specified in other sections of these specifications for mechanical equipment, the CONTRACTOR shall apply field coat or coats of paint in accordance with Manufacturer's recommendations. If shop finish coat 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.

3.02 INSTALLATION OF IDENTIFICATION TAPE

A. Identification tape shall be installed for all buried lines in accordance with the manufacturer's installation instructions and as specified herein.

B. Tracer wire shall be installed for under all FDOT crossings and FDOT Right-of-Ways.

C. Identification tape shall be installed at depth shown on Construction Drawing details.

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END OF SECTION

SECTION 10100
MODULAR TRAILER

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes component criteria for the purchase of a modular structure to be used as an occupied space for daily office and laboratory use by plant staff. Contractor shall ensure that all criteria included in this specification is included and is responsible for the purchase, installation, connection to site utilities, and all other work incidental thereto.

B. Related Work Specified Elsewhere

1. Division 1: General Requirements
2. Section 02215: Site Grading
3. Section 02226: Trenching Backfilling and Compaction
4. Section 03200: Concrete Reinforcement
5. Section 03300: Cast-in-Place Concrete
6. Section 10505: Metal Lockers

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

ADA – American Disabilities Act
ANSI - American National Standards Institute
ASTM - American Society for Testing and Materials
FBC – Florida Building Code
NEC – National Electric Code

B. Inspection

All work done in accordance with this specification shall be subject to inspection. The OWNER or ENGINEER shall have access to all places of manufacture where materials are being produced or fabricated, or where tests are being conducted and shall be accorded full facilities for inspection and observation.

C. Design

The modular trailer and all interior components shall be designed and sealed by an Architect or Professional Engineer registered in the State of Florida.

D. Anchors

The CONTRACTR shall provide certification that calculations have been performed and signed by a structural or civil engineer registered in the State of Florida confirming that the anchorage system provided is within allowable shear and tension limits. The anchorage system shall be designed to withstand a wind load of 150 miles per hour.

1.03 SUBMITTALS

A. Shop Drawings and Product Data

Submit manufacturer's drawings showing principal dimensions, general equipment construction, and materials used in all parts of the modular trailer. Also, furnish illustrated catalog data and parts schedule in sufficient detail to serve as a guide in assembly and disassembly and in ordering repair parts.

B. Certification

The manufacturer shall provide an affidavit of compliance with all applicable provisions of this specification.

C. Operations and Maintenance Data

Submit repair and maintenance instructions, repair parts listing, and recommended maintenance schedule of inspection and cleaning. See Section 01730 for requirements.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

Modular trailer shall be complete when shipped and the manufacturer shall use all due and customary care in preparing them for shipment to avoid damage in handling or in transit. Particular care shall be taken to see that the parts are completely closed and locked in position before shipment. Parts that are to be embedded in concrete may be shipped separately if requested by the CONTRACTOR.

Anchors and appurtenances to be embedded into concrete shall be available for proper construction sequence.

PART 2 – PRODUCTS

2.01 Modular Trailer

A. Components

As a minimum, the modular trailer shall be 12 ft x 56 ft and shall consist of the following components:

1. Office space (approximately 11 ft x 12 ft)
2. Shower
3. Locker room with benches. A minimum of four (4) lockers shall be provided. Refer to Section 10505 for locker and bench specifications.
4. ADA restroom with sink
5. Open area
    a. Two exterior access doors
    b. Double sink
    c. 15’ minimum counter space with cabinets above and below.
    d. Space for refrigerator (in lieu of storage closet)
    e. 8’x4’ table with six chairs
6. All flooring shall be tile
7. Trailer to be provided with multiple GFI electrical outlets and ethernet ports.

B. General

Modular trailer shall be designed and constructed in accordance with the Florida Building Code.

1. Modular trailer shall be designed to withstand ultimate hurricane force wind speeds.
2. Modular trailer shall be designed in accordance with the American Disabilities Act.
3. Primary entrance and all exits shall be designed for wheelchair access.
4. All doors shall be openable from the egress side without the use of a key, tool, special knowledge or effort. Manually operated flush bolts or surface bolts shall not be used.
5. All glazing within a 48-inch arc of doors, whose bottom edge is less than 60 inches above the floor, and all glazing in doors shall be safety, tempered or acrylic plastic sheet.
6. Floor design live load -100 psf.
7. Occupant load: 7 people. (based on 1 person per 100 square feet of business area).
8. Minimum corridor width shall be 44 inches.
9. Minimum corridor finish shall be gypsum.
10. Modular trailer shall be equipped with a portable fire extinguisher per NFPA 101.
11. Gutters and downspouts shall be provided if the low side of roof provides less than 6" of overhang.
12. Exterior glazing shall be protected with an impact resistant covering per FBC.
13. Emergency lighting shall be capable of providing initial illumination that is at least an average of 1 foot-candle. The emergency power system shall provide power for a duration of not less than 90 minutes.

C. Mechanical

1. All supply air registers shall be 10 inches x 10 inches adjustable with 10 inches x 20 inches (inside) overhead fiberglass duct, unless otherwise specified, ducts located in ventilated attic spaces shall have an R-6 insulation value. ducts located in unconditioned interior space. interior spaces shall have an R-4.2 insulation value.
2. Restroom vent fans shall provide 50 cfm minimum per water closet and / or urinal.
3. Vent fans shall be ducted to the exterior and terminate at an approved vent cap.
4. HVAC equipment shall be equipped with outside fresh intakes providing 20 cfm for each occupant or 50 cfm for each water heater closet and each urinal, whichever is greater.

D. Electrical

1. All circuits and equipment shall be grounded in accordance with the appropriate articles of the national electrical codes (NEC).
2. When light fixtures are installed in closets they shall be surface mounted or recessed.
3. When water heaters are installed they shall be provided with readily accessible disconnects adjacent to the water heaters served.
4. HVAC equipment shall be provided with readily accessible disconnects adjacent to the equipment served.
5. Fire alarm pull station operable device shall be located 42 to 45 inches above the floor. Fire alarm horn / strobe device shall be wall mounted.
6. Exterior lights not intended for 24-hour use and shall be connected to a photocell

or timer.

7. All receptacles installed in wet locations (exterior) shall be in weather proof enclosures.

E. Plumbing

1. Toilets shall be elongated with non-absorbent open front seat.
2. Restroom walls shall be covered with non-absorbent material to a minimum height of 48 inches above finished floor.
3. All plumbing fixtures shall have separate shut-off valves.
4. Water heater shall have safety pan with 1-inch drain to exterior, temperature and pressure relief valve with drain to exterior, and a shut off valve within 3 feet on a cold-water supply line.
5. Water supply lines shall be copper.
6. Water closets shall be tank type and urinals shall be flush tank type.
7. Showers shall be controlled by an approved mixing valve with a maximum water outlet temperature of 120° F.
8. Thermal expansion device, if required by water heater installed, shall be provided by the Contractor.

F Acceptable Manufactures

Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

1. ModSpace, 12'x56'; Lakeland Florida
2. Or Approved Equal

PART 3 – EXECUTION

3.01 SITE PREPARATION

Contractor shall ensure that the following minimum site preparations are performed prior to the installation of the modular trailer. Contractor shall be responsible for any additional requirements by the manufacturer.

1. Foundation shall be on an allowable soil bearing pressure of 3000 psf.
2. Foundation shall be built on undisturbed soil or properly compact fill material. Compacted soils shall be tested to a minimum of 95% proctor in accordance with ASTM D 1557.
3. Excavations for foundations shall be backfilled with soil which is free of organic material, construction debris, and large rocks.
4. Finish grade shall be sloped away from the foundation for drainage.
5. Ground anchors shall be installed per manufacturer recommendations.
6. Tie-down straps shall be installed per manufacturer recommendations
7. Contractor is responsible for providing ramps, stairs, and general access to the building; electrical service hookups (including feeders), communication connections (phone and/or internet), potable water connections, and sanitary sewer connections.

3.02 CONTRACTOR VERIFICATION

Before installation verify dimensions with construction in place. Check anchors and/or other components embedded in concrete to be adequate. Correct all defects and deficiencies before proceeding with the work.

3.03 INSTALLATION

Care shall be taken to install trailer per manufacturer's instructions.

END OF SECTION

SECTION 10200
LOUVERS AND VENTS

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Fixed, extruded-aluminum louvers.

B. Related Sections include the following:

1. Division 15 Sections for louvers that are a part of mechanical equipment.

1.03 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers.

1. Wind Loads: Determine loads based on pressures as indicated:
   a. Positive pressure = Refer to structural drawings for design pressures.
   b. Negative pressure = Refer to structural drawings for design pressures.

2. Missile Impact Loads: Provide large and small hurricane missile protection in accordance with the Florida Building Code, Section 1626 – Impact Tests for Windborne Debris.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.

C. Samples for Verification: For each type of metal finish required.

D. Qualification Data: For professional engineer.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.

1. Provide the Miami-Dade Notice of Acceptance Number.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2, "Structural Welding Code--Aluminum."

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements including masonry opening details indicated on drawings, provide products by one of the following:

- Construction Specialties, Inc. (Basis of Design)
- Industrial Louvers, Inc.
- Ruskin Company; Tomkins PLC.
- Greenheck, Inc.

2.02 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.

D. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.

2. Use Phillips pan-head screws for exposed fasteners, unless otherwise indicated.

E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.03 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Where indicated, provide subsills made of same material as louvers or extended sills for recessed louvers.

F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.04 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Hurricane-Resistant Louver:

1. Construction Specialties, Inc.
2. Industrial Louvers, Inc.
3. Ruskin Manufacturing
4. Greenheck model

B. Louver Depth: 6" to 11" overall assembly including missile protection system.

C. Performance Requirements:

1. Free Area: Refer to mechanical documents for free area requirements.

2.05 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.

2. Finish: Same finish as louver frames to which louver screens are attached.

D. Louver Screening for Aluminum Louvers: provide bird-screen and insect-screen (16 x 18 mesh with 51% free area, 0.0048-inch wire) as necessary.

2.06 FINISHES, GENERAL

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.07 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic-Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.03 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.04 ADJUSTING AND CLEANING

A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

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SECTION 10425
SIGNAGE

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Panel signs - room identification.

1.03 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract.

B. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

C. Shop drawings showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.

1. Provide message list for each sign required, including large-scale details of wording and lettering layout.

2. Templates: Furnish full-size spacing templates for individually mounted dimensional letters and numbers.

D. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.

1. Samples for initial selection of color, pattern, and texture:
   a. Cast Acrylic Sheet and Melamine Sheet: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.
   b. Aluminum: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate, showing the full range of colors available.

2. Samples for verification of color, patterns, and texture selected and compliance with requirements indicated:
   a. Cast Acrylic Sheet and Melamine Sheet: Provide a sample panel not less than 8-1/2 inches by 11 inches for each material, color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.

1.04 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

C. All signs shall conform to all requirements of the Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities, Articles 4.1.2 (7) and 4.30.1 through 4.30.7 (1) inclusive.

1.05 PROJECT CONDITIONS

Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Manufacturers of Panel Signs:

- Ace Sign Systems, Inc.
- Allen Industries, Inc.
- ASI-Modulex, Inc.
- Best Sign Systems, Inc.
- Designed Signs Clearwater, Inc.
- Environmental Graphics, Inc.
- Mohawk Sign Systems

2.02 PANEL SIGNS FOR ROOM IDENTIFICATION

A. Panel signs shall be minimum 1/8” thick (excluding thickness of raised sign letters) melamine or acrylic plastic with 1/32” thick raised characters with Grade 2 Braille.

1. At sign manufacturer’s option, the minimum 1/8” thickness of the panel can be achieved by laminating a base layer of melamine or acrylic to the top layer containing the integral raised characters. Edges shall be ground smooth.

2. The characters and background of signs shall be eggshell, matte, or other non-glare finish. Characters and symbols shall contract with the background – either light characters on a dark background or dark characters on a light background. Submit manufacturer’s standard palette of colors meeting these requirements to Architect for selection.

3. Raised Tactile Text shall be achieved by chemically welding 1/16" thick computer cut, colorfast MAP text characters into the 1/32" computer recessed area of the face of the base sheet. The text shall be chemically welded to the recessed surface of the base sheet using methylene chloride and shall, after fabrication, remain raised 1/32" above the face of the base sheet.

4. Grade 2 Braille shall be achieved by pressing optically correct acrylic raster balls into .003 in. computer drilled holes in the base sheet surface. The acrylic raster balls shall be U.V. protected and shall be guaranteed against fading. Bordered, depressed Braille is not acceptable.

5. Sign edges shall be square and the corners shall have a ¼" radius.

6. Text style shall be Helvetica upper and lower case letters. Text height shall be determined within a range of 5/8" to 2".

B. Room identification signs are to be provided at each door opening.

1. At all Toilet Rooms, in addition to a room name sign provide pictograms of the international symbol of accessibility.
   a. Example:
      i. Room Name Sign: Men's Restroom
      ii. Pictogram: Accessibility Symbol

2. Fabrication: The sign shall be approximately 4" x 8". Sign edges are to be straight and free from saw marks or any other imperfections. Corners shall be rounded, with 1/4" to 3/8" radius.

C. Typeface: Per artwork to be supplied, confirmed by Owner as necessary.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Room Identification Signs: Mount on adjoining walls and locate signs adjacent to the latch side of the door. In case of conflicts with closely spaced doors, with vision panels or where there is no wall space to the latch side of the door, notify Architect. Verify all sing locations with Architect prior to installation.

C. Wall Mounted Signs: Attach signs to wall surfaces using a minimum of two stainless steel screws. For exterior signs, use four stainless steel screws. Use expansion shields for screws set in masonry; use "Molly" type hollow wall fasteners for screws set in gypsum board or plaster.

1. Mounting shall be at a height of 60" to the centerline of the sign (to centerline of top sign when two signs are mounted one above the other).

D. Disabled Parking Space Signs: Install in locations and at mounting heights indicated on drawings.

3.02 CLEANING AND PROTECTION

After installation, clean soiled sign surfaces according to the manufacturer's instruction. Protect units from damage until acceptance by the Owner.

END OF SECTION

SECTION 10505
METAL LOCKERS

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Standard metal lockers.
2. Locker benches.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.

B. Shop Drawings: For metal lockers. Include plans, elevations, sections, details, and attachments to other work.

1. Show locker trim and accessories.
2. Include locker identification system and numbering sequence.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For metal lockers and locker benches, in manufacturer's standard sizes.

E. Qualification Data: For qualified Installer.

F. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

G. Warranty: Sample of special warranty.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain metal lockers, locker benches, and accessories from single source from single manufacturer.

C. Regulatory Requirements: Where metal lockers and benches are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1.

D. Preinstallation Conference: Conduct conference at the Project site.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

B. Deliver master and control keys to Owner at the end of installation.

1.06 PROJECT CONDITIONS

Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.07 COORDINATION

A. Coordinate sizes and locations of concrete / concrete masonry bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures.
   b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.

3. Warranty Period for All-Welded Metal Lockers: min. 10 years from date of Substantial Completion.

1.09 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Full-size units of the following metal locker hardware items units:
   a. Locks.
   b. Identification plates.
   c. Hooks.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with A60 zinc-iron, alloy (galvannealed) coating designation.

C. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

D. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as indicated, for corrosion resistance.

2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.02 STANDARD METAL LOCKERS

A. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

1. Art Metal Products; Standard K.D. Lockers.
2. ASI Storage Solutions Inc.; Traditional Collection.
3. DeBourgh Mfg. Co.; Worley Lockers.
4. General Storage Systems Ltd.; Decor Tri-Lok.
5. Hadrian Manufacturing Inc.; Emperor Lockers.
6. List Industries Inc.; Standard Quiet KD Lockers.
7. Lyon Workspace Products, LLC; Standard Lockers.
8. Republic Storage Systems Company; Standard Lockers.
9. Tennsco Corp.; Tennsco Lockers.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product as indicated on Drawings or comparable layout.

C. Locker Arrangement: Single tier as indicated on Drawings.

D. Material: Cold-rolled steel sheet.

E. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet as follows:

1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch nominal thickness, with single bend at sides.

2. Backs and Sides: 0.024-inch nominal thickness, with full-height, double-flanged connections.

3. Shelves: 0.024-inch nominal thickness, with double bend at front and single bend at sides and back.

F. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.

1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.

2. Frame Vents: Fabricate face frames with vents.

G. Doors: One piece; fabricated from 0.060-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Doors less than 12 inches wide may be fabricated from 0.048-inch nominal-thickness steel sheet.

2. Doors for box lockers less than 15 inches wide may be fabricated from 0.048-inch nominal-thickness steel sheet.

3. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.

4. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet; welded to inner face of doors.

5. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.

6. Door Style: Unperforated panel.

H. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches high. Provide no fewer than three hinges for each door more than 42 inches high.

2. Continuous Hinges: Manufacturer's standard, steel, full height.

I. Projecting Door Handle and Latch: Finger-lift latch control designed for use with either built-in combination locks or padlocks; positive automatic latching, chromium plated; pry and vandal resistant.

1. Latch Hooks: Equip doors 48 inches and higher with three latch hooks and doors less than 48 inches high with two latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.

2. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

J. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry and vandal resistant.

1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic latching and prelocking.
    a. Latch Hooks: Equip doors 48 inches and higher with three latch hooks; fabricated from 0.105-inch nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
    b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
    c. Latch Hook: Equip each door with one latch hook, fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.

K. Cylinder Locks: Built-in, flush, cam locks with five-pin tumbler keyway, keyed separately and master keyed. Furnish two change keys for each lock and two master keys.

1. Key Type: Flat with key head for accessible lockers.

2. Bolt Operation: Manually locking deadbolt.

L. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:

1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.

2. Coat Rods: For each compartment of single-tier metal lockers.

3. Coat Rods: In lieu of ceiling hook for metal lockers 24 inches high or more.

M. Accessories:

1. Legs: 6 inches high; formed by extending vertical frame members, or fabricated from 0.075-inch nominal-thickness steel sheet; welded to bottom of locker.
    a. Closed Front and End Bases: Fabricated from 0.036-inch nominal-thickness steel sheet.

2. Continuous Zee Base: Fabricated from 0.060-inch manufacturer's standard thickness, but not less than 0.060-inch nominal-thickness steel sheet.
    a. Height: 8 inches

3. Continuous Sloping Tops: Fabricated from 0.036-inch manufacturer's standard thickness, but not less than 0.036-inch nominal-thickness steel sheet.
    a. Closures: Vertical end type.
    b. Sloping-top corner fillers, mitered.

4. Individual Sloping Tops: Fabricated from 0.024-inch nominal-thickness steel sheet.

5. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.

6. Filler Panels: Fabricated from [0.036-inch manufacturer's standard thickness, but not less than 0.036-inch nominal-thickness steel sheet.

7. Boxed End Panels: Fabricated from 0.060-inch nominal-thickness steel sheet.

8. Finished End Panels: Fabricated from 0.024-inch nominal-thickness steel sheet.

9. Center Dividers: Fabricated from 0.024-inch nominal-thickness steel sheet.

N. Finish: Baked enamel.

1. Color(s): As indicated by manufacturer's designations, match Architect's sample as selected by Architect from manufacturer's full range.

2.03 LOCKER BENCHES

A. Provide bench units with overall assembly height of 17-1/2 inches X

B. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.

1. Size: Minimum 9-1/2 inches wide by 1-1/4 inches thick except provide minimum 20-inch wide tops where accessible benches are indicated.

2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.

3. Plastic laminate over particleboard core, with two steel tubes running full length of top and positioned to receive pedestal fasteners.
   a. Color: Match metal lockers, as indicated by manufacturer's designations.

4. Extruded aluminum with clear anodic finish.

C. Freestanding Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top, complete with fasteners, and as follows:

1. Aluminum: 1/8-inch-thick by 3-inch-wide channel or 1/4-inch-thick by 3-inch-wide bar stock, shaped into inverted-T form; with nonskid pads at bottom.
   a. Finish: Clear anodic finish.

2.04 FABRICATION

A. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.

2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

C. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.

D. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.

2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

E. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

F. Coat Rods: Fabricated from 1-inch- 3/4-inch- diameter steel, nickel plated.

G. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

H. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.

I. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

J. Individual Sloping Tops: Fabricated in width to fit one locker frame in lieu of flat locker tops; with integral back; finished to match lockers. Provide wedge-shaped divider panels between lockers.

K. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.

L. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

M. Boxed End Panels: Fabricated with 1-inch- wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

N. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

O. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.05 STEEL SHEET FINISHES

A. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.

B. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.

C. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.

2. Anchor single rows of metal lockers to walls near top and bottom of lockers of lockers and to floor.

3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Metal Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.

C. All-Welded Metal Lockers: Connect groups together with standard fasteners, with no exposed fasteners on face frames.

D. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach hooks with at least two fasteners.

2. Attach door locks on doors using security-type fasteners.

3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
   a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
   b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

4. Attach recess trim to recessed metal lockers with concealed clips.

5. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.

6. Attach sloping-top units to metal lockers, with closures at exposed ends.

7. Attach boxed end panels with concealed fasteners to conceal exposed ends of nonrecessed metal lockers.

8. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

E. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

F. Freestanding Locker Benches: Place benches in locations indicated on Drawings.

3.03 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

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END OF SECTION

SECTION 10522
FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES

PART I – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Fire extinguishers.
2. Fire extinguisher cabinets.

1.03 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract.

B. Product data for cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.

C. Samples for initial selection purposes in the form of manufacturer's color charts consisting of sections of units showing full range of colors, textures, and patterns available for each type of cabinet finish indicated or exposed to view.

1.04 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain extinguishers and cabinets from one source from a single manufacturer.

B. UL-Listed Products: Fire extinguishers shall be UL listed with UL listing mark for type, rating, and classification of extinguisher.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- J.L. Industries.
- Larsen's Manufacturing Co.
- Modern Metal Products by Muckle.
- Potter-Roemer, Inc.
- Samson Metal Products, Inc.

2.02 FIRE EXTINGUISHERS

A. General: Provide fire extinguishers for each cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard, that comply with authorities having jurisdiction.

B. Multipurpose Dry Chemical Type: UL-rated 2-A:10:B:C, 5-lb nominal capacity, in enameled steel container.

2.03 CABINETS

A. Construction: Manufacturer's standard box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

B. Cabinet Type: Suitable for containing the following:

1. Fire extinguisher.

C. Cabinet Mounting: Suitable for the following mounting conditions:

1. Semi-recessed: Cabinet box (tub) partially recessed in walls of shallow depth. The cabinet and door handle can only project a maximum of 4”, into the space.

D. Trim Style: Fabricate trim in one piece with corners mitered, welded, and ground smooth.

1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   a. Provide 2-1/2 inch rolled edge.

E. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.

1. Enameled Steel: Manufacturer's standard finish, hollow steel door construction with tubular stiles and rails.

F. Identify fire extinguisher in cabinet with FIRE EXTINGUISHER lettering applied to door. Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.

1. Application Process: Silk screen.
2. Lettering Style: Horizontal
3. Lettering Color: White.

G. Door Style: Manufacturer's standard design.

1. Full-Glass Panel: Tempered glass, 1/8 inch thick.

H. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.04 FINISHES FOR CABINETS, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying temporary strippable protective covering prior to shipping.

2.05 STEEL CABINET FINISHES

A. Surface Preparation: Solvent-clean surfaces complying with SSPS-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5 (white metal blast cleaning) or SSPC-SP 8 (pickling).

B. Factory-Priming for Field-Painted Finish: Apply shop primer specified below immediately following surface preparation and pretreatment.

1. Shop Primer: Manufacturer's or fabricator's standard fast-curing, lead-free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Baked-Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturer's standard two-coat baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's instructions for applying and baking to achieve a minimum dry film thickness of 2.0 mils.

1. Color: White. Paint the following:
   a. Exterior of cabinet.
   b. Interior of cabinet.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for thickness and framing for cabinets to verify cabinet depth and mounting prior to cabinet installation.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Follow manufacturer's printed instructions for installation.

B. Install in locations indicated. Each extinguisher requires a cabinet. Mount cabinet with

bottom edge of trim located 32" above finished floor.

1. Prepare recesses in walls for cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions. Recesses in masonry walls shall be neatly sawcut.

2. Fasten mounting brackets and cabinets to structure, square and plumb.

END OF SECTION

SECTION 11005
PROCESS EQUIPMENT GENERAL REQUIREMENTS

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes general provisions and requirements for all equipment specified in the Division 11 to be furnished and installed as indicated on the Plans complete with safety guards, anchor bolts and lubrication. This Section also includes component name plates, structural process modification requirements and maintenance prior to final acceptance.

B. Related Work Specified Elsewhere

1. Section 03300: Cast-in-Place Concrete
2. Section 03600: Mortar and Grout
3. Section 13450: Process Instruments, Controls and Monitoring Equipment
4. Section 16010: Electrical General Requirements

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work of this Section shall conform to the applicable portions of the following Standard Specifications:

1. AFBMA - Antifriction Bearing Manufacturing Association
2. ANSI - American Standards Association
3. AMCA - Air Moving and Conditioning Association
4. ASA - American Standards Association
5. ASTM - American Society for Testing Materials
6. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
7. ASME - American Society of Mechanical Engineers
8. AWWA - American Water Work Association
9. FM - Factory Mutual
10. NEMA - National Electrical Manufacturers' Association
11. NFPA - National Fire Protection Association
12. UL - Underwriters Laboratories, Inc.

B. Deviations and Modifications

1. Motor Size

Deviation from motor sizes specified or indicated on the Plans recommended to accommodate any particular piece of equipment specified in various Sections of this Division shall strictly comply with these Specifications. The CONTRACTOR shall include with his bid any additional engineering and construction costs necessary to redesign the mechanical and/or electrical services recommended through CONTRACTOR by equipment manufacturer or supplier. No deviations will be permitted without written approval by the OWNER.

2. Structure/Process Modification

Modifications to the structure or process configuration recommended for ease of installation, operation or maintenance for a particular piece of equipment specified in various Sections of these Specifications shall strictly comply with these Specifications. The CONTRACTOR shall include with his bid any additional engineering and construction costs necessary to perform modifications recommended through the CONTRACTOR by equipment manufacturer or supplier. No modifications will be permitted without written approval by the OWNER.

C. Workmanship

All Work shall be performed in accordance with latest accepted standards and practices for the trades involved. The workmanship shall be subject to the approval of the ENGINEER at all times.

Only craftsmen experienced in the Work to be performed will be allowed to do the Work. This applies particularly to skilled trades such as welding, pipe fitting, plumbing, and sheet metal work.

D. Codes, Ordinances, Permits, and Inspections

All materials and equipment required for the Work and their installation shall conform to the laws of the state of Florida and to all the current codes, rules, regulations, and ordinances of the locality where the Work is to be performed. The CONTRACTOR shall secure all permits, licenses, inspections and tests required in connection with his Work, however, the OWNER shall or has paid for these permits as described in Section 01010 Summary of Work. Upon completion of the Work, the CONTRACTOR shall secure and present to the OWNER a certificate of inspection and approval from the department having jurisdiction over his Work, if such be issued. All fees in connection with the above requirements shall be paid by the CONTRACTOR.

CONTRACTOR shall be required to conform to the above ordinances, laws, rules, and/or regulations without extra expense to the OWNER, except in the instance of ordinances, laws, rules, and/or regulations which are revised or enacted subsequent to the time of signing the Contract.

E. Design Drawings

The general arrangements, design, and extent of the Work prescribed in these Specifications are indicated and/or detailed on the accompanying drawings. Any discrepancies which may occur on the drawings and/or in the Specifications shall be called to the attention of the ENGINEER. No changes or alterations in the Work shall be made because of said discrepancies until approval of such changes or alterations has been secured from the ENGINEER.

In the event of disputes arising because of discrepancies between drawings of the Architectural, Structural, Civil, Mechanical, Process, and/or Electrical Trades, such disputes shall be taken up with the ENGINEER whose decisions will be final.

All dimensions which tie mechanical, process and/or electrical installations to the building structure shall be thoroughly field checked for accuracy and possibility of interferences due to field conditions. Ignorance of such field conditions because of the

CONTRACTOR's failure to field check the dimensions in question will be no excuse for additional compensation.

F. CONTRACTOR'S Interface

The CONTRACTOR shall be responsible to coordinate the furnishing and installation of all materials and labor required for a complete and operable facility.

The CONTRACTOR shall be responsible to include adequate appurtenances to complete installation of equipment furnished by him including motor starters when furnished as an integral part of a packaged piece of equipment or integral mechanical equipment system.

The CONTRACTOR shall be responsible for furnishing and installing the necessary piping to provide a complete and operable installation of all equipment and fixtures whether or not furnished by the CONTRACTOR.

G. Apportionment of the Work

The CONTRACTOR shall classify and apportion all materials and performance of all labor to the several trades involved in accordance with all local customs, rules, regulations, jurisdictional awards, decisions, etc., insofar as they may apply and as required to efficiently execute the Work involved in this Contract regardless of the classification indicated in these Specifications.

H. Surveys

The CONTRACTOR shall layout and establish the lines and grades of all pipes in accordance with the drawings and he shall employ a competent surveyor registered in the state of Florida for this Work. In the event of unforeseen obstructions, the CONTRACTOR shall confer with the ENGINEER and obtain his written approval before proceeding with any Work deviating from the governing drawings. The CONTRACTOR shall assume full responsibility for locations and grades throughout the Work.

I. Locations

All process equipment, plumbing fixtures, and mechanical equipment shall be in the exact locations as determined by the ENGINEER. It shall be the duty of the CONTRACTOR to request such exact locations from the ENGINEER sufficiently in advance of the time when such information will be required at the buildings so as not to interfere with progress of his Work.

J. Points of Termination

The points of connection and termination of the Work under these sections of the Specifications are shown on the drawings or stated in the Specifications, but in case of doubt as to such points of connection or termination, the decision of the ENGINEER shall be final.

K. Local Utilities

The CONTRACTOR shall be responsible for coordinating, obtaining service, including costs and advising the ENGINEER and utility company(s) as to installation schedules.

1.03 SUBMITTALS

A. Shop Drawings and Product Data

Submit shop drawings and product data as required in Section 01300, Submittals, of these Specifications. Submittals where specified in various Sections of these Specifications will be reviewed for circuit design and representation, quality of proposed equipment, availability of components and compatibility to overall control and operation.

B. Certificates

Each equipment manufacturer or supplier shall submit written certification that all equipment furnished is in compliance with the Occupational Safety Standards as specified in other Sections of this Division.

C. Installation Inspection Report

Submit inspection report performed on installed equipment made by the representative of manufacturer or supplier. Report shall certify that equipment has been properly installed, lubricated, ready for operation and results of test operation. See Article 3.03 of this Section.

D. Operation and Maintenance Data

The CONTRACTOR shall submit operating instructions, repair parts lists, equipment manuals, and automatic control diagrams. The submittals shall be as required in Section 01300, Submittals.

The CONTRACTOR shall also provide the ENGINEER with additional copies of the above material, each copy to be bound in book or pamphlet form with approved fastenings and covers. Each bound copy shall include a set of the finally approved shop drawings of all equipment, fixtures, and accessories used on this Project.

E. Equipment Record Card

The CONTRACTOR shall complete and submit an Equipment Record Card as attached at the end of this section, for all equipment furnished as part of this Contract, prior to OWNER acceptance of the equipment.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

Materials and equipment distributed, stored and placed upon or near the site of the work shall at all times be so disposed as not to interfere with work being prosecuted by other contractors in the employ of the OWNER, or with street drainage, fire hydrants or with access thereto, and not to hinder any more than may be necessary, the ordinary traffic of the street.

Materials may be stored on the site in locations designated by the OWNER.

All materials and equipment shall be handled in a manner to avoid damage or breakage and delay in the completion of the Work. The CONTRACTOR shall repair or replace, without cost to the OWNER and to the satisfaction of the OWNER, all items damaged or broken as a result of his operation.

All machined surfaces of the equipment subject to corrosion shall be protected by coating with grease immediately after finishing.

All flanges shall be protected prior to installation by means of wooden flanges bolted in place.

Pump casings shall be thoroughly drained of all water.

All parts of the equipment shall be carefully crafted to facilitate shipping and handling. The crates shall be constructed to completely protect the equipment and shall be sufficiently strong to permit lifting and skidding without requiring additional bracing or reinforcement.
The CONTRACTOR shall notify the ENGINEER not less than seven (7) days in advance of the delivery of any equipment.

All materials shall be so delivered, stored, and handled as to prevent the inclusion of foreign materials and/or damage by water, breakage or other causes. Packaged materials shall be delivered in original unopened containers and shall be stored until ready for use. Packages or materials showing evidence of damage or contamination, regardless of cause, will be rejected. All materials which have been stored shall be subject to retest and shall meet the requirements of these Specifications at the time they are used in the Work and at the time of final acceptance of the Work.

The CONTRACTOR shall obtain a letter from the equipment manufacturer describing the recommended methods of outdoor or indoor storage of the equipment at the site and shall fully comply with such recommendations to be eligible for partial payments on such equipment.

All materials to be incorporated in the Work shall be properly arranged, covered and protected, and the CONTRACTOR shall be solely responsible for the safety of the same. Material improperly stored shall not be included in estimates for partial payment, or if already included, shall be deducted from subsequent estimates.

1.05 JOB CONDITIONS

A. Protection and Maintenance

CONTRACTOR shall provide adequate protection of installed equipment and systems until final acceptance by the OWNER. All maintenance of installed equipment shall be the responsibility of the CONTRACTOR until final acceptance by the OWNER.

1.06 CUTTING AND PATCHING

All minor cutting that may be necessary for the installation of the Work and any minor patching as a consequence thereof shall be done by the CONTRACTOR after review by the ENGINEER.

All major cutting of the structure necessary for the installation of the mechanical Work and major repairs required as consequence thereof shall be done by the CONTRACTOR, after review by the ENGINEER.

PART 2 – PRODUCTS

2.01 MATERIALS

When specific manufacturers or trade names are mentioned in these Specifications, and/or on the drawings, they are used as the design criteria and to establish a minimum of quality standard.

Any substitution made that may affect building size or process function shall be deemed to be made for the convenience of the CONTRACTOR, and all shall be brought to the attention of the ENGINEER at an early date for consideration. Any additional costs resulting therefore shall be

borne by the CONTRACTOR.
The CONTRACTOR shall accept full responsibility that said substitution shall function as required by the process and shall not require additional building space or additional structural requirements. The CONTRACTOR shall also be responsible for all redesign expenses incurred because of the substitution.

Any items required to complete the Work and not specifically mentioned herein, shall conform fully to the quality pattern established by these Specifications.

All materials shall be new and be the standard products of the manufacturer. Seconds, rejects, or damaged materials will be rejected by the CONTRACTOR. The ENGINEER reserves the right to disapprove and reject any materials, proposed or installed which fail to meet these quality standards. The CONTRACTOR shall, at his own expense, remove and replace with approved materials, any materials which do not comply with these standards.

2.02 FABRICATION

Provide for possible adjustments in the field of mechanical and process work fabrications. Adjustments shall allow for adjustment to avoid interferences, installation of equipment or connecting to other Work.

2.03 EQUIPMENT

A. General

All accessories or appurtenances to mechanical or process equipment, such as remote switches, push buttons, relays, overloads, pilot lights, motors, or other items, shall conform to and be installed as required by this or other specification sections.

B. Low Voltage Motors (600 Volts and Below)

1. General Requirements

a. Scope

This Specification covers three phase squirrel cage induction motors NEMA Design "A", "B", and "C" high efficiency motors.

b. Standards

All motors shall be in accordance with NEMA Standard MG1-1978, or the latest revision insofar as it is applicable. Motors shall also comply with the applicable portions of the National Electric Code.

2. Electrical Requirements

a. Voltage and Frequency

Motors 1/3 HP and smaller shall be rated for service on 120 volt, single-phase service.

Standard motors 1/2 HP through 100 HP shall be rated 230/460 volts; motors above 100 HP shall be rated 460 volts, unless otherwise noted in the equipment schedules, specifications or noted on the drawings. Motors will be rated for operation on a three phase, 60 HZ power supply.

b. Operating Characteristics

i. Torques

Motors shall meet or exceed the locked rotor (starting) and minimum breakdown torques specified in NEMA Standards for Design B for the ratings specified.

Motors shall be of the NEMA Design required to meet the torque requirements of the driven load to which it is to be attached.

ii. Currents

Locked rotor (starting) currents shall not exceed NEMA Design B maximum values for the specified rating. Motors shall be capable of a 20 second stall at six times full load current without injurious heating to the motor components.

iii. Efficiency

Motors shall have a minimum and nominal full load efficiency which will meet or exceed the values listed in the motor efficiency tables 3(a) and 3(b); tested in accordance with NEMA Test Standard MG1.12.53a, IEEE Test Procedure 112, Method B, using accuracy improvement by segregated loss determination including stray load loss measurements. The minimum efficiency shall be guaranteed. Motors 100 HP and larger shall have a full load nominal efficiency of not less than 95% with a guaranteed minimum of 94%.

iv. Power Factor

The power factor for 3,600 and 1,800 rpm, 3 through 250 HP ratings at full load, at full voltage shall be a minimum of 83%. Six-pole ratings will be excluded from this requirement.

c. Service Factor and Ambient

Standard motors will be rated for a 1.15 service factor in 40°C ambient.

d. Insulation

i. Standard motors shall have a full Class B insulation system.

ii. Standard motors shall be dipped and baked in polyester varnish to consolidate the winding.

3. Motor Efficiency Tables (At Full Load)

a. Open Drip Proof

SYNCHRONOUS SPEED PERCENT EFFICIENCY 3,600 rpm		
HP	MINIMUM GUARANTEED	NOMINAL
3/4		
1		
1/2	81.5	84
2	84	86.5
3	84	86.5
5	86.5	88.5
7	86.5	88.5
10	88.5	90.2
15	88.5	90.2
20	91.7	91.7
25	90.2	91.7
30	91	92.4
40	91	92.4
50	91.7	93
60	92.4	92.6
75	93	94.1
100	93	94.1
125	93	94.1
150	93	94.1
200	94.1	95

SYNCHRONOUS SPEED PERCENT EFFICIENCY 1,800 rpm		
HP	MINIMUM GUARANTEED	NOMINAL
3/4		
1	81.5	84
1/2	81.5	84
2	81.5	84
3	86.5	88.5
5	86.5	88.5
7-1/2	89.5	91
10	89.5	91
15	90.2	91.7
20	91.7	93
25	91.7	93
30	91.7	93
40	93	94.1
50	93	94.1
60	93	94.1
75	94.1	95
100	94.1	95
125	94.1	95
150	94.5	95.4
200	94.5	95.4

SYNCHRONOUS SPEED PERCENT EFFICIENCY 1,200 rpm		
HP	MINIMUM GUARANTEED	NOMINAL
3/4	77	80
1	81.5	84
1/2	84	86.5
2	85.5	87.5
3	87.5	89.5
5	87.5	89.5
7-1/2	88.5	90.2
10	889.5	91
15	89.5	91
20	90.2	91.7
25	90.2	91.7
30	91	92.4
40	91.7	93
50	91.7	93
60	92.4	93.6
75	93	94.1
100	93	94.1
125	93	94.1
150	94.1	95
200	94.1	95

b. TENV - TEFC Severe Environment and Explosion Proof

SYNCHRONOUS SPEED PERCENT EFFICIENCY 3,600 rpm		
HP	MINIMUM GUARANTEED	NOMINAL
3/4		
1		
1/2	81.5	84
2	82.5	85.5
3	84	86.5
5	85.5	87.5
7-1/2	87.5	89.5
10	88.5	90.2
15	89.5	91
20	91.7	91.7
25	90.2	91.7
30	91	92.4
40	91	92.4
50	91.7	93
60	92.4	93.6
75	93	94.1
100	93	94.1
125	93.6	94.5
150	93.6	94.5
200	94.1	95

SYNCHRONOUS SPEED PERCENT EFFICIENCY 1,800 rpm		
HP	MINIMUM GUARANTEED	NOMINAL
3/4		
1	81.5	84
1/2	81.5	84
2	81.5	84
3	86.5	88.5
5	86.5	88.5
7-1/2	88.5	90.2
10	88.5	90.2
15	90.2	91.7
20	91.7	93
25	91.7	93
30	91.7	93
40	92.4	93.6
50	93	94.1
60	93.6	94.5
75	94.1	95
100	94.1	95
125	94.5	95.4
150	95	95.8
200	95	95.8

SYNCHRONOUS SPEED PERCENT EFFICIENCY 1,200 rpm		
HP	MINIMUM GUARANTEED	NOMINAL
3/4	77	80
1	78.5	81.5
1/2	84	86.5
2	84	86.5
3	87.5	89.5
5	87.5	89.5
77-1/2	87.5	89.5
10	89.5	91
15	89.5	91
20	90.2	91.7
25	90.2	91.7
30	91	92.4
40	91.7	93
50	91.7	93
60	91.7	93
75	93	94.1
100	93	94.1
125	94.1	95
150	95	95.8
200	94.5	95.4

4. Mechanical Requirements

a. Frame Size

Horsepower/frame relationship shall conform to the latest NEMA Standard for T frame motors.

b. Enclosure

i. Motors shall be open drip-proof, TEFC, explosion-proof, or other types of construction as called for in other sections of these Specifications.

ii. Motor frame and end shields shall be of cast iron or cast aluminum construction using alloys with low copper content. Conduct box may be either steel or aluminum.

c. Bearings

i. All motors shall have anti-friction bearings, sized for a L-10 life of at least 25,000 hours under minimum V belt sheave sizes for maximum loading conditions (see NEMA Standard MG1-14-42) or 125,000 hours L-10 life for a direct connected load.

ii. Aluminum end shields shall have a cast-in steel or cast iron bearing insert.

iii. Bearing housings shall be regreasable with provisions for purging old grease.

iv. Bearings shall be preloaded with a bearing loading spring to minimize noise and increase bearing life.

d. Miscellaneous

i. Conduit box shall be diagonally split and rotatable in 90^{o} increments.

ii. External hardware shall be plated to resist corrosion.

iii. External paint shall withstand industrial environments or shall be as called for in other Sections of these Specifications.

iv. Nameplates shall be of stainless steel and stamped per NEMA Standard MG1-10-37. Nameplate information shall include the nominal efficiency value per Standard MG1-12.53b and the manufacturer's minimum guaranteed efficiency value.

v. Motors 50 horsepower and larger shall have embedded passive temperature switches in the windings for use in the motor control circuit that will limit the winding temperature as defined by NEMA Standard MG1-12.53 Type 1. The contact shall be normally closed and rated to operate a 120 volt AC control relay (40 VA).

e. Motor Vibration

Motor vibration, when factory tested by manufacturer, shall not exceed the values of NEMA MG-1 12.05; that is, 0.0010 inches for 3,600 rpm motors, 0.0015 inches for 1,800 rpm motors, and 0.0020 inches for 1,200 rpm motors.

f. Ventilating Fans

TEFC, explosion-proof, chemical duty motors, etc., will be equipped with

ventilating fans of corrosion resistant, nonsparking material.

5. Noise Level

All noise levels shall be less than the maximum requirements of OSHA, NEMA, and IEEE Standards.

6. Tests

Tests shall be performed on each design to assure compliance with the design criteria of this Specification. Each motor 50 Hp or larger shall be dynamically balanced at the factory to within 0.6 mills in accordance with NEMA Standards. In addition, each motor shall be given standard commercial tests which include:

a. Non-load running current.
b. Current balance.
c. Air gap measure.
d. Winding resistance.
e. High potential test.
f. Bearing inspection.
g. Insulation resistance.

Reports of these tests shall be submitted to the ENGINEER for review prior to shipment of the motors.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Equipment

1. General

The CONTRACTOR's attention is directed to the fact that certain equipment, (fans, drives, and other machinery), must be installed before housing and/or enclosures are installed or completed. Doors and other access openings in some cases are not large enough to permit passage of the equipment completely assembled. The CONTRACTOR shall thoroughly investigate these conditions prior to fabrication or shipment.

Component parts furnished as part of a packaged equipment system shall be installed with the mechanical Work, ready for connection as specified in Division 16. Electrical connection between component mechanical parts shall be inclusive to mechanical Work.

Components such as remote operation controls, pilot lights, overloads or others not furnished as integral packaged pieces of equipment shall conform to and be installed as specified in Section 13450, Process Instruments, Controls and Monitoring Equipment.

2. Supports and Anchors

Provide bases, pads, platforms, hangers, clamps, or embedded inserts necessary for proper support and/or anchoring of mechanical and process Work. The CONTRACTOR shall be responsible for the proper sizes, locations, and

quantities of these bases and pads where same are to be on concrete floor slabs, and shall provide all anchor bolts, sleeves, and setting templates for the mechanical equipment and machinery. Bases and/or pads are to be provided for each piece of mechanical equipment and machinery whether shown or not shown on the drawings. Inserts to be embedded in concrete shall conform to and be installed as specified in Sections 03250: Concrete Accessories. Detailed specifications for anchoring are included in other Sections of these Specifications.

All necessary anchor bolts, nuts, washers, and sleeves shall be furnished as per the manufacturer's recommendations and shall be made of ample size and strength for the purpose intended. All anchor bolts, bolt sleeves, washers and nuts supplied shall be 316 Stainless Steel unless otherwise specified. Setting templates and working drawings for installation shall be furnished.

Unless otherwise indicated on the Plans or specified elsewhere, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete. Unless otherwise noted, all equipment baseplates shall be furnished complete with openings for grout.

Mechanical equipment resting on concrete foundations, bases or pads shall rest on a level and uniform bearing surface with grout when vibration isolation is not required or specified. Grout shall be nonshrink, nonstaining Type V as specified in Section 03600: Mortar and Grout.

3. Electrical Service

The CONTRACTOR shall furnish all motors required in connection with his Work and he shall mount or install all his motors in their finished locations.

Electrical components required and furnished for mechanical or process equipment systems provided as complete system by the manufacturer or Subcontractor, and automatic temperature control systems together with any power and control interface wiring shall be the responsibility of the CONTRACTOR. He shall perform this Work in accordance with all requirements of the electrical Specifications. The CONTRACTOR shall be responsible for the proper operation of his equipment and shall furnish all wiring and control diagrams to ensure proper operation of same.

B. Painting

Shop priming and finish coats including preparation shall be as specified in Section 09900: Painting and Special Coatings. All iron and steel surfaces shall be protected by suitable paint or coatings applied in the shop or point of fabrication. Surfaces which will be inaccessible after assembly or installation shall be finish coated to provide protection for the life of the equipment. Surfaces which have been inadequately coated or require touch up in the field shall be repainted. The repainting shall be the responsibility of the CONTRACTOR and performed to the satisfaction of the ENGINEER.

C. Sleeves

Provide sleeves where pipes or ducts pass through walls or floors necessary for installation and as specified elsewhere for process or mechanical Work. Sleeves for covered pipe or ducts shall be of proper size to allow the covering to pass through unless

otherwise directed or specified elsewhere.

D. Plates

Ceiling, floor or wall plates shall be installed at all points where exposed pipes pass through walls, ceiling, or floors. Plates shall be nickel-plated sectional, pressed steel plates with positive catches.

E. Lubrication of Equipment

After installation of any equipment is complete such as motors, pumps, compressors, etc., which depends on lubrication for efficient operation, they shall be lubricated in accordance with the manufacturer's recommendations. The CONTRACTOR shall furnish all oil and grease required to place all of the equipment in initial operation. Oil and grease shall be in accordance with the equipment manufacturer's recommendations. Lubrication points on equipment shall be easily accessible with all points of application provided with one standard fitting throughout the entire job for greases or placing oil. Where equipment is furnished by the manufacturer with different fittings, the CONTRACTOR, at his own expense, shall provide and install standard fittings. All fittings shall be installed in a readily accessible location or provided with extension lines for ease in lubrication. Lubrication shall be done before any test runs will be permitted and when equipment is placed in final operation.

F. Identification

All mechanical equipment including pumps, air handling units and each valve and regulator shall be identified in accordance with other Sections of these Specifications.

G. Welding

Material shall be clean either by wire brushing or by sandblasting, if needed, prior to welding, depending upon the condition of the material. If grease, or other foreign materials of the same nature are present, cleaning shall be done by a suitable solvent.

Black steel pipe and fittings may be welded by either oxyacetylene or electric arc method.

All welding shall be accomplished by welders meeting qualifications covered by the American Standard Code for Pressure Piping (ASA B31.1). Welding shall conform to the standards and requirements of this code and all applicable state and local codes. The OWNER reserves the right to require qualifying demonstrations of any welder assigned to the job by this CONTRACTOR.

Where pipe is specified to be welded, welding fittings shall be used. Scarf welding of branch pipe connections and use of mitered joints shall not be permitted.

All slag, dirt, and loose pieces of metal shall be removed from the interior of the vessels, jackets, nozzles and piping. All welds are to be thoroughly cleaned and wire brushed and weld spatter removed. Grinding of finished welds is not desired except where specified.

H. Safety Guards

Provide and install safety guards for all belts, gears, shafts or other reciprocating, rotating or moving parts of equipment whether shown on the Plans or required by ANSI B15.1, Safety Standard for Mechanical Power-Transmission Apparatus. Paint all guards safety

yellow unless otherwise directed by ENGINEER or specified elsewhere.

Guards shall be fabricated from galvanized or aluminum-clad sheet steel no thinner than 16 gage or galvanized 1/2-inch mesh expanded metal. Each guard shall allow for easy installation and removal. All necessary supports and accessories shall be included with guards. Supports and accessories, including bolts, shall be hot dip galvanized. Safety guards in outdoor locations shall prevent the entrance of rain and dripping water.

I. Nameplates

Provide nameplates on each component of equipment, unless otherwise specified. Plates shall clearly identify manufacturer catalog or model number, serial number and other data pertinent to operation. Securely attach plates to components or have data stamped or cast into the body. Plates or stampings shall be located in a position to be easily and fully visible after components are installed without removing any parts from the component. Only rigid metal plates riveted or screwed to components will be acceptable.

3.02 FIELD QUALITY CONTROL

A. Testing

During and after installation, those tests required by the local, county and state inspection bureaus, the OWNER and/or the ENGINEER, shall be performed in strict accordance with the department concerned and at the full expense of the CONTRACTOR.

The CONTRACTOR shall furnish all equipment, water, compressed air, apparatus, and labor necessary for the test. All defects disclosed by the tests shall be rectified by the CONTRACTOR without cost to the OWNER. Tests required by the OWNER after installation are outlined in Article 3.03 of this Section.

All equipment shall be tested as in normal operating service unless specific rating tests are required as results of questionable performance.

Gages and equipment, etc., which may be damaged by the tests shall be valved off or removed before testing.

Special tests required for certain apparatus are specified under the specific headings for that apparatus.

In general, all visible or audible leaks shall be fixed regardless of previous testing results.

B. Final Inspection

Upon completion of the Work, the CONTRACTOR shall conduct a complete inspection of all items of Work instituted by the Contract obligations; and make whatever corrections and adjustments deemed necessary to a well functioning system, same to meet the satisfaction of the ENGINEER and the OWNER.

The CONTRACTOR shall signify his readiness for final inspection in writing to the ENGINEER. The time of inspection may occur at the time of "Operating and Instructions." The inspection shall be made in the presence of the OWNER and ENGINEER.

3.03 EQUIPMENT STARTUP

A. Installation Inspection and Testing

After completion of the installation, all systems and equipment shall be tested by the CONTRACTOR in the presence of the ENGINEER under actual operating conditions. Tests shall be performed according to manufacturer's recommendations, and documented with an Installation Inspection Report, as included at the end of this Specification Section.

Installed equipment shall be operated under full working load conditions before being accepted by the ENGINEER as ready for satisfactory operation. Each piece of equipment shall be certified by the representative that installation is correct and ready for satisfactory operation. Such test operation shall last 4 hours, or until it is demonstrated to the OWNER and ENGINEER that the equipment is ready for acceptance or trial operation.

The manufacturer or supplier of each piece of equipment shall provide the services of a representative to field review installation procedures with the CONTRACTOR, inspect installed equipment and adjust for satisfactory operation. The CONTRACTOR shall include with his bid the services of all required equipment manufacturer's field service technician for a period necessary to complete the work to the satisfaction of the ENGINEER and OWNER. The representative shall provide all necessary tools and testing equipment required including noise level and vibration sensing equipment. A written Installation Inspection Report covering the representative’s findings and installation approval shall be submitted to the ENGINEER covering all inspections and outlining in detail any deficiencies noted.

Specific requirements, if any, such as trial operation, for a particular system or piece of equipment are contained in the particular specification sections.

The CONTRACTOR’s responsibility relative to coordinating these services is contained in Section 01700, Closeout Procedures and Section 01650 Starting and Placing Equipment into Operation.

B. Performance Testing

Certain specified equipment will be required to complete a Performance Testing period. During this period the equipment will be placed in normal operation and will run either manually or automatically as determined by the OWNER to be in the best interest of the facility.

During this period the OWNER will provide the power, operating supervision, and normal operation maintenance activities, however, the equipment shall remain the property of the CONTRACTOR, and shall not be accepted by the OWNER until successful completion of the performance testing period. The CONTRACTOR and/or manufacturer may be present during the trial operation if desired. Unless otherwise required by the individual specification sections, the performance testing period shall be seven 24 hour days. Performance testing may not commence until permanent power, controls, alarms, connecting piping and appurtenances and any devices or systems required for full automatic operation are completed, tested and ready for final inspection.

If during the performance testing period the equipment fails, causes alarm conditions, becomes overloaded, over temperature or in any way fails to perform in accordance with the contract requirements, the equipment shall be repaired, replaced or corrected to a new and perfect condition, and the performance testing period begun anew. See Section 01650: Starting and Placing Equipment into Operation, for additional information.

3.04 ADJUSTMENT AND CLEANING

Before turning the project over to the OWNER, clean all fixtures, piping, covering, exposed metal surfaces and leave all in clean condition at the end of the Work and remove from the premises all refuse, dirt and rubbish which are a result of the mechanical Work or workmen. Also, remove from the premises all cartons, scrap, and major debris at least once a week during progress of the Work.

All instruments used in the checking, adjusting, and balancing shall be accurately calibrated and maintained. Accuracy tests on instruments shall be performed in the presence of and whenever requested by the OWNER or the ENGINEER.

Air and water balance and checking shall not begin until systems have been completed and are in full working order. The CONTRACTOR shall put all heating, ventilating, and air conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing.

3.05 SPARE PARTS AND SPECIAL TOOLS

Spare parts shall be provided for each piece of equipment as specified in various Sections of this Division and shall be delivered to the Project site in boxes with labels identifying contents. Special tools necessary for maintenance by OWNER shall be furnished with each particular piece of equipment. These tools shall be included whether or not specified in various Sections of this Division.

Delivery of all parts and/or special tools shall be made prior to Contract Closeout as specified in Section 01700, Closeout Procedures. Storage shall be where determined by ENGINEER.

3.06 OPERATION AND MAINTENANCE TRAINING

Provide services of manufacturer's service representative to instruct OWNER's personnel in operation and maintenance of equipment. Training shall include start-up and shutdown, servicing and preventative maintenance schedule and procedures, and troubleshooting procedures plus procedures for obtaining repair parts and technical assistance.

1. Manufacturer’s representative shall provide 1 day, 8 hours, On-Site training, unless specified otherwise is individual specification sections.

2. Review operating and maintenance data contained in the operating and maintenance manuals.

3. Schedule training with OWNER, provide at least 15-day prior written notice to ENGINEER.

See Section 01800 for additional information and requirements.

3.07 Equipment Acceptance

Equipment, components and facilities shall be deemed accepted by the OWNER, and the warrantee start dates established, by the execution of a Certificate of Substantial Completion in accordance with the General Conditions.

Except, if required by the specifications or drawings, and/or if requested by the OWNER, individual equipment items, or systems, or components, may be accepted prior to Substantial Completion. Such partial acceptance shall be documented with a Partial Acceptance document, appended to this Specification Section. All acceptance requirements, including but not limited to

approved shop drawings, O&M manuals, Installation Inspection Report, testing and trial operation, training, and Operations and Maintenance Manuals shall apply.

END OF SECTION

EQUIPMENT RECORD CARD

NAME_____ MAKE_____MODEL_____

TYPE_____ SIZE_____SERIAL #_____

ORDER NUMBER_____SUPPLIER_____DATE PURCHASED_____

DATE INSTALLED_____APPLICATION_____PLANT #_____

Nameplate Data and Pump Info Stuffing Box Data Motor Data

GPM _____Diameter_____ Depth_____ Name_____Serial #_____

TDH _____Pack.Size_____Type_____H.P._____Speed_____

RPM_____Length _____No. Rings_____Ambient°_____

Gage Press Disc_____Lantern Ring_____Flushed_____RPM_____ Frame_____

Gage Press Suc_____Mech. Seal Name_____Size_____Volts_____Amps_____

Shut Off Press_____Type_____Phase_____ Cycle_____

Suction Head_____Shaft Size_____Key_____

Pump Materials

Rotation_____Casing_____Bearing Front_____

ImpellerType_____Shaft_____Rear_____

Impeller Dia._____Wearing Rings Casing_____Code_____ Type_____

Impeller Clear_____Wearing Rings Impeller_____Amps @ Max Speed_____

Coupl Type & Size_____Shaft Sleeve_____Amps @ Shut Off_____

Front Brg #_____Slinger_____Control Data Info_____

Rear Brg #_____Shims_____Starter_____

Lub Interval_____Gaskets_____NEMA Size_____

Lubricant_____"O"Rings_____Cat. #_____

Wearing Rings_____Brg. Seals Front_____Heater Size_____

Shaft Sleeve Size_____Rear_____Rated @_____

Pump Shaft Size_____Casing Wear Ring Size ID_____Control Voltage_____

Pump Keyway_____OD_____Variable Speed Type_____

Width_____Speed Max_____

Other Related Info

Impeller Wear Ring ID_____ Speed Mix_____

OD_____ Width_____

SECTION 11200
VERTICAL TURBINE PUMPS

PART I – GENERAL

1.01 This specification includes the supply of two (2) vertical turbine product lubricated open lineshaft pump(s). Each unit shall include a bowl assembly, suction strainer, column and open lineshaft, discharge head, sealing assembly and driver.

1.02 QUALITY ASSURANCE

A. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications and it shall be demonstrated to the satisfaction of the OWNER that the quality is equal to equipment made by that manufacturer specifically named herein.

B. Unit responsibility. Pump(s), complete with motor, necessary guards and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.

C. The vertical turbine pump(s) specified in this section shall be furnished by and be the product of one manufacturer.

D. Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.

E. Pump(s) are to be engineered and manufactured under the certification of ISO-9001:2000.

1.03 PERFORMANCE: CHLORINE CONTACT CHAMBER (CCC) EFFLUENT PUMPS

A. Three (3) CCC effluent pumps (1 Duty, 2 Standby) shall be designed for continuous operation and will be operated continuously under normal service.

B. OPERATION CRITERIA

	Flow (GPM)	TDH (ft.)	Max. Pump Speed (RPM)	Max. Shutoff Head (ft.)
Design Condition	2,100	94	1800	167

C. Total dynamic head shall be as measured at the discharge of the pump and shall include velocity head and vertical static head from the minimum water level to the centerline of the pump discharge.

D. Minimum water level shall be at elevation 49.9 inches.

E. Pump(s) are to be mounted at 32.5 feet elevation with the sump floor at 23.0 feet elevation.

F. Maximum pump speed shall not exceed 1800 RPM.

G. Driver size shall be limited to 75 HP maximum.

H. Liquid pumped is Reject Water with a maximum temperature of 85 deg. F.

I. Each pump shall be mounted in accordance with the current edition of the Florida Building Code. The CONTRACTR shall provide certification that calculations have been performed and signed by a structural or civil engineer registered in the State of Florida confirming that the anchorage system provided is within allowable shear and tension limits. The anchorage system shall be designed to withstand a wind load of 150 miles per hour.

1.04 PERFORMANCE: HIGH SERVICE PUMP STATION (HSPS) PUMPS (DEEP INJECTION)

A. Two (2) HSPS effluent pumps (1 Duty, 1 Standby) shall be designed for continuous operation and will be operated continuously under normal service.

B. OPERATION CRITERIA

	Flow (GPM)	TDH (ft.)	Max. Pump Speed (RPM)	Max. Shutoff Head (ft.)
Design Condition	2,100	153	1770	252

C. Total dynamic head shall be as measured at the discharge of the pump and shall include velocity head and vertical static head from the minimum water level to the centerline of the pump discharge.

D. Minimum water level shall be at elevation 48.5 inches.

E. Pump(s) are to be mounted at 25.0 feet elevation with the sump floor at 16.2 feet elevation.

F. Maximum pump speed shall not exceed 1800 RPM.

G. Driver size shall be limited to 125 HP maximum.

H. Liquid pumped is Reject Water with a maximum temperature of 85 deg. F.

I. Each pump shall be mounted in accordance with the current edition of the Florida Building Code. The CONTRACTR shall provide certification that calculations have been performed and signed by a structural or civil engineer registered in the State of Florida confirming that the anchorage system provided is within allowable shear and tension limits. The anchorage system shall be designed to withstand a wind load of 150 miles per hour.

PART 2 – PRODUCTS

2.01 PUMPS

A. Manufacturers

1. Pump(s) shall be the product of Peerless Pump (Model 14MC, 2 Stage for CCC pumps and 14MD, 2 Stage for HSPS pumps) or approved equal.

2. Manufacturer shall have installations of like or similar application with a minimum of 5 years service for this pump size.

B. Design

1. Rotation

a. The pump will be counterclockwise rotation when viewed from the driver end looking at the pump.

2. Impeller

a. The impeller shall be of bronze construction conforming to ASTM B584, C83600. The waterways through the impeller shall have extremely smooth contours, devoid of sharp corners, so as to promote maximum efficiency.

b. The impeller is to be balanced and secured to the shaft by means of a stainless steel drive collet for bowl shafts 1-15/16" diameter and smaller. For bowl shafts larger than 1-15/16" impellers shall be secured to the shaft using a combination of a thrust washer, key and/or snap rings.

c. Impellers shall be adjustable by means of a top shaft-adjusting nut.

3. Bowls

a. The bowls shall be made of close-grained cast iron conforming to ASTM A48 CL30. Castings shall be free from blowholes, sand holes and shall be accurately machined and fitted to close dimensions.

b. Bowls 8" and above shall be flange connected. Bowls below 8" nominal diameter may use either flanged or threaded connections.

c. Bowls shall be designed with smooth passages to ensure efficient operation and their interior shall be coated with Tnemec N140 Pota-Pox Plus, or equal.

d. The casing shall be hydrostatically tested to 1.5 times the design head or 1.25 times the shutoff head whichever is greater.

4. Impeller Shaft

a. Impeller shaft shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel).

b. The shaft shall be supported by bronze or neoprene bearings located on

both sides of each impeller.

c. Impeller shaft coupling shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel).

5. Wear Rings

a. Wear rings shall be provided on both the impellers and bowls on bowls of nominal diameter of 8” or larger so that clearances can be maintained throughout the life of the rings and minimize recirculation. Bowls of 6” and 7” nominal diameter shall incorporate bowl wear rings only.

b. Impeller wear rings shall be of the radial-type.

c. Bowl wear rings shall be of the radial-type.

d. Wear rings shall be attached to the impellers and bowls using an interference fit and Loctite.

e. Wear rings shall be bronze conforming to ASTM, B505 C93200.

6. Column

a. Column pipe in sizes 4” through 12” diameter shall be furnished in interchangeable sections not over ten feet in length, and shall be connected with threaded, sleeve-type couplings. Column pipe 14” diameter and larger shall be flanged and furnished in interchangeable sections not over ten feet in length.

b. Threaded column sections shall be connected with threaded, sleeve-type couplings. Column joints are to be butted to insure perfect column alignment after assembly.

7. Lineshafts

a. Lineshafting shall be of ample size to transmit the torque and operate the pump without distortion or vibration.

b. Lineshafting shall be made of carbon steel conforming to AISI 1045 and be furnished in interchangeable sections not over ten feet in length.

c. Lineshafting shall be coupled with extra-strong threaded steel couplings machined from solid bar steel.

d. Lineshafting shall be fitted with stainless steel replaceable sleeves at each bearing and shall conform to AISI 304 material.

e. Lineshaft bearings shall be of neoprene material construction.

f. Lineshaft bearings shall be retained in bronze guides that are fitted into the column coupling and secured in place by the butted column pipe ends. (for column sizes larger than 16” retainers shall be steel and fabricated into the

column assembly.

8. Discharge Head Assembly (above ground, mechanical seal)

   a. The pump discharge head shall be of the above ground type of either cast iron or fabricated steel construction with an ANSI 125# discharge flange.

   b. The discharge head shall be of sufficient design to support the entire weight of the pump and driver.

   c. If the application uses a variable frequency drive, the discharge head shall be fabricated steel and specifically designed to elevate the discharge head natural frequency above the operating speed.

   d. A drive shaft of the same material as the lineshaft shall extend through the sealing assembly of the discharge head and be coupled to a vertical solid shaft driver using a spacer type coupling to permit easy field removal of the mechanical seal.

   e. The shaft sealing assembly shall consist of a cast iron packing box, cast iron packing gland, bronze packing box bushing, stainless steel packing gland nuts and bolts and mechanical seal.

   f. Packing box shall be rated for 175 PSI.

   g. Discharge head openings shall be fitted with guards to prevent access to the rotating shaft and/or coupling.

9. Vibration Limitations (Field)

   a. The limits of vibration as set forth in the standards of the Hydraulic Institute shall govern.

10. Testing

   a. A certified factory hydrostatic and performance test shall be performed on each bowl assembly in accordance with Hydraulic Institute Standards, latest edition. Tests shall be sufficient to determine the curves of head, input horsepower, and efficiency relative to capacity from shutoff to 150% of design flow. A minimum of six points, including shutoff, shall be taken for each test. At least one point of the six shall be taken as near as possible to each specified condition.

   b. Results of the performance tests shall be certified by a Registered Professional Engineer and submitted for approval before final shipment.

PART 3 – EXECUTION

3.01 GENERAL

A. The equipment shall be installed properly to provide a complete working system. Installation shall follow the supplier's recommendations.

3.02 DELIVERY

A. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations, properly match-marked for ease of field erection

B. All components shall be erected immediately upon receipt from the manufacturer or stored in strict conformance with storage recommendations provided by the manufacturer in the operations and maintenance manual.

C. The equipment shall be lubricated in strict accordance with the instructions of the manufacturer's field service representative. The required lubricants shall be provided by the CONTRACTOR.

3.03 INSTALLATION

A. The equipment shall be erected in strict accordance with the manufacturer's recommendations as approved by the ENGINEER. See Division 16 for electrical installation requirements.

3.04 FIELD QUALITY CONTROL

A. Performance Tests:

After the pumping units have been erected, performance tests shall be conducted. The purpose of these performance tests shall be to demonstrate that the units have been properly erected, and that they and their appurtenant equipment will operate satisfactorily and meet the specified conditions and the guarantees of CONTRACTOR.

1. For the purpose of these tests, OWNER will furnish the electricity, lubricating oil, and the water for a test load when these items are available. The measurement of the quantity of water pumped may or may not be included in the performance test.

2. The performance tests shall be conducted under the supervision of ENGINEER with the cooperation of manufacturer's factory representative.

3. It is intended that these tests shall be carried out by operating each pumping unit through the range specified for a continuous period of at least 2 hours, or until it is shown to the satisfaction of ENGINEER that all of the equipment is in perfect condition and will meet the requirements specified. Throughout these tests of the pumping equipment, the motors and pumps must run smoothly without vibration or heating, otherwise the test shall be stopped and not again undertaken until the unit shall have been put into condition to comply with the requirements for smoothness of operation.

3.05 MANUFACTURER'S FIELD SERVICES

A. Provide services of a factory representative for a minimum of two (2) days to inspect, test, and adjust the equipment after installation to verify the mechanical, structural, and electrical integrity and conformance to the equipment specifications. Provide written certification that the equipment is properly installed following the initial site visit.

B. Provide services of a factory representative for two (2) days to verify the proper operating of the equipment and to instruct OWNER's personnel on operation and maintenance.

C. Provide additional services at no cost to the OWNER to correct any operational problems due to the design and/or fabrication of the ultraviolet disinfection equipment.

3.06 PUMP WARRANTY

The CONTRACTOR shall supply the pump manufacturer's warranty against defects in workmanship and material for a period of two (2) years from the date of Substantial Completion.

END OF SECTION

SECTION 11210
SUBMERSIBLE PUMPS

PART I – GENERAL

1.01 DESCRIPTION

This section includes submersible wastewater wet or dry pit pumps as shown in the schedule. The pump shall be specifically designed to pump raw unscreened wastewater.

For pumps in submerged applications, each pump shall be equipped with a submersible electric motor connected for operation on a 480 volts, 3-phase, 60 HZ service, with both power and control submersible cable, and supplied with a mating cast iron discharge connection elbow. Each submerged unit shall be fitted with lifting cable. The working load of the lifting cable shall be 50% greater than the weight of the pump. The discharge base and elbow shall be permanently installed in the wet well and connected to the discharge piping. The pumps shall connect to the guide base automatically and firmly, guided by a guide bar system from the top of the station to the discharge connections.

The submersible dry pit type wastewater pumps shall be capable of operating in a continuous submerged condition in a vertical position with permanent connections to the inlet and outlet pipes.
Each pump shall be equipped with an inverter duty rated submersible electric motor connected for operation on 480 Volts, 3 Phase, 60 Hertz. All cables shall be oil resistant chloroprene rubber jacketed. The pump, with its appurtenances, shall be capable of continuous submergence underwater without loss of watertight integrity. The motor and pump shall be designed and assembled by the same manufacturer.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Division 1: General Requirements
2. Section 03300: Cast-In-Place Concrete
3. Section 05500: Metal Fabrications
4. Section 11005: Process Equipment General Requirements
5. Section 15200: Process Piping and Valves

1.03 DESCRIPTION OF SYSTEM

The pumps shall be designed to pump raw unscreened wastewater. The discharge connection elbow shall be permanently installed in the dewatering shaft along with the discharge piping in submerged applications. The pumps shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection or service. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump. A sliding guide shall be an integral part of the pump unit. The entire weight of the pump unit shall be guided by a guide system and pressed tightly against the discharge connection elbow sealing the discharge interface. No portion of the pump shall bear directly on the floor of the sump. The pump, with its appurtenances, shall be capable of continuous submergence underwater without loss of watertight integrity. Each pump shall include a stainless steel, corrosion resistant lifting cable and shall include a fishing eye.

1.04 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the work of this Section shall conform to the applicable portions of the following Standard Specifications:

- AFBMA - Anti Friction Bearings Manufacturers Association
- ANSI - American National Standards Institute
- ASTM - American Society for Testing and Materials
- HI USA - Hydraulics Institute USA
- NEMA - National Electrical Manufacturers' Association

B. Source Quality Control

1. Each pump casing shall be hydrostatically tested to 1.5 times maximum shut-off pressure. Each assembled pump shall be fully tested on water and have curves plotted to determine the rated capacity of each pump in accordance with the standard of HI USA.

2. Certified pump curves by manufacturer and drawing reference number.

3. The manufacturer of the pump shall have a quality management system in place and shall be ISO 9001 certified.

4. The pump and accessories specified herein shall be the design and fabrication of a single manufacturer which shall have the sole source responsibility for the pump(s) and associated accessories.

1.05 SUBMITTALS

A. Shop Drawings and Product Data

All pertinent information needed to fully describe the pump(s) and accessories shall be included in the submittal. Where multiple options are included within standard literature, project specific part numbers and options shall be highlighted by enclosing the project-specific information (circling, clouding, text boxes) and other information shall be crossed out. Any deviations to these specifications must be listed on a separate page referencing the specification section with a brief description of the deviation and why it is equal to or superior to what is specified. Submittals for each size and type shall include, but not be limited to the following:

1. Name of Manufacturer

2. Type and Model

3. Rotational Speed

4. Major component materials of construction

5. Pump specification describing construction details:
   a. Assembly drawing, nomenclature and material list
   b. Type, manufacturer, model numbers, location and spacing of bearings.
   c. Impeller type, diameter, through-let dimensions, sphere size, number of vanes and identification number.

6. Setting plans shall include:
   a. Installation Drawing

b. Anchor bolt layout
c. Anchor bolt dimensions.
d. Outline dimensions and weights of pumps, bases, motors, and control enclosures.

7. Complete motor performance data including:

Rating, voltage/phase/frequency; design type; service factor; insulation class; motor pole number; actual rotation speed when combined with the specified pumps; current, power factor and active input power (HP) as a continuous function of shaft power from no load to at least 115 percent load; start (max. inrush) current; locked rotor current; NEC code letter; and motor torque as a continuous function through the motor start cycle from no rotation to full speed.

8. Warranty for the proposed equipment.

9. The manufacturer shall submit a preliminary pump curve indicate, by arrows to points on the Q/H curves, limits recommended for stable operation, between which the pumps are to be operated to prevent surging, cavitation, and vibration. The stable operating range shall be as large as possible, and shall be based on actual hydraulic and mechanical characteristics of the units and shall meet the hydraulic performance requirements of the proposed system. The pump curve shall also show the input power over the entire operating range. The pump curves shall be in units of horsepower, total dynamic head in feet, and flow in gallons per minute.

10. Manufacturer's recommended spare parts.

B. Certification

The manufacturer shall provide an affidavit of compliance with all applicable provisions of this specification.

C. Shop Performance Testing

As specified in Section 1.08 below.

D. Testing and Inspection Report

Prior to start-up the manufacture shall certify, in writing, that the completed installation is in accordance with his recommendations.

E. Operation and Maintenance Data

Submit operating instructions, repair parts listing and recommended maintenance schedule of inspection, cleaning and lubrication. Include manufacturer's recommended lubricants.

F. Warranty

Submit in accordance with the requirements of Section 01740 covering the items included under this Section.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Storage of Materials and Equipment

The CONTRACTOR shall store material and each piece of equipment in accordance with the manufacturer's recommendation for protection from weather, temperature, and moisture contamination.

B. Handling Materials and Equipment

All material shall be handled in a manner such as to eliminate the possibility of damage, breakage, or chipping in transit or otherwise.

1.07 JOB CONDITIONS

Provide sleeves, supports, anchors, or other components to be installed in the construction sequence by other Work. Include templates, setting diagrams or other information necessary for correct location and installation. The CONTRACTOR shall coordinate the location of the access hatches and the pump locations.

1.08 SHOP TEST

The CONTRACTOR shall conduct a full-scale, shop performance test at his expense on each pump. The final performance test will be conducted at the project site after installation. Pump shall be tested completely assembled. All tests shall be conducted in conformity with the latest revision of the Standards of the Hydraulic Institute in a test pit open to the atmosphere. Pump shall be tested over its complete anticipated head range. Pump shall not vibrate, cavitate, or make excessive noise. In cases where deviations from the standards are required, the test procedure shall be as approved by the ENGINEER.

The CONTRACTOR shall furnish drawings for approval showing the proposed test arrangement. These drawings shall be submitted at least 30 days in advance of the date scheduled for the tests. The drawings shall include data on the equipment to be used and the various measuring devices.

All testing apparatus and measuring devices shall be properly calibrated and proof of calibration shall be furnished to satisfaction of the ENGINEER'S.

Test runs shall be made for a least six points on the head capacity curve. There shall be no signs of cavitations such as break-off from the normal head capacity characteristic or any unusual sounds or vibrations when operating at these conditions. The length of time of each test run shall be sufficient to obtain stable and dependable results and shall be subject to the approval of the ENGINEER.

If the performance of the pumping unit does not meet the requirements of the specification, similar tests shall be conducted on a revised pump and proof shall be furnished to the ENGINEER that the requirements are met.

The CONTRACTOR shall submit certified pump curves for approval by the ENGINEER prior to shipment.

PART 2 – PRODUCTS

2.01 GENERAL

A. The pump shall be capable of handling raw, unscreened sewage. The discharge elbow shall be permanently installed in the wet well along with the discharge piping. The pumps shall be automatically connected to the discharge connection elbow when lowered into place. Pumps shall be easily removable for inspection or service, requiring no bolts, nuts or

other fastenings to be removed for the purpose and no need for personnel to enter the pump well. Sealing of the pumping unit to the discharge elbow shall be accomplished by a simple linear downward motion of the pumps with the entire weight of the pumping units guided to and pressed tightly against the discharge elbow with a metal to metal watertight contact. No portion of the pump shall bear directly on the floor of the sump, and there shall be no more than one 90 degree bend allowed between the volute discharge flange and sump piping. Guide bars, which shall steer the pump into proper contact with the discharge elbow shall be non-adjustable and shall not bear the weight of the pump.

B. Pumps shall be submersible, single stage, centrifugal type, supplied with integral electric motor, discharge elbow, guide bar brackets and installation accessories. The pumps shall be suitable for pumping raw sewage and shall be designed and fully guaranteed for this use. The fluid temperature range shall be from 35 degrees to 104 degrees F.

2.02 PUMP CONSTRUCTION

A. Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other casting irregularities. All exposed nuts or bolts shall be AISI type 316 stainless steel. All metal surfaces coming into contact with the pumped media, other than stainless steel and/or brass, shall be protected by a factory-applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish or two-part epoxy on the exterior of the pump.

B. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Pump/Motor unit mating surfaces where watertight sealing is required shall be machined and fitted with Viton Rubber O-rings. Joint sealing will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific bolt torque limit.

C. Rectangular cross sectioned gaskets that require specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

2.03 CABLE ENTRY

A. The cable entry seal design shall provide strain relief and preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of at least one elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the cable entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. For units greater than 100 HP, cable entry shall incorporate dual grommets which shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

B. The cable junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression-type terminals. The use of wire nuts or crimp-type connectors is not acceptable.

2.04 BEARINGS

The integrated pump/motor shaft shall rotate on two (2) sealed and permanently lubricated bearings. External bearing lubrication ports, which allow bearing contamination and over-packing, will not be

allowed. The upper bearing, providing for radial thrust, shall be a single row, roller or ball bearing. The lower bearing shall consist of one double row angular contact bearing for combined axial and radial loads. Minimum L_{10} bearing life shall be 50,000 hours at any usable portion of the pump curve.

2.05 MOTOR

A. Each pump shall be driven by a vertical, submersible squirrel cage induction motor, shell type NEMA B design, housed in a dry watertight chamber. The motor and the pump shall be produced by the same manufacturer.

B. The stator winding shall be insulated with moisture resistant Class H insulation, rated for a temperature of 180^{O}C. The stator shall be insulated using Class H monomer-free polyester resin, resulting in a winding fill factor of at least 95%. The stator shall be heat shrink fitted into the cast iron stator housing. The use of multiple step dip and bake type stator insulation process is not acceptable. The use of bolts, pins, screws, or other fastening devices used to locate or hold the stator and that penetrate the stator housing shall be rejected. The motor shall be designed for continuous duty, while handling pumped media of up to 104 degrees F. The motor shall be capable of withstanding at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum.

C. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with, and supplemental to, external motor overload protection, and shall be connected to the motor control panel.

D. The motor service factor (combined effect of voltage, frequency, viscosity, and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for continuous operation in a 40^{O}C. ambient environment and shall have a NEMA Class B maximum operating temperature rise of 80^{O}C. A motor performance curve shall be provided upon request, showing torque as a function of speed, and current, power factor, speed, input power in KW, and efficiency as a function of shaft power.

E. The motor shall be sized to be non-overloading when the pump is operated at any point on the pump performance characteristic curve.

F. Motors shall be 460 volts, 60 Hz, 3 phase.

G. Motor performance shall conform to the requirements of NEMA MG1 Part 12 and shall be expressed as indicated in NEMA MG1-12.30.

H. Motors shall be premium efficiency type.

I. Inverter Duty

All motors indicated in the Pump Schedule to be powered from variable-frequency alternating-current drives (VFD) shall have the following features in addition to those listed above:

1. Designed for used on pulse width modulated (PWM) VFD without external filters or cable length limitations.

2. Inverter grade, 1,600 volt, Class F insulation.

3. Service factor of 1.0 when operated from a VFD.

4. Meeting requirements of NEMA MG1 Part 31.

2.06 SHAFT

Pump and motor shaft shall be a solid continuous unit. The pump shaft is an extension of the motor shaft. Couplings and shafts incorporating sleeves shall not be acceptable. The pump shaft shall be completely isolated from the pumped liquid.

2.07 MOTOR CABLES

Pump motor power cables installed shall be oil resistant chloroprene rubber jacketed, type SPC multi-conductor cable, suitable for submersible pump applications and heavy mechanical stresses. The power cable shall also be sized according to NEC and ICEA standards. The total length of each cable shall be a minimum of 40 feet long. Power cables shall each include a ground check conductor (see Sec. 5.14).

2.08 HAZARDOUS LOCATION EQUIPMENT (EXPLOSION PROOF SERVICE)

A. In addition to the requirements listed above, for the installations which are considered to be in hazardous locations as defined by the National Electrical Code (NEC), only motors certified by Factory Mutual for use in such locations shall be used.

B. Specifically, the pump motors used shall be certified for use in all Class I, Divisions 1 and 2, Groups C and D, Class II, Divisions 1 and 2, Groups E, and G and Class III locations as outlined in Articles 500-502 inclusive of the NEC code.

2.09 GUIDE BARS AND BRACKETS

A. Guide bar(s) shall be provided for guiding the pump unit in raising and lowering. The guide bars shall not support any portion of the weight of the pump. The lower guide bar holders shall be integral with the discharge elbow. Guide cables shall not be considered equal to guide bars and will not be accepted. The pump unit shall be guided on the bars by a guide bracket which shall be an integral part of the pump. Intermediate supports shall be provided every 5 ft.

B. The guide bar(s), anchor bolts, upper guide bar brackets , intermediate guide bar brackets, and cable holder shall be fabricated from 316 series stainless steel.

2.10 LIFTING CABLE AND FITTINGS

Each pump shall be fitted with AISI 316 stainless steel lifting cable with necessary fittings, capable of lifting the pump and motor. The working load of the cable shall be 50% greater than the wet weight of the pump.

2.11 SPARE PARTS AND SPECIAL TOOLS

Provide manufacturer’s recommended spare parts, including any special tools necessary for maintenance. At a minimum, the following spare parts shall be furnished by the CONTRACTOR:

Description	Quantity for each Pump
Gasket set	1
Spare mechanical seal or seal assembly	1
Bearing set	1
Wrench for removing impeller for each pump impeller size	1
Impeller key, washer, and nut	1

2.12 Manufacturers

- ABS
- Wilo
- Flygt
- approved equal

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

Examine base and verify size of base end anchor bolt positioning. Rectify conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable for proper positioning, alignment, and anchorage.

ENGINEER shall observe proper mating of each pump with the base flange when lowered on guide rails.

3.02 INSTALLATION

Anchors of 316 stainless steel shall be embedded in concrete as specified in Section 03200. Anchor bolts shall be supplied by the Equipment Manufacturer. Install equipment at locations and position as indicated on the Plans with installation in strict conformance to manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

A. The general requirements for system testing, check out, initial start-up, certification, and instruction of plant personnel are contained in Section 01650.

B. Provide services of a factory representative for a minimum of two (2) days eight hours on-site to inspect, test, and adjust the equipment after installation to verify the mechanical, structural, and electrical integrity and conformance to the equipment specifications. Provide written certification that the equipment is properly installed following the initial site visit.

C. Provide services of a factory representative for two (2) days eight hours on-site to verify the proper operating of the equipment and to instruct OWNER'S personnel on operation and maintenance.

D. Provide additional services at no cost to the OWNER to correct any operational problems as determined by the ENGINEER or CONTRACTOR.

3.04 PUMP WARRANTY

The CONTRACTOR shall supply the pump manufacturer's warranty against defects in workmanship and material for a period of two (2) years from the date of Substantial Completion.

3.05 PUMP SCHEDULE

A. Furnish and install the following equipment under the Phase A project in train 1B.

1. Feed Forward Pumps - Submerged

	Number		3 (Two Duty and One Installed Spare)
	Tag		PMP-04011B1; 04011B2; 04011B3 (Spare)
	Flow / Head		
	Point 1		1850 gpm @ 28 ft TDH
	RPM		1165
	Motor Size		25 HP
	Suction Connection		10-in
	Discharge Connection		10-in
	VFD		YES
	Pumped Fluid		Screened Wastewater

2. Waste Activated Sludge (WAS) Transfer Pumps – Dry Pit

	Number		2
	Tag		PMP-190101A; 190101B
	Flow / Head		
	Point 1		70 gpm @ 30 ft TDH
	RPM		1695
	Motor Size		3 HP
	Suction Connection		3-in
	Discharge Connection		3-in
	VFD		NO
	Pumped Fluid		Waste Activated Sludge

3. Plant Drain Lift Station Pumps - Submerged

	Number		2 (One Duty and One Installed Spare)
	Tag		PMP-230301A; 230301B
	Flow / Head		
	Point 1		120 gpm @ 117 ft TDH
	RPM		3495
	Motor Size		11 HP
	Suction Connection		3-in
	Discharge Connection		3-in
	VFD		NO
	Pumped Fluid		Unscreened Wastewater

END OF SECTION

SECTION 11220
HORIZONTAL SELF-PRIMING CENTRIFUGAL PUMP

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

1. This section all furnishing all labor, materials, equipment, and supervision necessary for fabrication, production, installation, and erection of the items specified in this Section as shown on Drawings or listed on Schedule and all other work incidental thereto, except as otherwise noted.

2. The work under this section is intended to include the necessary materials and workmanship that are required for the completion of this equipment, as shown on the Drawings, unless otherwise specified.

3. The work shall be complete and ready for satisfactory operation whether or not each and every item is shown on the Drawings or specifically mentioned in these Specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Division 1: General Requirements
2. Section 11005: Process Equipment General Requirements
3. Section 16010: Electrical General Requirements

1.03 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

AISI - American Iron and Steel Institute

B. Manufacturers shall be regularly engaged in the manufacture of self-priming centrifugal pumping equipment as specified herein. The manufacturer shall have a quality management system in place and shall be ISO 9001 certified.

1.04 SYSTEM DESCRIPTION

A. Performance Requirements

1. Pumps must be designed to handle raw, unscreened, municipal wastewater.

2. All internal passages, impeller vanes, and recirculation ports shall pass a 2.5 - inch spherical solid. Smaller internal passages that create a maintenance nuisance or interfere with the priming and pump performance shall not be permitted.

3. The pump shall retain adequate liquid in the casing to insure automatic repriming

while operating at its rated speed in a completely open system. The need for suction check valve or external priming device shall not be required.

B. Reprime Performance Requirements

1. The pump shall retain adequate liquid in the casing to insure automatic repriming while operating at its rated speed in a completely open system. The need for a suction check valve or external priming device shall not be required.

2. Pump must reprime the Maximum Repriming Lift shown in the Pump Schedule at the specified speed and impeller diameter while operating with only one-half of the liquid remaining in the pump casing. (Reprime lift is defined as the static height of the pump suction above the liquid.) The pump must reprime and deliver full capacity within five minutes after the pump is energized in the reprime condition.

1.05 SYSTEM RESPONSIBILITY

Pump manufacturer may rely upon information on Pump Schedule pertaining to steady-state operating conditions (flow, TDH, NPSHA, etc.). However, pump manufacturer shall be responsible to review this Specification Section, Section 01600, Section 13450, relevant pipework Drawings, schematics, and electrical and instrumentation Drawings to ensure that equipment offered is suitable for the purposes intended by the Contract Documents. Refer questions and clarifications to ENGINEER.

1.06 SUBMITTALS

A. Shop Drawings

Submit in accordance with Section 01300, Submittals covering the items included under this Section.

All pertinent information needed to fully describe the pump(s) and accessories shall be included in the submittal. Where multiple options are included within standard literature, project specific part numbers and options shall be highlighted by enclosing the project-specific information (circling, clouding, text boxes) and other information shall be crossed out. Any deviations to these specifications must be listed on a separate page referencing the specification section with a brief description of the deviation and why it is equal to or superior to what is specified. Submittals for each size and type shall include, but not be limited to the following:

1. Name of manufacturer
2. Type and Model
3. Rotational speed
4. Major component materials of construction
5. Pump specification describing construction details
6. Outline Dimension Drawing
7. Installation Drawing
8. Complete performance data showing capacity and power input
9. Electrical Data that includes
    a. Motor rating, hp
    b. Motor temperature rating
    c. Motor full load rotational speed
    d. Motor full load current
    e. Motor locked rotor current

f. Motor performance curves showing speed, efficiency, current, power, etc.

10. Include a list of manufacturer's recommended spare parts

B. Certification

The manufacturer shall provide an affidavit of compliance with all applicable provisions of this specification.

C. Shop Performance Testing

As specified in Section 1.07 below.

D. Test and Inspection Report

A written report shall be submitted to ENGINEER documenting testing and/or inspection results. The report shall be prepared as noted under Section 01600.

E. Operation and Maintenance Manuals

Submit in accordance with requirements of Section 01730, Operation and Maintenance Manuals for items included under this Section.

F. Warranty

Submit in accordance with requirements of Section 01740, Warranties covering the items included under this Section.

1.07 SHOP TESTING

A. Shop Tests

Each pump shall be fully tested on water at manufacturer's plant or at a suitable facility. The purpose of the shop tests shall be to demonstrate that the pumps to be furnished will meet the requirements of the Specifications and, if applicable, the Special Warranties included in the Agreement.

1. The CONTRACTOR shall furnish drawings for approval showing the proposed test arrangement. These drawings shall be submitted at the time of shop drawing review. The drawings shall include data on the equipment to be used and the various measuring devices. All testing apparatus and measuring devices shall be properly calibrated and proof of calibration shall be furnished to the ENGINEER satisfaction

2. Tests shall consist of running the pumps with furnished impeller at their rated capacity, head, and speed, or range of speeds if furnished with variable speed drives, and at such other conditions of head and capacity to properly establish a performance curve or family of curves in the case of variable speed units. Performance data including efficiency and horsepower shall be collected and noted as part of the performance curve.

   Test runs shall be made for a least six points on the head capacity curve plus the shutoff head. There shall be no signs of cavitations such as break-off from the normal head capacity characteristic or any unusual sounds or vibrations when operating at these conditions. The length of time of each test run shall be sufficient to obtain stable and dependable results and shall be subject to the

approval of the ENGINEER.

3. All pumps shall be tested in accordance with the standards of the Hydraulic Institute. Certified copies of the test results and the performance curves, for each of the pumps to be furnished, shall be submitted to ENGINEER and approved prior to shipment of the pumps to the Site.

4. Generally, pumps shall be tested as a complete assembly including drive and motor. If the pumps are tested separately from the motors, CONTRACTOR shall submit to ENGINEER, characteristic curves of the motors to be furnished as guaranteed by motor manufacturer. These characteristic curves shall be obtained either from actual tests of the motors to be furnished or from tests of motors of the same size and construction. The motor manufacturer's curves shall supply all the necessary information concerning the motor as indicated for the complete shop tests. The characteristic curves shall be certified by motor manufacturer. If the pumps are tested separately from the drive, including variable speed, CONTRACTOR shall submit to ENGINEER performance data on the drive. Horsepower requirements of the variable speed drives shall be identified for each point along the pump's performance curve.

5. If the performance of the pumping unit does not meet the requirements of the specification, similar tests shall be conducted on a revised pump and proof shall be furnished to the ENGINEER that the requirements are met. The retesting will be witnessed by the ENGINEER.

PART 2 – PRODUCTS

2.01 PUMP DESIGN

A. Pumps shall be horizontal, self-priming centrifugal type, designed specifically for handling raw, unscreened, municipal wastewater. Pump solids handling capability and performance criteria shall be in accordance with requirements listed under Part 1 of this section.

B. Materials and Construction Features

1. Pump Casing: Casing shall be Cast Iron Class 30 with integral volute scroll. Casing shall incorporate the following features:
   a. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.
   b. Full port coverplate, 3 1/2-inch diameter, shall be opened after loosening a hand nut/clamp bar assembly. In consideration for safety, hand nut threads must provide slow release of pressure and the clamp bar shall be retained by detente lugs. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.
   c. Casing drain plug shall be at least 1 1/4-inch NPT to insure complete and rapid draining.
   d. Liquid volume and recirculation port design shall be consistent with the performance criteria listed under Part 1 of this section.

2. Coverplate: Coverplate shall be Cast Iron Class 30. Pump must incorporate the following maintenance features:

a. Retained by hand nuts for complete access to pump interior. Coverplate removal must provide ample clearances for removal of stoppages and allow service to the impeller, seal, wearplate or check valve without removing suction or discharge piping.
b. A replaceable wearplate secured to the coverplate by weld studs and masts shall be AISI 1015 HRS.
c. In consideration for safety, a pressure relief valve shall be supplied in the coverplate. Relief valve shall open at 75 to 200 PSI.
d. Two "O" rings of Buna-N material shall seal coverplate to pump casing.
e. Pusher bolt capability to assist in removal of coverplate. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.
f. Easy-grip handle shall be mounted to face of coverplate.

3. Rotating Assembly: A rotating assembly, which includes impeller, shaft, mechanical shaft seals, lip seals, bearings, sealplate, and bearing housing, must be removal as a single unit without disturbing the pump casing or piping. Design shall incorporate the following features:
   a. Sealplate and bearing housing shall be cast iron class 30. Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped. Three lip seals shall prevent leakage of oil.
      i. The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent the introduction of moist air to the bearings.
      ii. The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.
      iii. Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.
   b. Impeller shall be ductile iron, two-vane, semi-open, non-clog with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lockscrew and conical washer.
   c. Shaft shall be AISI 4140 Alloy Steel.
   d. Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir. Pump designs which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.
   e. Shaft seal shall be oil lubricated mechanical type. The stationary and rotating seal faces shall be silicon carbide alloy. Each mating surface shall be lapped to within three light bands flatness (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating by virtue of a dual O-ring design; an external O-ring secures the stationary seat to the sealplate, an internal O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be Viton. Cage and spring to be AISI 316 stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings.

f. Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for retaining rotating assembly.

4. Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.
   a. Clearances shall be maintained by external shimless coverplate adjustment, utilizing collar and adjusting screw design for incremental adjustment of clearances by hand. Requirement of realignment of belts, couplings, etc. shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings.
   b. There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above.
   c. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

5. Suction check valve shall be molded Neoprene with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished through the coverplate opening without disturbing the suction piping. Sole function of check valve shall be to save energy by eliminating the need to reprime after each pumping cycle. Pumps requiring a section check valve to assist reprime will not be acceptable.

6. Spool flanges shall be one-piece cast iron, class 30 fitted to suction and/or discharge ports. Each spool shall have one 1-1/4-inch NPT and one 1/4-inch NPT tapped hole with pipe plugs for mounting gauges or other equipment.

C. Gauge Kit

A gauge kit shall be supplied for each pump. Suction pressure shall be monitored by a glycerin-filled compound gauge, and discharge pressure by a glycerin-filled pressure gauge. Gauges to be at least 4 inches in diameter, graduated in feet water column. Rated accuracy shall be 1% of full scale reading.

Gauges shall be factory mounted on a resilient panel with frame assembly secured to pumps or piping. Gauge installations shall be complete with all hoses and stainless steel fittings, including a shutoff valve for each gauge line at the point of connection to suction and discharge pipes.

2.02 DRIVE UNIT

A. Pump Motor

1. Pump motors shall be TEFC, Sever Duty Rated, 460 volts 60 Hz 3 Phase, 1800 RPM, 1.15 Service Factor, NEMA design B with cast iron frame with copper windings, induction type, with normal starting torque and low starting current characteristics, suitable for continuous service. Motor performance shall conform to the requirements of NEMA MG1 Part 12 and shall be expressed as indicated in NEMA MG1-12.30. The motors shall not overload over the entire operating range of the pump. Motors shall be inverter duty rated suitable for use

with variable frequency drives. Additional motor requirements are specified in Section 11005.

2. Inverter Duty:
   a. Motors shall be inverter duty rated suitable for use with variable frequency drives
   b. All motors shall have the following features in addition to those listed above:
      i. Designed for used on pulse width modulated (PWM) VFD without external filters or cable length limitations.
      ii. Inverter grade, 1,600 volt, Class F insulation.
      iii. Service factor of 1.15 when operated from a VFD.
      iv. Meeting requirements of NEMA MG1 Part 31.

B. Drive Transmission

1. Power to pumps shall be transmitted by V-belt drive assemblies. The sheave/belt combination shall provide the speed ratio needed to achieve the specified pump operating conditions.

2. Each drive assembly shall utilize at least two V-belts providing minimum a combined safety factor of 1.5. Single belt drives or systems with a safety factor of less than 1.5 are not acceptable. Computation of safety factors shall be based on performance data published by the drive manufacturer.

3. The pump manufacturer shall submit power transmission calculations which document the following:
   a. Ratio of pump/motor speed.
   b. Pitch diameter of driver and driven sheaves.
   c. Number of belts required per drive.
   d. Theoretical horsepower transmitted per belt, based on vendor's data.
   e. Center distance between pump and motor shafts.
   f. Arc-length correction factor applied to theoretical horsepower transmitted.
   g. Service factor applied to established design horsepower.
   h. Safety factor ratio of power transmitted/brake horsepower required.

4. Belt guards
   a. Pump drives to be enclosed on all sides by an OSHA approved guard constructed of fabricated steel or combination of materials including expanded, perforated, or solid sheet metal. No opening to a rotating member shall exceed 1/2 inch.
   b. Guards must be completely removable without interference from any unit component, and shall be securely fastened and braced to the unit base.
   c. Metal shall be free from burrs and sharp edges. Structural joints shall be continuously welded. Rivet spacing on panels shall not exceed five inches. Tack welds shall not exceed four inch spacing.
   d. The guard shall be finished with one coat of gray W.R. non-lift primer and one coat of orange acrylic alkyd W.R. enamel in accordance with section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

2.03 PUMP/MOTOR BASE

The pump and motor assembly shall be factory mounted on an epoxy coated steel base with suitable attachment points.

2.04 SPARE PARTS

Provide the manufacturer's recommended spare parts. At a minimum, the following spare parts shall be supplied with the equipment:

1. One set of mechanical seal assemblies for each pump
2. Required cover plate O-Ring(s) for each pump
3. One rotating assembly O-Ring for each pump
4. One set of impeller clearance adjustment shims for each pump type
5. Any special tools that may be required to service the unit.

2.05 ACCEPTABLE MANUFACTURES

Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

- ABS
- Wilo
- Gorman Rupp
- Grundfos
- Or Equal

PART 3 – EXECUTION

3.01 GENERAL

The equipment shall be installed properly to provide a complete working system. Installation shall follow the supplier's recommendations.

3.02 DELIVERY

A. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations, properly match-marked for ease of field erection

B. All components shall be erected immediately upon receipt from the manufacturer or stored in strict conformance with storage recommendations provided by the manufacturer in the operations and maintenance manual.

C. The equipment shall be lubricated in strict accordance with the instructions of the manufacturer's field service representative. The required lubricants shall be provided by the contractor.

3.03 INSTALLATION

A. The equipment shall be erected in strict accordance with the manufacturer's recommendations as approved by the ENGINEER.

B. CONTRACTOR shall install, level, align, and lubricate pump(s) as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacture at time of delivery.

C. Sufficient supports and thrust blocks shall be installed to prevent strain and vibration on pump piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required.

D. After all anchor bolts, piping and control connections are installed, completely fill the grout dam in the pump station base with non-shrink grout.

3.04 FIELD QUALITY CONTROL

A. Performance Tests

After the pumping units have been erected, performance tests shall be conducted. The purpose of these performance tests shall be to demonstrate that the units have been properly erected, and that they and their appurtenant equipment will operate satisfactorily and meet the specified conditions and the guarantees of Contractor.

1. For the purpose of these tests, OWNER will furnish the electricity, lubricating oil, and the water for a test load when these items are available. The measurement of the quantity of water pumped may or may not be included in the performance test.

2. The performance tests shall be conducted under the supervision of ENGINEER with the cooperation of manufacturer's factory representative.

3. It is intended that these tests shall be carried out by operating each pumping unit through the range specified for a continuous period of at least 2 hours, or until it is shown to the satisfaction of ENGINEER that all of the equipment is in perfect condition and will meet the requirements specified. Throughout these tests of the pumping equipment, the motors and pumps must run smoothly without vibration or heating, otherwise the test shall be stopped and not again undertaken until the unit shall have been put into condition to comply with the requirements for smoothness of operation.

3.05 MANUFACTURER'S FIELD SERVICES

A. Provide services of a factory representative for a minimum of two (2) days eight hours on-site to inspect, test, and adjust the equipment after installation to verify the mechanical, structural, and electrical integrity and conformance to the equipment specifications. Provide written certification that the equipment is properly installed following the initial site visit.

B. Provide services of a factory representative for two (2) days eight hours on-site to verify the proper operating of the equipment and to instruct OWNER’S personnel on operation and maintenance.

C. Provide additional services at no cost to the Owner to correct any operational problems.

3.06 PUMP WARRANTY

The Contractor shall supply the pump manufacturer’s warranty against defects in workmanship and material for a period of two (2) years from the date of Substantial Completion.

3.07 PUMP SCHEDULE

A. Furnish and install the following equipment under the Phase A project in train 1B.

1. Permeate Pumps

	Number		4 (Four Duty)
	Tag		PMP-080001B1; 080001B2; 080001B3; 080001B4 (Spare)
	Flow / Head		
	Point 1		695 gpm @ 38 ft TDH
	RPM		1765
	Motor Size		12 HP
	Suction Connection		6-in
	Discharge Connection		6-in
	VFD		YES
	Pumped Fluid		Treated Effluent

2. Waste Activated Sludge (WAS) Pumps

	Number		2
	Tag		PMP-19001B1; 19001B2
	Flow / Head		
	Point 1		70 gpm @ 30 ft TDH
	RPM		1725
	Motor Size		3 HP
	Suction Connection		4-in
	Discharge Connection		3-in
	VFD		NO
	Pumped Fluid		Waste Activated Sludge

3. Plant Reuse Water System Pumps

	Number		2
	Tag		PMP-180211A ; PMP- 180211B
	Flow / Head		
	Point 1		600 gpm @ 30 ft TDH
	RPM		3500
	Motor Size		15 HP
	Suction Connection		2.5-in
	Discharge Connection		2-in
	VFD		NO
	Pumped Fluid		Reclaim Water

END OF SECTION

SECTION 11225
SUBMERSIBLE MIXERS

PART I – GENERAL

1.01 SCOPE

This section includes all labor, materials, equipment and work required for providing submersible, explosion proof mixers of the type, size and capacity specified and/or listed in the schedule.

1.02. RELATED WORK SPECIFIED ELSEWHERE

1. Division 1: General Requirements
2. Section 03300: Cast-in-Place Concrete
3. Section 09900: Painting and Special Coatings
4. Section 11005: Process Equipment General Requirements
5. Section 16010: Electrical General Requirements

1.03 DESCRIPTION

The submersible mixer shall be suitable for mixing raw screened sewage and mixed liquor in a wastewater activated sludge treatment system. Each mixer shall be equipped with an explosion proof, submersible electric motor connected for operation on 460 Volts, 3 Phase, 60 Hertz. All cables shall be oil resistant chloroprene rubber jacketed. The mixer, with its appurtenances, shall be capable of continuous submergence underwater without loss of watertight integrity. A sliding guide bracket shall be an integral part of the mixer unit. Each mixer shall include a stainless steel, corrosion resistant, lifting cable suitable for raising and lowering the unit from the tank without the need for personnel to enter the tank. The motor and mixer shall be designed and assembled by the same manufacturer.

1.04 QUALITY ASSURANCE

A. Reference Standards:

Unless otherwise specified, the work of this Section shall conform to the applicable portions of the following Standard Specifications:

1. AFBMA - Anti-Friction Bearings Manufacturers Association
2. ANSI - American National standards Institute
3. ASTM - American Society for Testing and Materials
4. HI USA - Hydraulics Institute USA
5. NEMA - National Electrical Manufacturers' Association

B. Design Criteria:

Mixer rating shall be as specified under Article 3.06 of this Specification.

1.05 SUBMITTALS

A. Shop Drawings and Product Data:

Submit shop drawings showing all system components and equipment in elevation and section; and all control and electrical drawings. Drawings shall also show details of anchoring and identify type, length, and diameter of anchors to be used. Drawing should

identify the location of the hatch opening in the cover system above the mixer. The submittal shall include all manufacturer's product data. The elevation of the mixer above the tank floor shall be per manufacturer's recommendations and as shown in the Schedule. Provide details of guide bar rail system. Provide manufacturer's technical analysis to show that sufficient mixers (number of units and motor size) have been provided to adequately mix the contents of the tanks. Provide listing of the manufacturer's recommended spare parts.

B. Certification

The manufacturer shall provide an affidavit of compliance with all applicable provisions of this specification.

C. Shop Performance Testing

As specified in Section 3.01 below.

D. Testing and Inspection Report

Prior to start-up the manufacture shall certify, in writing, that the completed installation is in accordance with his recommendations.

E. Operation and Maintenance Data

Submit operating instructions, repair parts listing and recommended maintenance schedule of inspection, cleaning and lubrication. Include manufacturer's recommended lubricants.

F. Warranty

Submit in accordance with the requirements of Section 01740 covering the items included under this Section.

For more information refer to Section 01300 – Submittals.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Storage of Materials and Equipment:

The CONTRACTOR shall store material and each piece of equipment in accordance with the equipment manufacturer's recommendation for protection from weather, temperature, and moisture contamination.

B. Handling Materials and Equipment:

All material shall be handled in a manner such as to eliminate the possibility of damage, breakage, or chipping in transit or otherwise.

1.07 JOB CONDITIONS

Providing sleeves, supports, anchors, or other components to be installed in the construction sequence by other Work. Include templates, setting diagrams or other information necessary for correct location and installation.

PART 2 – PRODUCTS

2.01 MANUFACTURER REQUIREMENTS

A. The mixing equipment specified herein shall be the design and fabrication of a single manufacturer which shall have sole source responsibility for said equipment.

B. Approved Manufacturers:

- ABS
- Wilo
- or approved equal

2.02 MIXER DESIGN

A. Service

1. All mixing equipment shall be designed to satisfactorily operate continuously in a submerged waste treatment plant environment.

2. The mixer(s) shall be designed to be easily raised, lowered, removed for inspection or service, and rotated horizontally without the need for personnel to enter the tank. A single cast sliding guide bracket shall be an integral part of each mixer. The single cast guide bracket shall guide the mixer into position and be capable of carrying the entire weight of the mixer and the maximum loads created by the mixer. The mixer, with its appurtenances and power cable, shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 130 ft.

B. General

Each mixer shall be of the closed-coupled, direct drive, submersible type design. All components of mixer, including the motor and power cable shall be capable of continuous underwater operation while the mixer propeller is completely submerged. In addition, all components of the mixer shall be capable of operation in air, completely unsubmerged for two (2) hours.

C. Materials

Major mixer components shall be of 316 stainless steel construction. All exposed hardware shall be 316 stainless steel. All surfaces coming into contact with tank fluid other than stainless steel shall be protected by a corrosion resistant coating and a two-part epoxy paint.

D. Propeller

The propeller shall be 316 stainless steel having 2 or 3 self cleaning backward curved blades capable of handling solids, fibrous materials, heavy sludges and other matter normally found in wastewater treatment applications. Each blade shall be precision cut and welded to the hub. Propeller shall be dynamically balanced, so the propeller imbalance does not exceed ISO 1940 G6.3 tolerances to prevent excessive vibrations.

E. Fasteners

All bolts, nuts, washers and other fasteners shall be 316 stainless steel.

F. Cable Entry

1. The electrical power cable entry shall be an integral part of the slide bracket.

2. The cable entry seal system shall be composed of elastomer grommets flanked by stainless steel washers all designed with close clearance fits against the cable outside diameter and the cable entry inside diameter.

3. A cable entry seal system shall provide a watertight seal between the electrical connection chamber and motor preventing fluid leakage into the motor.

4. Epoxy cable entry sealing systems are not considered equal or acceptable.

G. Shaft

The propeller and motor shaft shall be in integral unit. The shaft material shall be 316 stainless steel designed to meet the maximum loads generated by the mixer.

H. Propeller Shaft Seal

1. The mixer shall be provided with a double seal system consisting of a mechanical seal on the propeller (outer) side of the oil chamber and second mechanical seal on the motor (inner) side, each working independently of the other.

2. The mechanical seal shall require neither maintenance or adjustment, shall not be damaged when the mixer is run dry, shall be easy to check and replace, shall be capable of running in either direction without damage, and be readily available from any major seal manufacturer. Shaft seals that rely on the tank fluid as a lubricant will not be considered acceptable or equal.

I. Bearings

1. The mixer shall rotate on permanently lubricated bearings. Bearings shall be lubricated for life design and sized to transfer all radial and axial loads to the mixer housing and minimize shaft deflection for increased bearing and seal life.

2. Bearings shall not require pre-loading and shall be maintenance free with a minimum L10 (B10) bearing life of 100,000 hours at design conditions. Mixer's having bearings that require pre-loading or periodic lubrication will not be considered acceptable or equal.

J. Sealing of Mating Surfaces

All mating surfaces of the mixer shall be machined and fitted with Viton O-rings providing watertight sealing. Mating surfaces shall be designed to provide watertight seals when metal to metal contact is made resulting in controlled O-ring compression without special torque requirements. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease or other devices shall be used as a means of sealing.

K. Motor

1. The multi-pole motor shall be directly connected to the propeller (gearbox designs are not acceptable).

2. The motor shall have a minimum 1.15 service factor with an integrated variable speed drive, a minimum of 30 feet of power and control cable, be of the squirrel-cage, induction, shell type NEMA B design, housed in an air filled watertight chamber.

3. Stator winding and leads shall be insulated with moisture resistant Class F insulation, or better, which will resist a temperature of 155 deg C (311 deg F).

4. The stator shall be dipped and baked three (3) times in Class H varnish.

5. The motor shall be designed for continuous duty, capable of sustaining unlimited evenly spaced starts per hour.

6. The rotor bars and short circuit rings shall be constructed of aluminum.

7. Motor shall be explosion proof rated.

8. The motor efficiency shall be equivalent to IEC standard 60034-30-01 for international efficiency, class IE4 levels. The mixer speed shall be adjustable via either remote communications or a separate operator panel. The drive shall monitor temperature and current and stop the mixer in case of overload.

L. Thermal Protection

1. Each phase of the motor shall contain a bi-metallic temperature monitor in the upper portion of the stator windings to monitor stator temperatures. The temperature monitors shall be imbedded in the stator winding coils, connected in series and coupled to the motor contactor coil providing single switch shutdown capability.

2. The temperature setting shall be as recommended by the manufacturer and will automatically reset once the stator temperature returns to normal.

3. Temperature monitors shall be used in conjunction with, and supplemental to, external motor overload protection, and wired to the control panel.

M. Moisture Sensor

1. Each mixer shall be equipped with an electrical probe to detect the presence of moisture in the oil chamber before bearing and motor damage occurs.

2. The moisture detection probe will provide the capability for remote monitoring of the state of the moisture probe either by monitoring a dry contact or through the generation of a 24 VAC or 120 VAC discrete signal. CONTRACTOR shall coordinate requirements.

N. Galvanic Corrosion Protection

When necessary to prevent galvanic corrosion, the mixer guide bracket shall have a chemical and abrasion resistant polyurethane liner and guide rollers preventing metal to metal contact between the guide bracket and the mounting and support system. Also, a polyurethane bushing shall be provided between the lifting cable shackle and the lifting clamp. The chemical and abrasion resistant liner, rollers and bushing are to provide galvanic corrosion protection by completely separating the mixer from the mounting system.

2.03 MOUNTING AND SUPPORT SYSTEM

A. Power Cable Support

A 30 feet long, ¼ inch diameter, 316 stainless steel power cable support cable shall be provided with each mixer and be permanently attached to the mixer shackle on one end and the upper guide bracket of the mounting system on the other end. The power cable shall be attached to the support cable using sway clamps at a minimum of 5 feet intervals.

B. Lifting Cable

A 30 feet long, 316 stainless steel lifting cable shall be provided and attached to the lifting clamp shackle on the mixer. A cable cleat shall be provided to store the cable when needed. The working load of the cable shall be 50% greater than the wet weight of the mixer.

C. Mounting System

1. A mounting system shall be supplied by the mixer manufacturer and used to mount the mixer and guide it during installation and removal without entering or emptying the tank. The upper guide bracket shall have a positioning locking plate and locking pin that securely positions the guide rail system at any position within a 150 degree arc in 15 degree increments without entering or emptying the tank. The mixer shall rest on a stop near the bottom of the tank preventing the mixer blades from contacting the tank floor. A 316 stainless steel mast system shall be used to guide and securely hold the mixer in place and be designed to withstand the maximum loads produced by the mixer. The mast shall interface with the guide brackets to guide the mixer securely into position.

2. To ensure the integrity of the mounting system the mixer manufacturer shall supply the support guide brackets and mast.

3. The guide rail system shall be supplied with intermediate brackets to support the mast at spacing no greater than every 5 ft.

2.04 SPARE PARTS AND SPECIAL TOOLS

The manufacturer's recommended spare parts shall be supplied. Any special tools necessary for maintenance shall be supplied. The following shall be the minimum spare parts to be supplied:

Description	Quantity
Spare mechanical, lip and O-ring seals assembly for each mixer	1
Wrench for removing propeller	1
Propeller key, washer, and nut for each mixer	1

PART 3 – EXECUTION

3.01 SHOP PERFORMACNE TESTING

A. The mixer manufacturer shall perform the following inspections and tests on each mixer before shipment from the factory:

1. Propeller, motor rating, and electrical connections shall first be checked for compliance to the customer's purchase order.

2. A motor and cable insulation test for moisture content or insulation defects shall be made.

3. Prior to shipment, the mixer shall be run dry to establish correct rotation and mechanical integrity.

B. A written report stating the foregoing steps have been done shall be supplied with each mixer prior to shipment.

3.02 CONTRACTOR'S VERIFICATION

Examine guide brackets and verify size of anchor bolt positioning. Rectify conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable for proper positioning, alignment, and anchorage.

3.03 INSTALLATION

Anchors of 316 stainless steel shall be embedded in concrete as specified in Section 03200. The Equipment Manufacturer shall supply anchor bolts. Install equipment at locations and position as indicated on the Plans with installation in strict conformance to manufacturer's recommendations.

3.04 FIELD QUALITY CONTROL

A. The general requirements for system testing, check out, initial start-up, certification, and instruction of plant personnel are contained in Section 01600 and 01800.

B. Provide services of a factory representative for a minimum of one (1) day eight hours on-site to inspect, test, and adjust the equipment after installation to verify the mechanical, structural, and electrical integrity and conformance to the equipment specifications. Provide written certification that the equipment is properly installed following the initial site visit.

C. Provide services of a factory representative for one (1) day eight hours on-site to verify the proper operating of the equipment and to instruct OWNER’S personnel on operation and maintenance.

D. Provide additional services at no cost to the OWNER to correct any operational problems as determined by the ENGINEER or CONTRACTOR.

3.05 WARRANTY

The Manufacturer shall warrant the units being supplied to the OWNER against defects in workmanship and material for a period of 2 (two) years from the date of Substantial Completion.

3.06 SCHEDULE

A. PHASE A – Furnish and install the following equipment under the Phase A project in train 1B.

Anaerobic Mixers

	Number		2
	Tag		MXR-030101B1; MXR030101B2
	RPM		220
	Motor Size		2 HP
	Number of Blades		Three
	Propeller Diameter		22.8 in
	Service		Screened Wastewater
	Notes		Explosion Proof Motor Provide Mixers with Flow Ring Assemblies

Anoxic Mixers

	Number		2
	Tag		MXR-040101B1; MXR040101B2
	RPM		23
	Motor Size		3 HP
	Number of Blades		Three
	Propeller Diameter		78.7 in
	Service		Screened Wastewater
	Notes		Explosion Proof Motor Provide Mixers with Flow Ring Assemblies

END OF SECTION

SECTION 11287
ISOLATION GATES

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes the design, fabrication, assembly, erection, testing and supervision of fabricated slide gates as indicated on the Drawings and specified herein, and all other work incidental thereto, except as otherwise

B. Related Work Specified Elsewhere

1. Division 1: General Requirements
2. Section 03200: Concrete Reinforcement
3. Section 03300: Cast-in-Place Concrete
4. Section 11005: Process Equipment General Requirements
5. Section 09900: Painting and Special Coatings

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

ANSI - American National Standards Institute
ASTM - American Society for Testing and Materials

B. Inspection

All work done in accordance with this specification shall be subject to inspection. The OWNER or ENGINEER shall have access to all places of manufacture where materials are being produced or fabricated, or where tests are being conducted and shall be accorded full facilities for inspection and observation. Any sluice gate or part which does not conform to the requirements of this specification shall be made satisfactory or shall be rejected and replaced.

C. Design

The gate shall be designed and sealed by a Professional Engineer registered in the state where the gate is designed and manufactured.

D. Anchors

Each gate shall be mounted in accordance with the current edition of the Florida Building Code. The CONTRACTR shall provide certification that calculations have been performed and signed by a structural or civil engineer registered in the State of Florida confirming that the anchorage system provided is within allowable shear and tension limits. The anchorage system shall be designed to withstand a wind load of 150 miles per hour.

1.03 SUBMITTALS

A. Shop Drawings and Product Data

Submit manufacturer's drawings showing principal dimensions, general equipment construction, and materials used in all parts of the slide gate and lift mechanism. All slide gates shall be manufacturer and furnished in accordance with these drawings. Also, furnish illustrated catalog data and parts schedule in sufficient detail to serve as a guide in assembly and disassembly and in ordering repair parts.

B. Certification

The manufacturer shall provide an affidavit of compliance with all applicable provisions of this specification.

C. Operations and Maintenance Data

Submit operating instructions, repair parts listing, and recommended maintenance schedule of inspection, cleaning, and lubrication. Include manufacturers recommended lubricants. See Section 01730 – Operations and Maintenance Manual for requirements.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

Slide gates shall be complete when shipped and the manufacturer shall use all due and customary care in preparing them for shipment to avoid damage in handling or in transit. Particular care shall be taken to see that the parts are completely closed and locked in position before shipment. Parts that are to be embedded in concrete may be shipped separately if requested by the CONTRACTOR. Slide gates of 24 inches and larger shall be securely bolted or otherwise fastened to skids in such a manner that they may be safely handled.

Anchors and appurtenances to be embedded into concrete shall be available for proper construction sequence.

PART 2 – PRODUCTS

2.01 CHANNEL ISOLATION SLIDE GATES

A. General

All materials designated hereinafter, when used in slide gates produced under this specification shall conform to the requirements designated below for each material listed. When reference is made to American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), Copper Development Association Alloy (CDA), or other standards as may be stipulated, the latest revision thereof shall apply. The requirements of ANSI, ASTM, or other standards to which reference is made elsewhere in this text, shall govern the physical and chemical characteristics of the slide gate components. Whenever slide gate components are to be made in conformance with ANSI, ASTM, or other standards that include test requirements or testing procedures, such requirements or procedures shall be met by the manufacturer. The records of such tests, if required by the ENGINEER shall be provided upon request.

B. Disc

The gate disc shall consist of a flat plate reinforced with structural or formed members

welded to the plate. The disc plate and structural or formed members shall be ASTM A276 Type 316 stainless steel. The disc is to be designed to limit deflection of the gate to 1/720th of its span. The working design stress shall not exceed the lesser of 40 percent of yield strength or 25 percent of the ultimate strength of the material. All disc components shall have a minimum material thickness of 1/4-inch.

C. Frame

The gate frame shall consist of guides, invert members, and if self-contained, an operator yoke welded or bolted together forming a rigid one piece frame. The guides shall be a sandwich type construction built of plates, angles, and formed shapes. The guide slot shall engage the disc plate a minimum of one inch. The invert members shall be an angle, channel, or formed shape welded to the bottom of the guide to form a flush surface and to meet with the disc seal. For self-contained gates, the yoke member shall be designed for the maximum output of the gate hoist. Yoke members to be designed to limit the deflection to 1/720th of its span. The working stresses shall not exceed the lesser of 40 percent of the yield strength or 25 percent of the ultimate strength of the material and shall be arranged to permit removal of the disc form the frame.

D. Seals

A specially molded resilient seal (neoprene) will be mounted on the bottom of the frame to provide flush bottom closure. The shape of the seal produces a seating surface having a minimum width of 3/4-inch. The vertical face of the seal will be in contact with the seating of the guide to provide a proper seal at the corners. J-type seals (Rubber ASTM D2000, Grade 2BC615) shall not be used. UHMWPE seals shall be used along with a continuous neoprene cod seal attached to the frame to restrict leakage to 0.5 gallons per minute per foot.

E. Stems

Stems shall be ASTM A276 Type 316 stainless steel. Stem threads shall be of the cut ACME type. Stems shall be designed to transmit in compression a minimum of two times the rated output of the hoist at 40 lbs effort on the crank or handwheel. The L/r ratio of the unsupported stem shall not exceed 200. Stem guides, where required to limit the unsupported stem length, shall be polymer or bronze bushed.

F. Stem Covers

Rising stem gates shall be provided with clear polycarbonate stem cover (ASTM D3935 D707) to provide a visual indication of gate position, permit inspection of the stem threads, and to protect the stem from contamination. Vent holes shall be provided to prevent condensation.

G. Actuator

The benchstand or floorstand hoist shall be sized to permit operation of the gate under the full operating head with a maximum effort of 40 lbs on the crank or handwheel. The hoist nut shall be manganese bronze conforming to ASTM B584 C86500. The hoist nut shall be supported on roller bearings. The lubrication fittings shall be provided for lubrication of hoist bearings without disassembly of the hoist. Suitable seals shall be provided to prevent entry of foreign matter. The direction of handwheel or crank rotation to open the gate shall be clearly and permanently marked on the hoist. Where the actuators are to be interconnected it shall be by means of a flexible coupling and stainless steel tubing.

H Acceptable Manufactures

Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

- Waterman Valve
- Hydrogate, Fabricated Slide Gate
- Or approved equal

2.02 WEIR GATE

A. General

Weir gates shall be either self-contained or non self-contained, and of the rising stem or non-rising stem configuration, as indicated on the gate schedule.

B. Frame

The gate frame shall be constructed of structural members or formed plate welded to form a rigid one-piece frame. The frame shall be of the flange back design, suitable for mounting on a concrete wall (CW). The guide slot shall be made of UHMWPE (ultra high molecular weight polyethylene).

C. Slide

The slide shall consist of a flat plate reinforced with formed plates or structural members to limit its deflection to 1/720 of the gate's span under the design head.

D. Guides and Seals

1 The guides shall be made of UHMWPE (ultra high molecular weight polyethylene) and shall be of such length as to retain and support at least two thirds (2/3) of the vertical height of the slide in the fully open position.

2. The bottom and side seals shall be made of UHMWPE (ultra high molecular weight polyethylene) of the self-adjusting type. A continuous compression cord shall ensure contact between the UHMWPE guide and the gate in all positions. The sealing system shall maintain efficient sealing in any position of the slide and let the water flow only in the open part of the gate.

3. Seals shall maintain the specified leakage rate in both seating and unseating conditions.

E. Stem and Couplings

1. The operating stem shall be of stainless steel designed to transmit in compression at least two (2) times the rated output of the operating manual mechanism with a 40 lbs (178 N) effort on the crank or handwheel.

2. The stem shall have a slenderness ratio (L/r) less than 200. The threaded portion of the stem shall have machine cut threads of the Acme type.

3. Where a hydraulic, pneumatic or electric operator is used, the stem design force shall not be less than 1.25 times the output thrust of the hydraulic or pneumatic

cylinder, with a pressure equal to the maximum working pressure of the supply or 1.25 times the output thrust of the electric motor in the stalled condition.

4. For stems in more than one piece and with a diameter of 1 ¾ inches (45 mm) and larger, the different sections shall be joined together by solid bronze couplings. Stems with a diameter smaller than 1 ¾ inches, shall be pinned to an extension tube. The couplings shall be grooved and keyed and shall be of greater strength than the stem.

5. Gates having width equal to or greater than two times their height shall be provided with two lifting mechanisms connected by a tandem shaft.

F. Stem Guides

Stem guides shall be fabricated from type 304L (or 316L) stainless steel. The guide shall be equipped with an UHMWPE bushing. Guides shall be adjustable and shall be spaced in accordance with the manufacturer's recommendation. The L/r ratio shall not be greater than 200.

G. Stem Cover

Rising stem gates shall be provided with a clear polycarbonate stem cover. The stem cover shall have a cap and condensation vents as well as a clear mylar position indicating tape. The tape shall be field applied to the stem cover after the gate has been installed and positioned.

H. Lifting Mechanism

1. Manual operators of the types listed in the schedule shall be provided by the gate manufacturer.

2. All bearings and gears shall be totally enclosed in a weather tight housing. The pinion shaft of crank-operated mechanisms shall be constructed of stainless steel and supported by roller or needle bearings.

3. Each manual operator shall be designed to operate the gate under the maximum specified seating and unseating heads by using a maximum effort of 40 lbs (178 N) on the crank or handwheel, and shall be able to withstand, without damage, an effort of 80 lbs (356 N).

4. The crank shall be removable and fitted with a corrosion resistant rotating handle. The maximum crank radius shall be 15 inches (381 mm) and the maximum handwheel diameter shall be 24 inches (610 mm).

I. Yoke

Self-contained gates shall be provided with a yoke made of structural members or formed plates. The maximum deflection shall be 1/360 of the gate's span.

J. Materials

PART	MATERIAL
Frame, yoke, stem guides, slide, stem extension	Stainless steel ASTM A-240 316L
Guides, side and bottom seals, stem guide liner	Ultra high molecular weight polyethylene (UHMWPE) ASTM D-4020
Compression cord	Nitrile ASTM D2000 M6BG 708, A14, B14, E014, E034
Threaded stem	Stainless steel ASTM A-276 316
Fasteners	ASTM F593 and F594 GR1 for type 304 and GR2 for type 316
Pedestal, handwheel and crank	Tenzaloy aluminum
Seal (between frame and wall)	Shall include non-shrink grout
Stem cover	Polycarbonate ASTM D-3935
Lift nut, couplings	Manganese bronze ASTM B584 UNS-C86500

K. Leakage

Weir gates shall be substantially watertight under the design head conditions. Leakage shall not exceed 0.1 U.S. gallons per minute per foot of seal periphery under the design seating head and 0.2 U.S. gallon per minute per foot of seal periphery for the design unseating head.

L. Design Head

Weir gates shall be designed to withstand the design head (maximum design head shall be taken as the height of the slide unless otherwise shown in the schedule).

M. Seal Performance Test

The weir gate's sealing system should have been tested through a cycle test in an abrasive environment and should show that the leakage requirements are still obtained after 25,000 cycles with a minimum deterioration. Additionally acceptable is demonstrating leakage requirements for greater than 25,000 cycles for non-abrasive tests.

PART 3 – EXECUTION

3.01 CONTRACTOR VERIFICATION

Before fabrication and/or installation verify dimensions with construction in place. Check anchors and/or other components embedded in concrete to be adequate. Correct all defects and deficiencies before proceeding with the work.

3.02 PREPARATION

Surfaces shall be clean of all dust, dirt or other debris which would impair proper installation.

3.03 INSTALLATION

A. General

Care shall be taken to avoid warping the gate frame and to maintain tolerances between seating faces. All gates, stems, and operators shall be plumbed, shimmed and accurately aligned.

Anchors and/or other components embedded in concrete shall be in accordance with Section 3.03.

B. Surface Protection

During construction, the surfaces of the gate shall be covered or otherwise protected from concrete spillage, paint, oil and debris. Any damage that occurs to the gate in storage or handling shall be corrected prior to installation of the gate or operation and testing of the gate.

C. Slide Operation

After the entire assembly has been installed, adjusted and properly lubricated, each slide shall be operated for one complete cycle, open-close-open or close-open-close to the satisfaction of the ENGINEER.

3.04 FIELD QUALITY CONTROL

A. General

Installed gates shall be tested and inspected before acceptance of Work. Operation of the cover shall move freely with no binding or other obstructions. Cover and frame gaps will be inspected and shall be adjusted if necessary.

B. Field Leakage Test

A field leakage test shall be performed after installation of the gate. The manufacturer shall be notified of the test in sufficient time to enable him to have a representative present at that test. After all adjustments have been made and the mechanisms properly lubricated, each gate slide shall be run through one complete cycle as a final check on proper operation before starting the leakage test. Seating and unseating heads shall be measured from the top surface of the water to the center of the gate.

3.05 SCHEDULES

The following list of slide gates is to be furnished and installed under this Section together with any other slide gates shown on the Plans or required for a complete job.

A. Furnish and install the equipment on the following page under the Phase A project

Name	Gate No.	Size	Head Seat	Head Unseat	Operator	Section	Notes
Grit Concentrator Influent Isolation Slide Gate	WEG-010101A	48”x48”	3 ft	3 ft	Manual	2.01	I-3, P-4 Self Contained, Surface Mounted with Pedestal Mounted Gearbox, Rising Stem
Grit Concentrator Bypass Isolation Slide Gate	WEG-010101B	48”x48”	3 ft	3 ft	Manual	2.01	
Anaerobic Channel 1B1	WEG-010201B	48”x48”	3 ft	3 ft	Manual	2.01	
Anaerobic Channel 1B2	WEG-010202B	48”x48”	3 ft	3 ft	Manual	2.01	
Feed Forward Pump Station 1B1 Isolation Slide Gate	WEG-050101B1	48”x48”	19 ft	19 ft	Manual	2.01	I-5, P-3 Self Contained, Surface Mounted with Pedestal Mounted Gearbox, Rising Stem
Feed Forward Pump Station 1B2 Isolation Slide Gate	WEG-050101B2	48”x48”	19 ft	19 ft	Manual	2.01	
MBR Feed Channel 1B1 Isolation Slide Gate	WEG-230105B	48”x48”	5 ft	5 ft	Manual	2.02	I-8, P-4 Self Contained, Surface Mounted with Pedestal Mounted Gearbox, Rising Stem
MBR Feed Channel 1B2 Isolation Slide Gate	WEG-230205B	48”x48”	5 ft	5 ft	Manual	2.02	
MBR 1B1 Isolation Weir Gate	WEG-60011B1	48”x48”	5 ft	5 ft	Manual	2.03	I-8, P-4 Self Contained, Surface Mounted with Pedestal Mounted Gearbox, Rising Stem, Downward Opening
MBR 1B2 Isolation Weir Gate	WEG-60011B2	48”x48”	5 ft	5 ft	Manual	2.03	
MBR 1B3 Isolation Weir Gate	WEG-60011B3	48”x48”	5 ft	5 ft	Manual	2.03	
MBR 1B4 Isolation Weir Gate	WEG-60011B4	48”x48”	5 ft	5 ft	Manual	2.03	

Note: CONTRACTOR is responsible for verification of the data contained within the table with the Plans for a complete job.

END OF SECTION

SECTION 11288
TELESCOPIC VALVES

PART I – GENERAL

1.01 GENERAL

A. The CONTRACTOR shall furnish all fabrication, assembly, erection, placement, and supervision required to install telescopic valves and related appurtenances, as indicated on the Drawings and specified herein, and all other work incidental thereto, except as otherwise noted.

B. The work under this section is intended to include the necessary materials and workmanship that are required for the completion of this equipment, as shown on the Drawings, unless otherwise specified.

C. The work shall be complete and ready for satisfactory operation whether or not each and every item is shown on the Drawings or specifically mentioned in these Specifications.

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

ASTM - American Society for Testing and Materials
ASME - American Society of Mechanical Engineering

B. Inspection

All work done in accordance with this specification shall be subject to inspection. The OWNER or ENGINEER shall have access to all places of manufacture where materials are being produced or fabricated, or where tests are being conducted and shall be accorded full facilities for inspection and observation. Any telescopic valve or part which does not conform to the requirements of this specification shall be made satisfactory or shall be rejected and replaced.

C. Experience

The manufacturer shall have experience in the production of substantially similar equipment and shall show evidence if satisfactory operation in at least five installations.

D. Welding Certification

The manufacturer's shop welds, welding procedures, and welders shall be qualified and certified in accordance with the requirements of the latest edition of ASME, Section IX.

1.03 SUBMITTALS

A. Shop Drawings and Product Data

Submit manufacturer's drawings showing principal dimensions, general equipment construction, and materials used in all parts of the telescopic valve and lift mechanism.

Also, furnish illustrated catalog data and parts schedule in sufficient detail to serve as a guide in assembly and disassembly and in ordering repair parts.

B. Certification

The manufacturer shall provide an affidavit of compliance with all applicable provisions of this specification.

C. Operations and Maintenance Data

Submit operating instructions, repair parts listing, and recommended maintenance schedule of inspection, cleaning, and lubrication. Include manufacturers recommended lubricants. See Section 01730 for requirements.

D. Warranty

Submit in accordance with the requirements of Section 01740 – Warranties and Bonds, covering the items included under this Section.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

Telescopic valve shall be complete when shipped and the manufacturer shall use all due and customary care in preparing them for shipment to avoid damage in handling or in transit. Particular care shall be taken to see that the parts are completely closed and locked in position before shipment. Parts that are to be embedded in concrete may be shipped separately if requested by the CONTRACTOR. Equipment shall be securely bolted or otherwise fastened to skids in such a manner that they may be safely handled.

Anchors and appurtenances to be embedded into concrete shall be available for proper construction sequence.

1.05 ANCHORS

Each valve shall be mounted in accordance with the current edition of the Florida Building Code. The CONTRACTR shall provide certification that calculations have been performed and signed by a structural or civil engineer registered in the State of Florida confirming that the anchorage system provided is within allowable shear and tension limits. The anchorage system shall be designed to withstand a wind load of 150 miles per hour.

PART 2 – PRODUCTS

2.01 TELESCOPIC VALVES

A. General Design

Telescopic valves are designed to control the heights of liquid within a tank. The assembly consists of a drain tube which can slip up and down inside a stationary vertical pipe. Through a lifting device, the tube is raised and lowered to maintain the desired level within tank as overflow liquids drain down in the center pipe. The flow can be easily calculated by the inclusion of a weir box shaped with a V-notch weir.

B. Valve Body

The valve body shall be constructed of shall be ASTM A276 Type 316 stainless steel structural tubing or pipe

C. Tube

The tube shall be constructed of shall be ASTM A276 Type 316 stainless steel. The inlet may be of the plain style, v-notch style, flared style or weir box. Wear pads (guides) must be installed at the lower end of the tube to guide it inside the body and prevent metal-to-metal contact.

D. Guide Seal

A guide seal must be provided where the tube enters the body. The ASTM D-4020 UHMWPE guide seal is part of the 150 lbs. mating flange bolted to the stainless steel flange, which is welded to the outside pipe.

2.02 OPERATORS AND STEMS

All operators, stems, and parts exposed to potentially corrosive gases must be protected using special coatings as discussed in Section 09900 – Painting and Special Coatings.

A. Stem and Coupling

The operating stem shall be ASTM A-276 Type 316 stainless steel designed to transmit in compression at least 2 times the rated output of the operating manual mechanism with a 40 lbs effort on the crank or handwheel. The stem shall have a slenderness ratio (L/r) less than 200. The threated portion of the stem shall have machined cut threads of the Acme type

B. Stem Guides

Stem guides shall be made of ASTM A-276 Type 316 stainless steel and equipped with a ASTM D-4020 UHMWPE bushing. Guides shall be adjustable and spaced in accordance with manufacturer's recommendations. Guides shall be provided so that the slenderness ratio (L/r) shall be less than 200.

C. Stem Bracket and Hardware

The operating bail shall be ASTM A-276 Type 316 stainless steel which shall attach the stem to the valve body. The fasteners shall be stainless steel.

2.03 STEM COVERS

Rising stem gates shall be provided with clear polycarbonate stem cover (ASTM D3935 D707) to provide a visual indication of valve position, permit inspection of the stem threads, and to protect the stem from contamination. Vent holes shall be provided to prevent condensation. A clear mylar position indicating tape shall be field applied to the stem cover after the valve has been installed and positioned.

2.04 LIFTING MECHANISM

The manual 316 stainless steel 48-inch floorstand hoist shall be sized to permit operation of the valve under the full operating head with a maximum effort of 40 lbs on the crank or handwheel and shall be able to withstand, without damage, an effort of 80 lbs. The hoist nut shall be manganese bronze conforming to ASTM B584 C86500. The hoist nut shall be supported on roller bearings in a totally enclosed in a weathertight housing. The lubrication fittings shall be provided for lubrication of hoist bearings without disassembly of the hoist. Suitable seals shall be provided to prevent entry of foreign matter.

The crank shall be removable and fitted with a corrosion resistant Tenzaloy Aluminum rotation handle. The direction of handwheel or crank rotation to open the valve shall be clearly and permanently marked. The maximum crank radius shall be 15 inches and the maximum handwheel diameter shall be 24 inches.

2.05 BASE PLATE

The floorstand shall be mounted using a 1/2-inch thick minimum 316 stainless base plate designed to transfer the thrust generated by the valve to the adjacent structure. The plate shall be supplied with suitable anchor bolts provided the manufacturer.

2.06 ACCEPTABLE MANUFACTURES

Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

- Waterman Industries
- or approved equal.

PART 3 – EXECUTION

3.01 CONTRACTOR VERIFICATION

Before fabrication and/or installation verify dimensions with construction in place. Check anchors and/or other components embedded in concrete to be adequate. Correct all defects and deficiencies before proceeding with the work.

3.02 INSTALLATION

A. General

Gate and appurtenances shall be handled and installed in accordance with the manufacturer's recommendations.

B. Valve Operation

After the entire assembly has been installed, adjusted and properly lubricated, each valve shall be operated through at least two complete up-down cycles to the satisfaction of the ENGINEER.

3.03 WARRANTY

The Manufacturer shall warrant the units being supplied to the OWNER against defects in workmanship and material for a period of 2 (two) years from the date of Substantial Completion.

3.04 SCHEDULES

A. PHASE A – Furnish and install the following equipment under the Phase A project.

Name	Valve No.	Size (in)	Travel (in)	Capacity (gpm)	Operating Floor (ELV)	Max HGL (ELV)	Notes
MBR 1B Recycle Control Tel-Valve	TV-070101A	12	36	2500	43.5	39.5	I-9, P-4 Rising Stem Style
MBR 2B Recycle Control Tel-Valve	TV-070201A	12	36	2500	43.5	39.5	I-10, P-4 Rising Stem Style
MBR 3B Recycle Control Tel-Valve	TV-070301A	12	36	2500	43.5	39.5	I-11, P-4 Rising Stem Style
MBR 4B Recycle Control Tel-Valve	TV-070401A	12	36	2500	43.5	39.5	I-12, P-4 Rising Stem Style
Sludge Storage Decant Tel-Valve	TV-190101A	6	60	500	43.5	39.5	I-19, P-4 Rising Stem Style
Sludge Storage Decant Tel-Valve	TV-190201A	6	60	500	43.5	39.5	I-19, P-4 Rising Stem Style

Note: CONTRACTOR is responsible for verification of the data contained within the table with the Plans for a complete job.

END OF SECTION

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SECTION 11305
AUTOMATIC SAMPLER

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This section includes all work necessary to furnish, install, and place into initial operation refrigerated automatic wastewater sampler for the collection and storage of wastewater as shown on the Plans and described in the Specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Section 01730: Operations and Maintenance Manual
2. Section 01800: Training
3. Section 11005: Process Equipment General Requirements
4. Section 15200: Process Piping and Valves

1.03 SUBMITTALS

A. Shop Drawings and Product Data

Submit shop drawings showing all system components and equipment in elevation and section; and all control and electrical drawings, including internal wiring diagrams. Drawings should also show anchoring details. Include manufacturer's product data.

B. Certification

The manufacturer shall provide an affidavit of compliance with all applicable portions of this specification.

C. Testing and Inspection Report

Submit a written report describing the inspection performed on installed equipment made by representatives of manufacturer or supplier. Report shall certify that equipment has been properly installed, lubricated, made ready of operation, and results of start-up test operation. Include noise level, vibration readings, and any other measurements as necessary to document condition of equipment at the time of inspection. Submit a report from the factory representative on installed equipment

D. Operation and Maintenance Manual

Submit operating instructions, repair parts listing and recommended maintenance schedule of inspection, cleaning, and lubrication. Include manufacturer's recommended lubricants. See Section 01730 for requirements.

E. Warranty

Submit in accordance with the requirements of Section 01740 covering the items included under this Section.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Storage of Materials and Equipment

The CONTRACTOR shall store material and each unit of equipment in accordance with the manufacturer's recommendation for protection from weather, temperature, and moisture contamination.

B. Handling Materials and Equipment

All material shall be handled in a manner such as to eliminate the possibility of damage, breakage, or chipping in transit or otherwise.

1.05 ANCHORS

Each sampler shall be mounted in accordance with the current edition of the Florida Building Code. The CONTRACTR shall provide certification that calculations have been performed and signed by a structural or civil engineer registered in the State of Florida confirming that the anchorage system provided is within allowable shear and tension limits. The anchorage system shall be designed to withstand a wind load of 150 miles per hour.

PART 2 – PRODUCTS

2.01 EQUIPMENT

The composite sampler shall be capable of collecting repeated sample increments and depositing them in a single container.

The sampler shall be the peristaltic pump type. The sampler shall be constructed of NEMA 4X rated rotationally molded polyethylene enclosure and shall have all the equipment necessary for representatively collecting and preserving by refrigeration liquid samples. The sampler shall be equipped with peristaltic pump to provide +/- 5 ml repeatability at approximately 1 gpm using a 3/8-inch line. The tubing shall be vinyl and shall have tubing life exceeding 1,000,000 pump counts. The unit shall deliver samples to a line velocity of 2 ft/sec or greater at suction lifts of up to 28 ft.

The sampler shall take a sample on a signal from the sampler's integral timer/controller or external flow meter signal. After having collected the sample, the sampling mechanism shall deliver the liquid through a sealed transfer tube to a 2 or 2-1/2 gallon wide mouth composite container located within the refrigerated sample compartment. Four, 2 or 2-1/2 gallon polyethylene composite sample containers with lids shall be provided for each automatic sampler.

The sampler shall have the capability of operating as a composite or a 24 bottle sequential unit when equipped with a 24 bottle discrete assembly. The 24 bottle assembly shall be plug in type. The composite and 24 bottle mode shall be panel selectable. The sample shall be equipped with multiplex which shall be in the 24 bottle mode allow multiple sample bottles to be filled each interval. It shall also be possible utilizing multiplex to collect multiple samples per individual bottle. Both multiplex modes shall be selectable in 1,2, 3, 4, 6, 8, and 12 multiples.

The sampler shall have the built-in and switch selectable capability for both time cycle and flow proportional sampling. The sample interval shall be controlled by a quartz crystal time base clock. The interval shall be adjustable from 1-9999 minutes in one minute increments. The sampler shall be equipped with a 4-digit LED display indicating the number of minutes or pulses remaining before the next sample. There shall be a provision to delay the start of the sampling program up to 9999 minutes before the initial sample is collected. The delay shall be set digitally. In the flow

proportional mode, the sampler shall have the capability to accumulate and totalize from 1-9999 or contact closures. In this mode, the display shall indicate the number of pulses remaining before the next sample. A control element shall be provided to accept a 4-20 ma mode signal for taking flow weighted composite samples.

Sample volume shall be 10 to 25 ml per cycle and may be multiplied each interval by setting the number of cycles on a digital adjustment from 1-99. It shall be possible to preset the number of samples to be taken by means of front panel switch. Sampler operation shall terminate automatically with a full composite container and shall be accomplished electronically with no switch or sensor coming in contact with the sample liquid. The full bottle condition shall be indicated by a front panel light. It shall be possible utilizing a push button to manually initiate a sample cycle without interrupting the preset program. All controls and indicators shall be readable behind a lift-off protective cover.

The sampler refrigerator volume shall be approximately two cubic feet, thermostatically controlled, and capable of maintaining samples at 34-42° F, during the collection period and until analysis can be performed. The refrigerator shall be equipped with a 1/6 HP compressor, epoxy coated fan cooled condenser, front ventilation, silver brazed joints and polyurethane coated coils and plumbing to resist corrosion. The sample taking mechanism shall be enclosed by a lift-off cover permitting viewing of the mechanism. The entire mechanism shall disassemble and be removable for cleaning.

The sampler shall operate on 120 VAC power. Operating instructions shall be permanently affixed to the sampler.

The sampler shall be suitable for outdoor use with an operational temperature range from -20 to 120 °F.

2.02 ACCEPTABLE MANUFACTURER

The automatic sampler shall be Teledyne Isco Model 5800 or better or approved equal.

PART 3 – EXECUTION

3.01 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service

The manufacturer shall provide the services of a factory-trained service engineer, specifically trained on the type of equipment specified to assist in the installation and start-up of the equipment and to train personnel in the operation and maintenance of the equipment.

B. Testing

Test each sampler in the presence of ENGINEER to demonstrate satisfactory operation. Correct all defects or replace defective equipment revealed and noted during test, make necessary adjustments at the time of tests, at no cost to the OWNER. Repeat tests if necessary to obtain results acceptable to ENGINEER. The test shall be conducted under the supervision of the manufacturer’s representation.

3.02 WARRANTY

The contractor shall supply the manufacturer's warranty against defects in workmanship and material for a period of 2 (two) years from the date of Substantial Completion.

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SECTION 11320
ROTARY SCREEN

PART I – GENERAL

1.01 DESCRIPTION

A. There will be furnished two (2) rotary screen units consisting of a screen assembly, base frame, distribution pan, splash guards, hood, trunnion wheels, spray system, cylinder stabilizer and positive drive assembly.

B. Each screen will be capable of treating a peak flow of 3.5 MGD at a maximum suspended solids concentration of 300 mg/l.

PART 2 – PRODUCTS

2.01 MANUFACTURER REQUIREMENTS

A. The rotary screening equipment specified herein shall be the design and fabrication of a single manufacturer which shall have sole source responsibility for said equipment.

B. Approved Manufacturer: Parkson Corporation Model RDS6072DV Rotoshear® EZ-CARE™ Screen or approved equal.

2.02 MATERIALS OF CONSTRUCTION

A. Screen Assembly

The screening element will be a perforated sheet with 2mm openings fastened to a cylinder substructure constructed of type 316 stainless steel. The cylinder substructure will be equipped with continuous stainless steel diverters welded to longitudinal support bars. The diverters will be arranged in a helical pattern throughout the length of the screen causing the solids to continually move forward. The diverter height will be a minimum of 1/2 inch.

One end ring will be considered the drive end and provide the necessary attachment of the drive sprocket. The other end ring will be considered the discharge end and be designed with an extended bellmouth to provide the effective discharge of dewatered solids away from the base of the unit.

B. Stainless Steel Base Frame

The base frame of the rotary screen unit will be fabricated of type 316 stainless steel. The base frame assembly will be accurately fabricated to provide a mounting surface for the screen assembly. The frame will be designed to withstand the loads imposed by the headbox structure and rotating screen element. The base will also be designed to allow for 4-point support at each corner without undue deflection throughout its length.

C. Headbox

The headbox will be designed to receive the incoming flow and distribute the flow to the screen element. The incoming flow will be introduced to the headbox by a 20.0 inch diameter inlet pipe. The flow will be baffled to reduce forward velocity and provide momentary flow equalization. The flow will enter the distribution pan through a controlled

opening providing a minimum open area of one times the inlet pipe area.
The flow will be controlled to provide linear and vertical distribution by means of an open tapered header. The fabricated headbox structure will have minimum 10 gauge type 316 stainless steel components. The final distribution of the flow to the screen element will be by two weirs. The headbox will be provided with cleanout and drain ports for maintenance purposes. The exterior portion of the headbox will have a removable stainless steel cover.

D. Flange Connections

The influent, and effluent pipe connections will be equipped with a type 316 stainless steel face ring and stainless steel loose back-up flange with a bolt pattern compatible with 125/150# class flange.

E. Splash Guards

External splash guards will be constructed of minimum 14 gauge type 316 stainless steel and be fitted on each side of the screening element. The splash guards will be designed to contain and direct the flow through the base discharge opening.

The splash guards will be fastened to the hood support structure. The guards will be designed to be easily removed for maintenance purposes.

F. Hood and Support Structure

A hood will be supplied to enclose the top of the screen assembly. It will be fabricated of minimum 14 gauge type 316 stainless steel welded to a support structure. The support structure will be fabricated of type 316 stainless steel 1/4 inch bent angles.

G. Discharge End Enclosure

The discharge end enclosure, fabricated of minimum 12 gauge type 316 stainless steel, will be provided to direct screenings into a chute fabricated to discharge screenings onto a screw conveyor. The screenings chutes shall be coordinated with the screw conveyor manufacturer.

H. Trunnion Wheels

Each screen assembly will be provided with eight (8) trunnion wheels and trunnion wheel mounting assemblies. Trunnion wheel assemblies will be accurately mounted to the base frame to provide positive horizontal placement of the screen assembly.

1. The trunnion wheels will be constructed of solid polyethylene with a minimum outside diameter of 8 inches. Flanged ball bearings will be bolted to each side of the trunnion wheel. The bearings will be designed to receive lubrication through the support shaft.

2. Support Shaft

   The support shaft will be of type 316 stainless steel having a minimum diameter of 1-1/2 inches. Each shaft will be accurately positioned and secured by the trunnion mounting bracket. The shaft will be designed to provide center lubrication to the bearing and trunnion wheel. Each shaft will be provided with an alemite grease fitting for ease of lubrication.

3. Trunnion Wheel Support Bracket

The trunnion wheel support bracket will be fabricated of stainless steel plates. The bracket assembly will be all welded construction, accurately fabricated to interface with the support base. The bracket assembly will be designed to locate the trunnion support shafts and support the loads imposed by the cylinder assembly.

I. Spray System

A water spray system constructed of type 316 stainless steel will be provided. One header with nozzles mounted parallel to the longitudinal screen axis and external to the screen, will be furnished. The nozzles will spray at an angle of 90 degrees to insure the spray penetration between the cylinder wires. The header will be equipped with a 1-1/2 inch NPT coupling and 18 type 303 stainless steel nozzles.

J. Internal Spray

An internal water spray system constructed of type 316 stainless steel will be provided. One header with nozzles mounted parallel to the longitudinal screen axis and internal to the screen will be furnished. The nozzles will spray at an angle of approximately 15 degrees below horizontal. The header will be equipped with a 1-1/2 inch NPT coupling and 15 type 303 stainless steel nozzles.

1. An internal deflector will be provided to cover the internal spray bar assembly. The deflector will be designed so as not to interfere with the spray pattern yet provide adequate discharge of solids that may accumulate over the spray bar. The deflector will be constructed of minimum 16 gauge type 316 stainless steel.

K. Cylinder Stabilizer

A cylinder stabilizer assembly will be provided at the inlet end of the cylinder to maintain proper cylinder position along the longitudinal axis of the unit. The cylinder stabilizer assembly will comprise of two UHMWPE guides contacting the cylinder flange. The stabilizer will be mounted on the base plate to engage the cylinder ring flange such that cylinder movement will be limited to ± 0.125 inch. The guides will be fitted for grease lubrication.

L. Positive Drive Assembly

The screen unit will be equipped with a 460 voltage, 3 Phase, 60 Hz, 1 HP motor with high inertia fan. The motor will be suitable for severe service with a 1.15 service factor. The motor will be close coupled to a parallel helical double reduction gear reducer. The reducer will be sized to maintain a 1.25 service factor based on input brake horsepower. The reducer output shaft will be keyed to accept a drive sprocket that provides the rotational motion to the screen cylinder.

Positive drive will be accomplished by the engagement of the drive sprocket with roller chain. The roller chain will be wrapped around the driven sprocket, which is mounted on the inlet cylinder head. The drive assembly will be mounted on a rigid base, which will provide adequate adjustment of the drive, sprocket, and roller chain interface.

The chain will be a No. 2080 double pitch roller type fabricated of carbon steel. The sprockets will be No. 80 single pitch fabricated of carbon steel. If carbon steel, the sprockets will have their tooth profile hardened to a minimum 39 Rockwell C. The chain

must be inspected and manually lubed, with Bel-Ray Waterproof Chain Lubricant, once every 24 hours of operation, unless the unit is supplied with the automatic chain oiler system option.

M. Automatic Chain Oiler System

A NEMA 12 lubrication pump with a built-in timer will be supplied with tubing and the necessary fittings to deliver a controlled amount of oil to the Rotary screen unit chains. The oil will be applied to the chain via a guide track assembly that helps insure proper oil coverage on the chain and rollers. The pump includes a 3-Liter oil reservoir. The pump requires 110V, 60Hz single phase power. The pump and tubing will be separate of the Rotoshear unit. The pump must be field mounted, wired and tubing must connect the pump to the guide track assembly mounted internal to the Rotary screen unit.

1. NEMA 4X enclosure for automatic chain oiler pump.

   The pump will be housed in the enclosure and mounted to the Rotary screen unit. Field connection of wiring to the pump will be required.

N. Surface Finish

1. The Rotary screen unit will be properly prepared and coated for the purposes intended. All stainless steel components will remain unpainted but adequately cleaned of all commercial and shop markings during fabrication.

2. All carbon steel surfaces will receive a minimum SSPC-SP6 commercial sandblast treatment. The sandblasted surface will then receive a minimum of one coat of Carboline 890 Industrial Grade Primer with a minimum of 1.5 mils dry film thickness. The finish will be a minimum of two coats of Carboline 890 High Build Epoxy, each coat having a minimum dry film thickness of 2 mils. The finished color will be black as the manufacturer standard.

3. Motors and gear reducers will remain the manufacturer's standard finish for severe environment. All plastic parts will remain unfinished, supplied as the manufacturer's standard.

O. Electrical Devices

1. Interlock Switch

   An interlock switch will be fitted on each side splash guards. The switches will be wired to the control panel to cause the unit to completely stop rotating upon opening of the guard. Proper wiring from the switch to the control panel will be the responsibility of others. Interlock switch is rated for NEMA 4X, 120 volt and is provided with a 72 inch long 18/2 lead.

2. Emergency Stop Local Push Button Station

   A NEMA 4X polycarbonate emergency stop push button station will be mounted to the headbox and will have provision for 1/2 inch conduit.

3. Spray Solenoid Valve

   While the unit is in operation, each water spray will be actuated by 115 volt, single phase, normally closed, solenoid valve with 1-1/2 inch NPT pipe connections.

Electrical housing will be rated NEMA 4X.

4. Motion Failure Switch

   A motion failure switch will be provided to detect loss of motion to the cylinder. A NEMA 4X probe will receive signals from ferrous blocks mounted to the inlet head of the cylinder. An NEMA 4X or open amplifier will receive the signal and contracts will be provided for customer use (i.e. to activate an alarm).

5. A 480 volt primary U. L. listed and labeled control panel in a NEMA 4X type 316 stainless steel enclosure suitable for wall mounting. It will contain the following logic devices for proper operation of the equipment:
   a. Relays and timers to monitor equipment mounted electrical devices to perform necessary logic functions.
   b. Emergency Stop push button.
   c. Hand-Off-Auto selector switch for the drive and water spray(s).
   d. Control power and run indicating lights.
   e. Fault Light.
   f. Run and fault auxiliary output contacts for customer use.

6. A disconnect switch, motor starter and control power transformer will be provided.

2.03 ANCHORS

Each screen shall be mounted in accordance with the current edition of the Florida Building Code. The CONTRACTR shall provide certification that calculations have been performed and signed by a structural or civil engineer registered in the State of Florida confirming that the anchorage system provided is within allowable shear and tension limits. The anchorage system shall be designed to withstand a wind load of 150 miles per hour.

PART 3 – EXECUTION

3.01 FACTORY SERVICE

The rotary screen unit manufacturer will provide factory service, during one (1) trip, for a total of one (1) day for inspection of installation, equipment start up and operator training.

3.02 FACTORY ASSEMBLY, TESTING AND INSPECTION

The equipment will be factory operated and inspected prior to shipment to insure the proper interface, and adjustment of all parts.

3.03 INSTALLATION, OPERATION AND MAINTENANCE MANUAL

In addition to the normal Installation, Operation and Maintenance manuals required by contract, a spare manual will be shipped with the unit in order to allow for proper operation of equipment prior to release of all final Installation, Operation and Maintenance Manuals to the end user.

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SECTION 11330
SCREW CONVEYOR AND COMPACTOR

PART I – GENERAL

1.01 DESCRIPTION

A. The screw conveyor unit will consist of a spiral, trough, covers, support legs, press zone, drive system and controls.

B. The screw conveyor unit will be designed to receive materials and will reduce the volume and water content by means of a pressing zone. Solids to be pressed will be gravity fed to an inlet trough and conveyed by the spiral to the press zone. Water from the press zone will be directed to the drainage system for discharge. The press unit will be inclined at 6.3 degrees from horizontal.

C. The press will have an inlet capacity of 70.5 cubic feet per hour at a 6 degree trough incline, handling wet screenings with an approximate dry weight of not less than 8% solids.

PART 2 – PRODUCTS

2.01 MANUFACTURER REQUIREMENTS

A. The screw conveyor equipment specified herein shall be the design and fabrication of a single manufacturer which shall have sole source responsibility for said equipment.

B. Approved Manufacturer:

- MLM Conveying Systems
- Parkson Corporation
- or approved equal

2.02 MATERIALS OF CONSTRUCTION

A. Spiral

The spiral will be constructed of high strength carbon steel, prime coated for protection during shipment. Two (2) concentric flights will be formed from bar stock and will be welded together. Spirals with single flights will be specifically excluded. The outer spiral flight will have a nominal thickness of 0.75 inch and the inner spiral flight will have a nominal thickness of 0.63 inch. The total flight height will be 3.35 inches. The spiral will have an OD of approximately 9 inches. The spiral is shaftless through the conveying section of the trough. There is a 12.00 inch long shaft at the drive end of the spiral to strengthen the drive connection and a 9.5 inch long restrictor plug at the discharge end of the spiral to help form the solids plug. The spiral will develop a 6 inch of pressed material.

1. “Spiral flights shall be cold-formed high strength chrome alloy steel with a minimum hardness of 220 Brinnell, a minimum yield strength of 450 N/m and a minimum tensile strength of 600 N/m.

2. The spiral flights shall be designed for the maximum torque requirements specified. The spiral flights shall be designed with adequate stability to prevent distortion and jumping in the trough under maximum load conditions. A second, inner spiral, concentric with the outside spiral shall also be provided. The torsional

rating of the auger flighting shall exceed the torque rating of the drive motor at 250% of its nameplate horsepower. The "spring effect" of the spiral shall not exceed + 0.0039 mm per 100 mm of length at maximum load conditions. The minimum outer spiral thickness shall be 20 mm for spiral diameters up to 225 mm and 25 mm for spirals diameters exceeding 225 mm.

3. The spiral flighting shall be formed in sections from one continuous flat bar with a minimum thickness of 20 mm and shall be concentric to within 2 mm. Single stage forming and sectional flighting formed from plate shall not be permitted.

4. Pitch measured between flights, measured at outside diameter of screen flights, along and straight lines parallel to axial centerline through 0^{o}, 90^{o}, 180^{o} and 270^{o} positions shall not vary from design pitch by more than $\pm$2% of outside diameter of screw flights.

5. Spiral flighting shall have full penetration welds at all splice connections. The flights shall be aligned to assure true alignment when assembled in the field and shall be made in accordance with the supplier's requirements. The spiral flights shall be coupled to the end shaft by a flanged, bolted connection.

6. The spiral will be fitted with a special water-resistant nylon brush with stainless steel holder to clean the drain area. The brush will be welded to the spiral in the trough drainage area only.

B. Trough

The press trough will have an internal dimension of 12 inches and be constructed of 11 gauge type 316L stainless steel. Trough length will be roughly 480 inches.

1. Trough Liner

The trough will be lined with 3/8 inch thick UHMW polyethylene sheet.

2. Drainage Area

Free liquid from feed materials will drain through a screen located at the drive end of the unit. Screen will conform to the press trough radius and be 7.50 inches long, perforated with 0.19 inch diameter openings. A 3.00 inch OD plain-end type 316L stainless steel pipe will be provided to remove liquid accumulated in the drainage area.

3. Inlet Area

Two available inlet areas of 12.0 inches wide by 51.0 inches long shall receive incoming materials from the drum screens, with a future connection to be added. A third available inlet area of 12.0 inches wide by 12.0 inches long shall be provided to receive discharge from the grit classifier unit. These area will be covered with shipping covers. Transition feed hoppers to be supplied by the conveyor manufacturer.

4. Transition Hoppers

11 gauge type 316L stainless steel transition hoppers will be supplied to direct materials into the inlet feed area from the drum screens and grit classifier. The hopper will be flange bolted to the trough with each side a minimum 60 degrees

from horizontal. The transition hoppers shall be coordinated with the drum screen and grit classifier manufacturers.

C. Covers

For safety and hygienic purposes, the trough will be covered with 14 gauge type 316L stainless steel covers.

D. Support Legs

The unit will have support legs constructed of 11 gauge type 316L stainless steel designed to support the required loads. The leg heights will be appropriate to inclination intended.

E. Press Zone

The press zone will consist of a screen insert, jacket assembly and spray wash system.

1. Screen Insert

The screen will consist of a type 316L stainless steel wedgewire cylinder with clear openings of .040 inch which extend the entire length of the press zone.

2. Jacket Assembly

The jacket assembly will consist of an 11 gauge type 316L stainless steel outer shell, a hinged top cover with lockdown latches to provide easy access for cleaning the screen and an adjustable spring loaded back pressure door which will allow the initial screenings plug to form at the discharge end.

3. Drain Flush Spray

A spray wash system to flush screenings residue from the press zone will consist of a radial spray header and solenoid valve. Spray header will have seven (7) 0.19 inch diameter openings. The system will have an output of 8 GPM at 40 psig. Spray connection will be 3/4 inch NPT.

F. Drive System

The Screw conveyor unit drive system will consist of a motor, gear reducer and drive shaft.

1. Motor

The motor will be a 3 HP, 1800 RPM, 230/460 volt, 3 Phase, 60 Hz, 1.15 S.F., TEFC, NEMA Design B, Class F insulation, 40°C ambient temperature rise and rated for severe duty.

2. Gear Reducer

The gear reducer will be a shaft-mounted parallel helical type gear reducer driven by a direct coupled motor. The reducer will have a cast iron housing and have an output speed of 26 RPM. The service factor rating will be 1.8.

3. Shaft

The drive shaft will be direct coupled to the spiral and be constructed of prime coated AISI 1045 carbon steel.

G. Fasteners

All fasteners will be type 18-8 stainless steel.

H. Surface Finish

1. All stainless steel subassemblies will be acid passivated after welding for corrosion resistance and to provide a superior surface finish. This will be done by full dipping of weldments; or by using an acid passivation paste in the weld and heat affected areas and spray-on acid solutions elsewhere. After passivation, the weldments will be thoroughly rinsed with clean water and allowed to air dry. Sandblasting, bead blasting or grit blasting of stainless steel surfaces will not be allowed in lieu of acid passivation.

2. Motor, gear reducer and solenoid valve will be manufacturer's standard finish. The torque bracket will be epoxy coated carbon steel. UHMW polyethylene liner and rubber drain pipe coupling will be unpainted. Drive shaft and spiral will be prime coated carbon steel.

I. Electrical Devices

In addition to the drive motor, the following electrical devices will be supplied with the unit.

1. Solenoid Valve

The spray wash system will be actuated by 120 volt, single phase, normally closed solenoid valve. Valve will consist of a brass body with BUNA seals and 3/4 inch NPT pipe connection. Electrical housing will be rated NEMA 4X and will have 18-inch long integral leads and a 1/2 inch NPTF conduit fitting.

2. A local NEMA 4X plastic E-Stop push button station will be mounted on the unit.

3. Overload Protection

The Screw conveyor unit will be supplied with an overcurrent sensor to be mounted in the customer provided control panel to detect any overload conditions. The sensor will sense high current draw of the motor. The sensor will be suitable for 115 volt, single phase current.

2.03 ANCHORS

The unit shall be mounted in accordance with the current edition of the Florida Building Code. The CONTRACTR shall provide certification that calculations have been performed and signed by a structural or civil engineer registered in the State of Florida confirming that the anchorage system provided is within allowable shear and tension limits. The anchorage system shall be designed to withstand a wind load of 150 miles per hour.

PART 3 – EXECUTION

3.01 FACTORY SERVICE

Equipment manufacturer will provide factory service, during one (1) trip, for one (1) day for inspection of installation, equipment start up, and operator training.

3.02 FACTORY ASSEMBLY, TESTING AND INSPECTION

The unit will be factory operated and inspected prior to shipment. The Engineer and/or Owner may, at their own option and expense, witness the factory test.

3.03 INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

In addition to the normal Installation, Operation and Maintenance Manuals required by contract, a spare manual will be shipped with the unit in order to allow for proper operation of equipment prior to release of all final Installation, Operation and Maintenance manuals to the end user.

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SECTION 11335
DOUBLE WALL POLYETHYLENE CHEMICAL STORAGE TANKS

PART I – GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. This section covers the furnishing and installation of double wall 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. Section 11350: Skid Mounted Chemical Metering Pumps and Accessories
2. Section 15050: Mechanical General Requirements
3. Section 15200: Process Piping and Valves

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 which can be visibly inspected.

B. Factory Testing

1. Test specimens shall be taken from fitting location areas or piggy-back test molds.

2. Low Temperature Impact Test
   a. Test specimens should be conditioned at -40 degrees Fahrenheit for a minimum of 2 hours.
   b. The test specimens shall be impacted in accordance with the standard testing methods as found in ASTM D1998. Test specimens < 1/2" thickness shall be tested at 100 ft.-lb. Test specimens > 1/2" thickness shall be tested at 200 ft.-lb.

3. Degree of Crosslinking Test (% Gel - Crosslinked Only)
   a. The test method used is to be the o-xlene insoluble fraction (gel test) per ASTM D2765 Method C. This test method is for determination of the ortho-xlene insoluble fraction (gel) of crosslinked polyethylene.

b. The percent gel level for Type I tanks on the inside 1/8 in. of the wall shall be a minimum of 65%.

4. Ultrasonic Tank Thickness Test
   a. All tanks 2,000 gallons or larger shall be measured for tank wall thickness at 6", 1 ft., 2 ft. and 3 ft. on the tank sidewall height at 0° and 180° around the tank circumference with 0° being the tank manway and going counter-clockwise per ANSI standard drafting specifications. A copy of this test report can be ordered when placing the original tank order. All tanks shall meet design thickness requirements and tolerances.
   b. Tanks smaller than 2,000 gallons are only periodically measured at the start of a production run or after any design changes. Customers can place an order for tank wall thickness measurements on smaller tank sizes when placing the original order. A copy of the test report will be provided if ordered.

5. Hydrostatic Testing
   a. 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 method shall fill the tank to the maximum overflow level. The test duration shall be 24 hours. Following successful testing, the tank shall be emptied and dried prior to shipment.
   b. 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 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. Manufacturer's unloading and installation procedures.

5. Manufacturer's Qualifications

B. Certification

The manufacturer shall provide an affidavit of compliance with all applicable provisions of this specification.

C. Shop Testing

Prior to shipment, submit results of the shop testing to include the following:

1. Material, specific gravity rating at 600 psi @ 100 degrees F. design hoop stress.

2. Ultrasound Wall thickness verification.

3. Fitting placement verification.

4. Visual inspection

5. Impact test

6. Gel test

7. Hydrostatic test

8. Degree of resin crosslinking, if applicable.

D. Operations and Maintenance Data

Submit operating instructions, description of repair techniques, and recommended maintenance schedule for inspection and cleaning. 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 See Section 01730 for requirements.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

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.

1.05 WARRANTY AND GUARANTEES

The tank shall be warranted for 5 years to be free of defects in material and workmanship. Warranty shall be prorated over the last 3 years.

PART 2 – PRODUCTS

2.01 GENERAL

The chemical tank shall be an upright, double wall, flat bottom storage tank assembly. The assembly consists of one cylindrical inner primary tank and one blended form octagonal outer secondary tank. Each tank is molded in one-piece seamless construction by rotational molding. The tanks are designed for above-ground, vertical installation and are capable of containing chemicals at atmospheric pressure. The assembly shall be designed to prevent rainwater from entering the containment tank. The containment tank shall be designed to hold a minimum of 115 percent of the normal fill capacity of the primary tank.

2.02 MATERIALS AND EQUIPMENT

A. Basic materials shall be as follows:

1. Tank Shell and Covers - High density polyethylene, linear construction, USDA approved, with UV inhibitor.

2. Nozzles - Same as tank shell.

3. Hardware -AISI Type 316 stainless steel.

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 Number	TNK-230001A
Chemical	Sodium Hypochlorite (NaOCl)
Maximum Concentration	8 to 12% Trade
Maximum Specific Gravity	1.21
Max Temp	120 °F
Min Temp	30 °F

2. Design Criteria:
   a. 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.
   b. The tanks shall conform to the following requirements:

Tank Number	TNK-230001A
Chemical	Sodium Hypochlorite (NaOCl)
Tank Type	Vertical, Double Wall
Usable Capacity	2,500 gal
Max Diameter	102”
Primary Tank	
Design Specific Gravity	1.9
Color	Opaque White
Secondary Tank	
Design Specific Gravity	1.5
Color	Natural

NOTE: Usable Capacity is calculated as the volume of liquid available between the bottom of the overflow nozzle and the bottom of the suction nozzle.

2.03 MATERIALS OF CONSTRUCTION

A. The material used shall be virgin polyethylene resin as compounded and certified by the manufacturer. Tanks made from molded linear polyethylene resin as manufactured by ExxonMobil Chemical, or resin of equal physical and chemical properties.

B. All polyethylene resin material shall contain a minimum of a U.V. 8 stabilizer as

compounded by the resin manufacturer. Pigments may be added at the purchaser's request, but shall not exceed 0.25% (dry blended) of the total weight.

C. The mechanical properties of tanks molded from linear polyethylene resin material shall be:

PROPERTY	ASTM	VALUE
Density (Resin)	D1505	0.940-0.948 g/cc
Tensile (Yield Stress 2"/min)	D638	2950 PSI
Elongation at Break (2"/min.)	D638	> 1000 %
ESCR (100% Igepal, Cond. A, F50)	D1693	550 hours
ESCR (10% Igepal, Cond. A, F50)	D1693	48 hours
Vicat Softening Degrees F. Temperature	D1525	250
Flexural Modulus	D790	129,000 PSI

2.04 DESIGN REQUIREMENTS

A. The minimum required wall thickness of the cylindrical shell at any fluid level shall be determined by the following equation, but shall not be less than 0.187 in. thick.

$$T = P \times O.D./2\,SD = 0.433 \times S.G. \times H \times O.D./2\,SD$$

Where

T = wall thickness, in
SD = hydrostatic design stress, PSI
P = pressure (0.433 x S.G. x H), PSI
H = fluid head, ft.
S.G. = specific gravity, g/cm^3
O.D. = outside diameter, in.

1. The hydrostatic design stress shall be determined by multiplying the hydrostatic design basis, determined by ASTM D2837 using rotationally molded samples, with a service factor selected for the application. The hydrostatic design stress is 600 PSI at 73 degrees Fahrenheit for cross-linkable and linear polyethylene molded tanks. In accordance with the formula shown in this section, the tank shall have a stratiform (tapered wall thickness) wall. In NO case shall the tank thickness be less than design requirements per ASTM D 1998.

2. The hydrostatic design stress shall be derated for service above 100 degrees Fahrenheit and for mechanical loading of the tank.

3. The tanks shall be designed to the specific gravity shown above or as recommended by the tank manufacturer.

B. The minimum required wall thickness for the cylinder straight shell must be sufficient to support its own weight in an upright position without any external support but shall not be less than 0.187 inches thick. Flat areas shall be provided to allow locating large fittings on the cylinder straight shell. Secondary containment tanks shall be designed per standard thickness requirements. The secondary containment shall be configured to allow shipment of the primary tank inside of the secondary tank. The shipment shall be done without the aid of additional spacer blocks.

C. The top head must be integrally molded with the cylinder shell. The minimum thickness

of the top head shall be equal to the top of the straight wall. The top head of tanks with 2,000 or more gallons of capacity shall be designed to provide a minimum of 1300 square inches of flat area for fitting locations. The primary tank shall be keyed to the secondary tank preventing primary tank rotation. The secondary containment shall have 115% of the normal fill capacity of the primary tank.

D. Tanks with 2,000 or more gallons of capacity shall have a minimum of 3 lifting lugs integrally molded into the top head. The lifting lugs shall be designed to allow erection of an empty tank. Tanks shall be capable of being lifted into position as a single unit.

E. The tank shall be designed to provide a minimum of 4 tie-down lugs integrally molded into the top head. The tie-down lugs shall be designed to allow tank retention in wind and seismic loading situations without tank damage. The primary/secondary tank unit shall be configured to allow direct primary tank base retention for seismic load conditions. The base retention unit shall be anchor bolted to the base slab and not require additional spacer blocks.

F. The tank and its tie-down system shall be designed to withstand 150 MPH wind loads and meet local building code. The shop drawings shall include a design signed and sealed by a Professional Engineer in the state where the tank is manufactured to verify compliance with this requirement. The tie-down system shall be 316 stainless steel construction.

G. Dimensions and Tolerances

All dimensions will be taken with the tank in the vertical position, unfilled. Tank dimensions will represent the exterior measurements.

1. The tolerance for the outside diameter, including out of roundness, shall be per ASTM D1998.

2. The tolerance for fitting placements shall be +/- 0.5 in. in elevation and 2 degrees radial at ambient temperature

2.05 ACCESSORIES

A. Tank Fittings –Location

Each tank shall be provided with the following fittings with the orientation as shown on the Drawings.

B. Tank Fittings –Type

1. Materials of Construction

All materials of construction shall conform to the manufacturer's recommendations. Fittings shall be constructed of Schedule 80 PVC. Gaskets shall be shall be a minimum of 1/4" thickness and constructed of 60-70 durometer Viton. All hardware shall be titanium.

2. Threaded Bulkhead

Threaded bulkhead fittings are to be used for above liquid installation. Fittings must be placed away from tank knuckle radius' and flange lines. The maximum allowable size for bulkhead fittings placed on a curved cylindrical section of tanks is 2 inch. The placement of the fitting and the size of the fitting shall be conformance with the tank manufacturer's recommendations.

3. Bolted Double 150 lb Flange Fittings

Bolted double flange fittings are to be used for below liquid level installation. Fittings must be placed away from tank knuckle radius' and flange lines. The placement of the fitting and the size of the fitting shall be conformance with the tank manufacturer's recommendations.

The bolted double flange fitting shall be constructed with 2 ea. 150 lb. flanges, 2 ea.150 lb. flange gaskets, and the correct number and size of all-thread bolts for the flange specified by the flange manufacturer.

There shall be a minimum of 4 ea. full thread bolts. The bolts may have gasketed flanged metal heads or bolt heads encapsulated in Type II polyethylene material. The encapsulated bolt shall be designed to prevent metal exposure to the liquid in the tank and prevent bolt rotation during installation. The polyethylene encapsulation shall fully cover the bolt head and a minimum of 1/4" of the threads closest to the bolt head. The polyethylene shall be color coded to distinguish bolt material (white - 316 S.S., yellow - Hastelloy C276, red - Monel, green - Titanium). Each encapsulated bolt shall have a gasket to provide a sealing surface against the inner flange.

Standard orientation of bolted double flange fittings shall have bolt holes straddling the principal centerline of the tank in accordance with ANSI/ASME B-16.5 unless otherwise specified.

4. Containment Seal between Inner and Outer Tank Walls

Any fittings outlets which penetrate the inner and outer tank walls shall be furnished with a flexible containment seal between the inner primary tank and the outer secondary containment tank. This fitting outlet provides access for connecting piping to the inner primary tank while maintaining containment integrity between the inner primary tank and the outer secondary containment tank. This fitting outlet may be used for 2, 3, and 4 in. fitting sizes.

The fitting outlet shall consist of 1 ea. flexible polyethylene containment boot, 1 ea. appropriate fitting gasket, 1 ea. flexible containment seal gasket, 1 ea. solid flange, 1 ea. split flange, and 12 ea. 3/8 in. titanium bolt assemblies. All components of the flexible containment seal shall be chemically suitable for the application.

5. Flexible Couplings

All tank fitting attachments shall be equipped with flexible couplers or other movement provisions. The tank will deflect based upon tank loading, chemical temperature, and storage time duration. Tank piping flexible couplers shall be designed to allow 4% design movement. Movement shall be considered to occur both outward in tank radius and downward in fitting elevation from the neutral

tank fitting placement. All components of the flexible coupling shall be chemically suitable for the application.

C. Vents:

Each tank must be properly vented for the type of material and flow rates expected. Vents must comply with OSHA 1910.106 (F) (iii) (2) (IV) (9) normal venting for atmospheric tanks or other accepted standard, or shall be as large as the filling or withdrawal connection, whichever is larger but in no case less than 1 in. nominal inside diameter. The vents are to be U-type of the size indicated and be provided with an insect screen of material compatible with the chemical stored. All U-vents shall be constructed of PVC or other suitable materials.

D. Manways:

A 24-inch bolted sealed top manway shall be provided. The sealed manway shall be constructed of polyethylene material or other suitable chemically resistant material. The bolts shall be polypropylene or other specified material. The gaskets shall be closed cell, crosslinked polyethylene foam and Viton materials.

E. Fill Pipes:

An external fill pipes shall be provided. The external fill pipes shall be supported at 3 ft. maximum intervals with a support structure independent of the tank (ground supported). All external fill pipes shall be constructed of PVC or other suitable materials.

An internal down pipe shall be provided which terminates 3 ft above the tank floor. All internal down pipes shall be supported at 5 ft. maximum intervals with a support structure welded to the inside of the primary tank The support design may utilize a PVC clamp or other specified materials for support. All designs shall be in accordance with the manufacturer's recommendations. All internal down pipes shall be constructed of PVC or other suitable materials.

F. Leak Detector Unit:

The leak detector unit shall consist of a proximity sensor, a welded 2 in. fpt connection, a 2 in. bung plug with a ¾ in strain relief, and an indicator box. The sensor is placed in the interstitial space between the primary and secondary tanks approximately 1 in. above the tank bottom. The indicator box shall be NEMA 4X rated 316 stainless steel construction and factory pre-wired for 110 VAC power. All connections shall be labeled to prevent errors in field installation.

The indicator box will show a green light when power is on and the sensor is not detecting a liquid. The light is a push to test light allowing the operator to test for power outage or malfunction. If the green light goes out there are two possibilities. The green light does not come on when the button is pushed. This would indicate a lack of power to the unit or the light bulb is burned out. If the green light comes on when pushed, then a possible leak condition is indicated.

G. Ladder and Safety Cage

Ladders shall be constructed of FRP. Safety cages shall be provided with ladders as required by OSHA standards. Ladders shall be designed to meet applicable OSHA standards. Ladders must be mounted to the tank to allow for tank expansion and

contraction due to temperature and loading changes. All top ladder mounts shall be connected to integrally molded in attachment lugs that allow for tank movement

H. Nameplates and Chemical Hazard Signage:

Each tank shall be provided with a nameplate to identify the chemical stored. The nameplates shall be of orange phenolic material with black engraved lettering one inch high and shall 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. Each tank shall be provided with all OSHA required chemical hazard signage for the chemicals to be stored in the tank. The nameplate shall also provide the DOT UN number for the chemicals to be stored in the tank.

I. Certification Plates:

A stainless steel 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.

2.06 QUALITY CONTROL

CONTRACTOR shall follow Manufacturer's and Supplier's product quality control specifics as required for this project.

2.07 MANUFACTURERS

A. Subject to compliance with specific requirements, manufacturers offering products which may be incorporated in Work include:

- Snyder Industries, Inc.
- or approved equal.

PART 3 – EXECUTION

3.01 PREPARATION (NOT APPLICABLE)

3.02 INSTALLATION

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: Mortar and Grout.

3.03 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 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 to the ENGINEER for approval.

END OF SECTION

SECTION 11350
SKID MOUNTED CHEMICAL METERING PUMPS AND ACCESSORIES

PART I – GENERAL

1.01 SCOPE OF WORK

A. The work under his section includes the furnishing of all labor, materials, equipment, supervision, documentation, training and start-up services for the manufacturer and installation of skid mounted chemical metering systems suitable for the application of chemicals as shown on the drawings and specifications herein.

B. These specifications are intended to give a general description of what is required but does not cover all details, which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, shop testing, delivery, complete installation, and field testing of all materials, equipment, and appurtenances for the complete pumping units as herein specified.

C. For all units, furnish and install all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these specifications or not. This installation shall incorporate the highest standards for the type of service shown on the drawings, including field testing of the entire installation and instruction of the regular operating personnel in the care, operation, and maintenance of all equipment.

1.02 DESCRIPTION OF SYSTEMS

A. The chemical metering pumps shall be installed as outlined in this Specification, shown on the Drawings and as recommended by the manufacturer.

B. Related Work Described Elsewhere

1. Mechanical piping, valves, pipe hangers, and supports are included in their respective Sections of Division 15.
2. Electrical work, except as hereinafter specified, is included in Division 16

C. General Design

1. All of the equipment specified herein is intended to be new standards equipment for use in the chemical feed systems as specified and shall include, but not be limited to, the following items of material and equipment:
   a. Chemical metering pumps
   b. Calibration columns
   c. Pressure relief valves
   d. Pulsation dampeners
   e. Backpressure valves
   f. On-skid pre-wired motors and controls
   g. Diaphragm protected pressure gauges
   h. On-skid piping and valves

2. All working parts of identical pumps and motors, such as bearings, check valves, shafts, sleeves, motors, etc. shall be of standard dimension built to limit gauges or formed to templates such as that parts will be interchangeable between like units and such that Owner may at any time in the future obtain replacement and repair parts for those furnished in the original equipment. All parts shall be

properly stamped for identification and location in the equipment as shown on the Operation and Maintenance Manuals furnished.

1.03 PATENTS AND LICENSES

A. The pumping equipment manufacturer shall be responsible for all patents or licenses that exist because of the equipment that may be provided.

B. The manufacturer shall assume all costs of patent fees or licenses for the equipment or process, and shall safeguard and save harmless the OWNER from all damages, judgments, claims, and expenses arising from license fees, or claimed infringement of any letters, patent or patent rights, or fees for the use of any equipment or process structural feature or arrangement of any of the component parts of the installation, and the price bid shall be deemed to include payment of all such patent fees, licenses or other costs pertaining thereto.

1.04 QUALITY ASSURANCES

A. Manufacturer's Qualifications

Manufacturer shall have experience in manufacturing chemical metering pump skids of the same or larger size to the units specified. For a manufacturer to be determine acceptable for providing chemical metering pump skids on this project, it must supply references of five (5) separate, substantially similar installations with contact names and phone numbers. Referenced installations must be for the same chemicals required in this specification and have been in satisfactory operation for a minimum of two years.

B. Single Suppliers

All equipment provided under this Section shall be obtained from a single supplier or manufacturer who, with the CONTRACTOR, shall assume full responsibility for the completeness and proper operation of the chemical feed system.

C. Assembly

To insure quality and unit responsibility, the pump skids must be assembled and tested by the manufacturer at his facility and be a standard and regularly marketed product of that manufacturer. The manufacturer must have a physical plant, technical and design staff, and fabrication personnel to compete the work specified.

D. Shop Testing

1. Tests shall be conducted on the actual pumps and skids being provided for this project. All pumps shall be tested prior to shipment.

2. Each skid system shall be tested prior to shipment. The test can be performed with water. The system shall be operated throughout the entire operating range of the pumps.

3. All piping shall be hydrostatically tested against a closed isolation valve without leakage. Documented testing results shall be provided prior to shipment.

E. Assembly

The equipment specified in this Section shall be furnished, coordinated, serviced, and

guaranteed by one supplier who shall be experienced in the design, manufacturer, coordination, installation, and servicing of equipment of the type, size, and complexity specified in this Section. The supplier shall have a permanent organization of office and field technical personnel and facilities necessary for fulfilling all requirements of this Specification.

1.05 SUBMITTALS

A. Submit for approval show drawings and other data to establish compliance with these specifications, in accordance with provisions of Section 01300 and as follows:

1. Equipment catalog cut sheets, descriptive literature, bulletins, or other published information for the equipment.

2. Certified shop and erection drawings showing all important details of construction and outline dimensions of all equipment including anchor bolt locations.

3. Cross section drawings of all pumps and equipment with parts identification and material specifications.

4. Data regarding the characteristics and performance of each pump. Data shall include factory guaranteed performance curves, based upon actual shop tests of similar units, which show they meet the specified requirements for head, capacity, efficiency, NPSHR, and motor horsepower.

5. Total weight of the equipment including weight of the single largest item

6. Motor nameplate data and specifications sheet for all electric motors, including all information as required herein.

7. A complete bill of materials for all equipment

8. Piping schematic with details of connections to Contractor supplied piping. Skid manufacturer shall provide review comments for piping shown on drawings if his equipment will require modification to the piping design.

9. Electrical schematics and complete wiring diagrams for control panels showing extent of factory prewiring and control panel construction. Electrical drawings shall include extent of required field wiring.

10. Shop painting specifications (2) for ferrous surfaces, if required.

11. A list of manufacturer's recommended spare parts to be supplied in addition to those specified herein. Include gaskets, packing, etc. on the list. List bearings by the bearing manufacture's numbers only.

12. List of local facilities to obtain parts for all equipment.

13. List of manufacturer approved service organizations for all equipment.

14. Handling and storage instructions

15. Copies of all factory test results, as specified herein.

16. PVC cement to be used for socked welded connections. PVC cement shall

provide maximum chemical resistance to chemical service. Provide certification from PVC cement that cement is chemically resistance.

B. Submit for approval results of shop testing of pumps and chemical feed skids system prior to shipment.

C. Submit for approval operating and maintenance manuals. The manuals shall be prepared specified for this installation and shall include all required catalog cuts, drawings, equipment lists, descriptions, and necessary information, that are required to instruct operating and maintenance personnel unfamiliar with such equipment. A complete, corrected and approved copy of the shop drawing submittal shall be included with each manual provided. Provide a listing of manufacturer's recommended maintenance schedule of inspection, cleaning, and lubrication. Special requirements for the preparation of O&M manuals shall be as specified in Section 01730.

1.06 TOOLS AND SPARE PARTS

A. Furnish to the Owner a complete set of all special tools, including lubricating devices, required for normal operation, adjustment and maintenance of the equipment supplied.

B. Each skid mounted chemical feed system shall be provided with a complete set of the manufacturer's recommended spare parts.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All equipment and parts shall be properly protected so that no damage or deterioration will occur during a prolong delay for the time of shipment until installation is complete and the units and equipment are ready for operation

B. All equipment and parts must be properly protected against any damage during a prolonged period at the site. Pumps and appurtenances shall be stored as recommended by the manufacturer until the time of installation.

C. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

D. Finished surfaced of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted thereto.

E. Finished iron or steel surfaces not painted shall be properly protected to prevent rust or corrosion.

F. After hydrostatic or other testing, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage, and handling.

G. Each box, crate, or package shall be properly marked to show its net weight in addition to its contents.

H. Handle during delivery, storage, and installation in a manner to prevent damage of any nature in accordance with manufacturer's approved instructions.

1.08 WARRANTY AND GUARANTEES

A. The skid manufacturer and the CONTRACTOR shall provide a warranty for all chemical metering pump skids, control and appurtenances for a period of two (2) years on the

skids, control, and accessories, and two (2) years on the chemical metering pumps.

B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced at no expense to the OWNER.

C. The Skid manufacturer's warranty period shall run concurrently with the Contractor's warranty period.

D. Refer to the General Conditions for additional guarantee and warranty requirements.

PART 2 – PRODUCTS

2.01 SERVICE CONDITIONS

A. The skid manufacturer shall furnish chemical metering pumps skids, with all accessories, fittings, appurtenances, specialty items and all supports and anchors required for complete and operating pumping systems.

B. All parts and mechanisms shall be amply proportioned for all stresses that may occur during fabrication, shipping, erection, and intermittent or continuous operation. All units shall be constructed such that dismantling and repairing can be accomplished without difficulty.

2.02 PERFORMANCE

A. The pumping unit shall operate without vibration or excessive noise over the operating speed range.

B. Pumping system vibration shall not exceed the acceptable field vibration limits given in the standards of the Hydraulic Institute.

C. All wetted surfaces of the chemical metering pump and appurtenances shall be suitable for continuous exposure to the chemicals being pumped as outlined in the Pump Schedule.

D. Pumping units shall perform according to the following parameters:

1. The pumping units shall be able to perform within a temperature range of 32 to 120°F.

2. Diaphragm pumping units shall have disc style diaphragms. No tube diaphragms will be allowed.

E. Service Conditions

The chemical feed system shall be used to dose the following chemical into the treatment process:

Chemical Name	Sodium Hypochlorite (NaOCl)
Concentration	8 to 12%
Specific Gravity	1.21
Maximum Temperature	100°F

F. Design Summary: The skid manufacturer shall provide the following pump skids

Skid Number	
No. of Pumps	2 Duty + 1 Standby
Chemical	Hypochlorite
Type of Pump	Diaphragm
Stroke Length	Manual
Stroke Rate	Automatic
Pump Capacity	12.5 gph
Pump Pressure	10 psi
Pipe Materials	PVC Sch 80
Type of On-Skid Isolation Valves	Diaphragm
Skid Piping Outputs	
Head	PVDF
Diaphragm	PTFE
Check Valve	Ceramic
Seats	Viton

2.03 CHEMICAL METERING SKIDS

A. The chemical metering skids shall be constructed of chemically resistant material. The skid shall be self-supporting and all components of the chemical metering system shall be contained within the skid. Pedestals shall be provided to elevate the metering pumps above the skid base. The skid shall have containment built into the base equal to 20 gallons per pump and a drain valve to empty any spills. The skids shall be manufactured using thermal welding technology; bolted construction is not acceptable.

B. For each chemical metering pump the piping system shall include (1) pressure relief valve; (1) pulsation dampener; (1) diaphragm protected pressure gauge; (1) back pressure valve; (1) flushing inlet; (1) flushing outlet; (1) vent return; and all required piping, valves, and supports. Piping shall include isolation valves and unions for all serviceable components. The chemical supply piping shall allow for chemical inlets with a bulkhead fitting thru the containment. Y-type strainers shall be in the suction line outside of the skid. One calibration column shall be provided and designed for use with any of the metering pumps. The discharge piping shall allow for each pump to serve individual loads or a common load with backup.

C. All piping shall be schedule 80 PVC bearing the NSF potable water logo with assembly performed in a controlled shop environment by the skid manufacturer. All pipe shall be squarely cut on precision equipment with the ends chamfered and deburred. All socket-welded connections shall follow the guidelines set by the pipe/fitting manufacturer for proper cleaning, priming and gluing procedures. The glue used shall be resistance to chemical attack from the chemicals used. All threaded connections will utilize Teflon tape, a suitable thread sealant or a combination of both. Threaded connections shall utilize stainless steel reinforcement rings where applicable to reduce the risk of cracking.

D. The piping shall be attached to the chemical metering skid with a non-metallic corrosion resistant support system. The straps shall be removable and reusable to allow for servicing of the system. All inlet/outlet connections, valves and pump accessories shall be clearly labeled on the skid.

E. A NEMA 4X terminal box shall be provided on the skid back panel for termination of all power/control wiring. A power receptacle with weatherproof cover shall be provided for the metering pump power cords and shall be prewired to the terminal junction box.

F. Surge protection shall be provided locally in the skid mounted terminal junction box. Protection shall be provided for the main power supply as well as all digital and analog input and output signals. Surge protection devices shall be as manufactured by EDCO Inc. of Florida or equal.

G. The chemical metering skids shall be completely assembled and tested by the manufacturer prior to delivery to the job site. Each skid shall include 316 SS mounting brackets.

2.04 SAFETY SPRAY SHIELD

A safety spray shield shall be provided to protect operation and maintenance personnel from contact with the chemical. The spray shield shall be clear or include a large viewing area and be easily removable for normal operation and maintenance tasks. Fabric safety shields are not acceptable.

2.05 CHEMICAL METERING PUMPS

A. Scope

This specification in combination with pump schedule identifies the minimum requirements for chemical metering pumps

B. Reference codes and standards

Pumps shall comply with the latest editions of the following codes and standards:

1. UL Standard 778
2. Hydraulic Institute standards
3. National Electric Code

C. Metering Pump

The metering pumps shall be a compact positive displacement diaphragm type pump, with integrated intelligent stepper motor drive, in an IP 65 plastic enclosure. The pump shall be designed for optimum user-friendliness, accuracy and reliability and be equipped with a front mounted logical control panel with one-touch buttons and a multi-language backlight display.

The capacity to be dosed in each function shall be set directly in L or mL. For enhanced accuracy, the pump can be calibrated to the actual installation by means of a simple calibration function. The turndown ratio is 1 to 1000 with the same accuracy and uniform dosage with reduced pulsation throughout the capacity range. The pump is also equipped with a maximum capacity function (100%) that allows the pump to work for a preset time at maximum capacity for priming or ordinary maintenance without changing pump settings.

The liquid end of the pump is composed of the following: 1) pump head; 2) PTFE-coated diaphragm; 3) ball valves; and manual bleed valve. The liquid end materials of

construction shall be as shown above in Section 2.02 and shall be as recommended by the pump manufacturer for the service conditions.

The pump shall be suitable to operate based upon an externally supplied analog 4-20 mA control signal with possibility to adjust the pump capacity at maximum signal.

The pump shall be furnished with the following features: 1) On-site calibration function for calibrating the pump to the actual installation; 2) anti-cavitation function for high-viscosity, gassing liquids or long suction lines; 3) maximum capacity limitation; 4) counters for numbers of pump strokes, operation hours and power on/off; and alarm relay output. The pump shall be provided with an integrated vent valve that is piped to drain. The pump shall be supplied with a dosing monitoring system. If available, a diaphragm leakage sensor shall be supplied which will alarm is leakage behind the diaphragm is detected.

The pump shall be suitable to operate on a single phase, 120 volt, 60 Hz power supply.

The metering pump shall be a Grundfos Alldos DME Series or approved equal.

2.06 ACCESSORIES

A. Calibration Columns

A clear PVC calibration column shall be provided in the chemical supply piping. The piping shall be designed for the calibration column to be used with any of the metering pumps. The top of the calibration column shall be vented back to the supply container by the contractor. Calibration columns may also be used as de-gassing chambers. The calibration column shall be sized to provide a minimum capacity for 5 minutes of pump operating time.

B. Pressure Relief Valves

Pressure relief valves shall be provided to eliminate excess pressure in the system. The pressure relief valves shall be fully adjustable with PVC bodies, Teflon diaphragm and shall have no metal parts in contact with the chemical.

C. Pulsation Dampeners

Gas charged pulsation dampeners shall be provided and sized for a minimum of 90% dampening. Pulsation dampeners shall be PVC with a Viton bladder and include gas charge fitting and pressure gauge. The dampeners shall be installed as close to the metering pump discharge as possible.

D. Diaphragm Protected Pressure Gauges

Pressure gauges of the diaphragm-protected type shall be provided for indication of system pressure. Industrial quality liquid filled 316 Stainless Steel gauges shall be utilized and the isolators shall have PVC housings with a Teflon diaphragm and suitable liquid fill. Pressure gauge shall be as specified in Section 15200.

E. Back Pressure Valves

Back pressure valves shall be provided to provide a constant back pressure at the chemical metering pump discharge. The back pressure valves shall be fully adjustable with PVC bodies, Teflon diaphragm and shall have no metal parts in contact with the chemical.

F. Piping and Valves

1. All piping shall be solvent welded schedule 80 PVC and shall bear the NSF potable water logo.

2. All valves and unions shall be schedule 80 PVC with Viton o-rings. Valves shall be true union type and include built-in handle locking mechanisms. Ball valves for use with chemical prone to gassing, such as sodium hypochlorite, shall be vented.

2.07 SPARE PARTS

A. Provide the following spare parts to the OWNER for each chemical metering skid. All parts shall be in one box labeled with the Skid ID information:

1. Maintenance kit for each chemical metering pump. Maintenance kits shall include but not be limited to; diaphragm, check valve seats, gaskets and o-rings.

2. Parts list for all serviceable components.

2.08 MANUFACTURERS

A. Subject to compliance with specific requirements, manufacturers offering products which may be incorporated in Work include:

- Blue Planet Environmental Systems, Inc. Palm Bay, FL
- EmPro Technologies
- or equal

PART 3 – EXECUTION

3.01 INSTALLATION

Install the chemical metering skids as indicated on the drawings and specified and in compliance with the manufacturer's instructions

3.02 TESTING

Upon completion of installation, a full operating test shall be performed in the presence of the Engineer and a qualified manufacturer's representative. The Contractor shall furnish all labor, materials, and equipment required for such test and shall correct any deficiencies noted.

3.03 INSTALLATION SUPPORT

A. The services of a factory trained representative shall be provided to supervise the installation of the equipment, test the equipment, supervise the initial operation of the treatment system, and to instruct the OWNER's personnel in the operation of the equipment. The vendor's services shall be as specified in Section 01610.

B. Training shall not take place until startup is completed and the equipment is fully operational.

3.04 TRAINING

Training sessions to instruct the OWNER'S personnel in the operations and maintenance of the Skid Mounted Chemical Feed Equipment shall be as prescribed in Section 01800. Training of the Owner's personnel shall be done by an experienced technical representative of the vendor.

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END OF SECTION

SECTION 11500
MEMBRANE BIOREACTOR SYSTEM

PART I – GENERAL

1.01 WORK INCLUDED

A. The MBR System Supplier shall furnish and commission one submerged membrane bioreactor treatment system (MBR). The CONTRACTOR shall furnish all labor, rigging, testing, training, startup, warranty support and incidentals required for installation of the MBR system. Once installed, the MBR shall be complete and operational with all control equipment and accessories as specified herein.

B. In general, MBR System Supplier shall furnish the Subsystem Components listed below and components not explicitly listed but deemed essential to desired operation of the MBR System in accordance with the requirements of the project Specifications, Drawings and Contract Documents. All components shall be shipped loose for installation by the Contractor unless otherwise noted.

1. Anaerobic Basin
   a. Mixers

2. Anoxic Basin
   a. Mixers
   b. Feed forward pumps and flow meters
   c. Basin high and low level switches
   d. Basin level sensors and transmitters

3. Aeration Basins
   a. Fine bubble diffusers
   b. Combination DO/temperature sensors and transmitters

4. Membrane Basins
   a. System submerged membrane units (SMUs)
   b. In-basin interconnecting air and permeate piping
   c. Permeate header piping and valves terminating with a permeate header isolation valve after the final SMU branch connection
   d. Air header piping and valves terminating with an air header isolation valve after the final SMU branch connection
   e. Pipe supports and support anchors for all Supplier-provided piping
   f. Basin high and low level switches

5. Permeate Collection System
   a. MBR permeate pumps
   b. MBR permeate control valves
   c. MBR permeate process instrumentation
   d. MBR permeate turbidimeters
   e. Permeate vent solenoid valves

6. Cleaning Systems
   a. Maintenance clean system valves, meters, switches, and instrumentation

7. WAS Handling System
   a. WAS pumps

b. WAS control valves
c. WAS instrumentation and meters

8. Supplemental (Process) Aeration System
   a. Process air blowers with one standby of equal or greater capacity
   b. Process air flow control valves
   c. Process air instrumentation and meters

9. Membrane Zone (Scour) Aeration System
   a. Scour air blowers with one standby of equal or greater capacity
   b. Scour air flow control valves
   c. Scour air instrumentation and meters

10. Internal Recycle System
   a. RAS instrumentation
   b. RAS control valves

11. Controls
   a. MBR motor control center panel
   b. MBR PLC control panel
   c. MBR operator interface
   d. SCADA and PLC programming

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The requirements of specifications sections listed below apply to the work of this Section:

Section 01300: Submittals
Section 01650: Starting and Placing Equipment into Operation
Section 01730: Operations and Maintenance Manual
Section 01750: Spare Parts, Maintenance Items, and Tools
Section 01800: Training
Section 09900: Painting and Special Coatings
Section 11005: Process Equipment General Provisions
Section 11210: Submersible Pumps
Section 11220: Horizontal Self-Priming Centrifugal Pumps
Section 11225: Submersible Mixers
Section 11600: Positive Displacement Blowers
Section 13451: Instrumentation
Section 13452: SCADA System
Section 13453: MBR Control System
Section 15200: Process Piping and Valves
Section 16010: Electrical General Provisions
Section 16460: Electrical Motors

1.03 DEFINITIONS

A. MBR System Supplier / Supplier: The company responsible for providing all equipment and services as described herein and for providing warranty support.

B. Contractor: The company responsible for construction and installation of the MBR System, including, but not limited to, site preparation, tank and basin construction, and mechanical and electrical installation.

C. MBR System: A collective term for all process and membrane zones that make a complete biological treatment system.

D. Process Train: A stand-alone combination of Process Zones designed and operated to achieve specific treatment objectives.

E. Process Zone: An area in a Process Train designed and operated to meet a specific biological treatment objective.

F. Membrane Zone: Any Membrane Tank or MBR containing membranes

G. Membrane Basin / MBR: A tank or basin containing one or more SMUs that are operated as one unit.

H. Submerged Membrane Unit (SMU): An assembly consisting of one or more SMU cassettes and an integral diffuser assembly.

I. Membrane Cartridge: The smallest assembled unit of the SMU that is designed to be removed from a SMU and replaced as a complete unit.

J. Production Capacity: The net permeate flow rate over a given period of continuous operation accounting for CIP procedures and relaxation. Production capacity requirements are given in terms of:

1. Average Daily Flow (ADF): The net daily flow requirement generally occurring during dry weather conditions and lasting nine (9) months.

2. Maximum Monthly Flow (MMF): The net daily flow requirement generally occurring during wet weather conditions and lasting three (3) months.

3. Peak Daily Flow (PDF): The net daily flow required during peak daily flow conditions and lasting 24 hours.

4. Peak Hourly Flow (PHF): The net peak hourly flow requirement generally occurring during wet weather flow conditions and lasting 4hr.

5. Peak Instantaneous Flow: The highest allowable flow rate under any conditions.

K. Flux: Gallons of permeate flow per day per square foot of membrane area (gfd). Additional definitions of flux that are used to characterize design criteria and membrane performance include:

1. Gross Flux: Calculated by dividing measured permeate flow rate by working membrane area at any instant.

2. Instantaneous Flux: See Gross Flux.

3. Net Flux: Calculated by dividing the total amount of permeate produced (available for discharge) in a given time frame by the working membrane area.

L. Maintenance Clean: Synonymous with chemically enhanced backwash and CIP. A Maintenance Cleaning is performed in-situ and in mixed liquor or activated sludge. The procedure is conducted by charging cleaning chemicals to membranes in the reverse direction of permeate flow with a soak time lasting more than 0.5hr. Typical Maintenance Cleaning characteristics are provided below.

L.

Summary of Maintenance Cleaning Characteristics

Parameter	Value (Condition)	Type
Membrane Soak Time	> 0.5 hour	Primary
Conducted In Mixed Liquor	Yes	Primary
Conducted In-Situ	Yes	Secondary
Typical Duration	0.5hr – 2.0 hrs	Secondary
Fill Direction	Reverse	Secondary
Tank Fill/Drain	No	Secondary
Chemicals Required	Yes	Secondary

M. Recovery Cleaning: Synonymous with intensive cleaning and CIP. A Recovery Cleaning is performed in-situ or ex-situ and in water or dilute chemical. The procedure is conducted by charging cleaning chemicals to membranes in either direction with variable soak times. Typical Recovery Cleaning characteristics are provided below.

Summary of Recovery Cleaning Characteristics

Parameter	Value (Condition)	Type
Membrane Soak Time	Optional	Primary
Conducted In Mixed Liquor	No	Primary
Conducted In-Situ	Optional	Secondary
Typical Duration	6 .0hrs – 24.0 hrs	Secondary
Fill Direction	Optional	Secondary
Tank Fill/Drain	Optional	Secondary
Chemicals Required	Yes	Secondary

N. Mechanical Cleaning: Synonymous with manual cleaning, physical cleaning and hand cleaning. Mechanical Cleaning is any instance where membranes are cleaned by hand or machine (water jetting or other) for the purposes of removing fouling or localized dewatering.

O. Localized Dewatering: Synonymous with clogging, sludging and plugging. Localized dewatering is the excessive accumulation of solids at a membrane surface in the form of refractory cake and generally in discrete, localized areas. Often caused by excessive filtration in combination with unequal or inadequate air scouring.

P. Cycle: A continuous period of operation lasting 1,440 minutes.

Q. Days: Defined as calendar days.

R. MLSS: Mixed liquor suspended solids reported as mg/lL.

S. Permeability: Equals the instantaneous flux rate divided by the transmembrane pressure (TMP). The units of permeability are gfd/psi.

T. Relaxation: A temporary suspension of membrane filtration with continued air scouring for the purpose maintaining treatment capacity or reducing CIP requirements.

U. Transmembrane Pressure (TMP): The effective pressure differential across the

membrane during normal operation.

U.

1.04 SUBMITTALS

A. A. Submittal shall be prepared and submitted in accordance with Section 01300.

B. Project Submittal:

The MBR Supplier shall submit to the ENGINEER manufacturer's complete descriptive information for all equipment, instrumentation, and components in the Supplier's Scope of Supply for the ENGINEER'S approval prior to purchase of equipment. The Project Submittal shall contain the following:

1. Biowin GPS-X computer model analysis of biological treatment process shall be submitted to the ENGINEER for review and approval. The model analysis shall be signed and sealed by a Professional Engineer licensed in the State of Florida who shall be responsible for supervising the model development.

2. Membrane installation drawings, detailing membrane unit dimensions, materials, weights, locations of lifting lugs/points, and anchor bolt locations.

3. MBR basin mechanical layout drawings, detailing the number of membrane units, air and permeate piping distribution, piping supports, in-basin instrumentation and valves, and all other components comprising the MBR basin systems. Drawings will detail information in plan and elevation/section views and include details as necessary to completely describe the installation requirements. Drawings will be based on the basin/structural design provided by the Engineer.

4. Plan view equipment and instrument drawings showing the location of all components provided by the MBR Supplier. Locations and installation details are to be coordinated with the Engineer's drawings to avoid conflicting information.

5. Manufacturer's literature for all equipment in MBR Suppliers scope of supply. Literature will include (as applicable):
    a. Pump curves
    b. Blower curves
    c. Mixer velocity distribution profiles
    d. Materials of construction
    e. Shop drawings showing all dimensions, sizes and locations of anchors
    f. Minimum, maximum, and design duty points (flow rates and pressures/TDH)
    g. Unit performance and efficiency data
    h. Motor horsepower and voltage
    i. Complete wiring and control diagrams which show the point of connection for the power supply and control system
    j. All project-specific installation data for used by the Contractor.
    k. Recommended storage requirements.

6. Where manufacturers' standard literature is submitted, it shall be clearly marked to indicate which features are to be furnished under this contract.

7. Process and Instrumentation Diagrams (PIDs) showing all equipment and instrumentation which will be controlled by the MBR suppliers control system, including components provided by others. Unless otherwise directed by the

Engineer, the MBR supplier is responsible for establishing the tagging scheme for the PIDs. Tagging scheme will assign a unique tag to all components and their associated I/O. Tagging scheme will organize components by subsystem and train.

8. Instrumentation list and manufacturers' literature and cut sheets, clearly identifying manufacturer, models, ranges, materials of construction, installation details, power supply voltage, wiring information.

~~8.~~

9. Valve list and manufacturers' literature and cut sheets, clearly identifying manufacturer, models, C_v range, materials of construction, pressure rating, and dimensions.

10. Valve actuator manufacturers' literature and cut sheets, clearly identifying models, motor horsepower and voltage, control wiring, installation/connection details, torque rating, actuation times, duty cycle, and materials of construction.

11. Control panel drawings, detailing the interior and exterior layouts, components, panel dimensions, and panel materials of construction and NEMA rating.

12. Control panel component manufacturers' literature, clearly denoting model numbers of all PLC components, relays, terminal blocks, power supplies, buttons, switches, fuse blocks, etc.

13. Control panel wiring schematics.

14. Process control narrative

15. Warranty information, detailing membrane design fluxes for all seasonal flow conditions.

16. System start-up and test procedures.

17. Location of nearest stocking distributor of spare parts.

18. Schedule of equipment delivery.

19. Listing of manufacturer's recommended spare parts.

C. Testing Protocol:

Submit a written testing protocol for the system testing to be performed at the time of start-up.

D. Equipment Testing and Inspection Report:

A written report shall be submitted to ENGINEER documenting testing and/or inspection of equipment at the time of start-up with field test data and rest records.

E. Record Drawings:

At Project closeout, submit Record Drawings of installed products, in accordance with requirements of Section 01700, Contract Closeout.

F. Operation and Maintenance Manuals

Submit in accordance with Section 01730, Operations and Maintenance Manuals for items included under this section. The MBR Supplier shall furnish a Plant Operations Manual within 6 weeks after completion of the System Commissioning. The supplier is to provide two hard copies and two CDs containing the following information:

1. HMI (operator interface) User's Manual, detailing screens and functions within the operator interface program.
2. Process variables and final control narrative
3. As-built PIDs
4. As-built electrical schematics and control panel drawings
5. Safety guidelines

1.05 QUALITY ASSURANCE

A. All the equipment and services specified under this Section shall be furnished by a single manufacturer, and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed.

B. To show evidence of being able to provide the quality of equipment and services described in this specification, the Membrane System Supplier shall submit their quality system ISO 9001 certification. The quality procedures shall provide for a means of qualifying all sub-vendors and shall specify that the fabrication facility is a critical vendor and shall require inspection. The quality system shall be audited by a third party independent inspector. Certification shall remain in effect throughout the project startup.

C. All equipment furnished under this Section shall be new and unused and shall be the standard products of a Membrane Manufacturer having a successful record of manufacturing and servicing the equipment and systems specified herein for a minimum of ten (10) years.

D. The MBR System Supplier shall have a minimum of ten-year history of designing wastewater treatment facilities.

E. In addition to qualifications specified elsewhere in the Contract Documents, the MBR System Supplier shall provide the location, size, and start-up dates of ten representative installations that meet the following MINIMUM criteria in order to be considered qualified:

1. Utilize the same type of membrane system proposed for this project.

2. Have a plant or process train design capacity equal to the listed MMF (±50%).

3. Utilize the same type of headworks (aperture/slot size) and MBR as the proposed system.

4. Use similar aeration and CIP strategies as that of the proposed system.

5. Have been in operation for at least one year at time of bid.

6. Have operated within 25% of nominal rated capacity for a minimum of 12 months at time of bid.

7. Have a minimum of three operating MBR facilities in the State of Florida at time of

bid.

8. Have a minimum of three operating facilities utilizing a pump assisted gravity permeate collection design. This design has the ability to operate as both a gravity and a pumped permeate collection system.

F. Warranty

The membrane vendor shall guarantee that the MBR system will meet the effluent parameters specified and guarantee the MBR system and all appurtenances against defect in material, work, and workmanship for a period of two (2) years. The MBR Vendor shall further guarantee the membrane filtration modules for a minimum period of five (5 years (non-prorated warranty). The warranty shall not be pro-rated. Any defects in material, work, or workmanship shall be repaired or related at no cost to the Owner.

1. Material and Workmanship Warranty. The mechanical warranty is only applicable on equipment supplied by MBR system Vendor. The Warranty Period on all equipment supplied, unless otherwise noted, is two (2) years from the date of substantial completion and acceptance by the OWNER of the equipment.

2. Membrane Module Warranty. This warranty shall commence on the earlier of (i) wet start-up of the equipment or (ii) six months after the delivery of the membrane units to the OWNER ("Commencement Date") and continue for a period of the "term". The sole remedy of this warranty shall be repair, replace or add membrane modules under the following conditions at no cost to the OWNER:
   a. If the membranes fail to meet the plant production capacity
   b. If the membranes fail to meet the filtration quality requirement
   c. For warranty purposes, the maximum net flux rates and operation parameters are listed below:

Table 1. Operating Parameters Applicable to the Membrane Module Warranty

Membrane Maximum Month Net Flux Rate	16 gfd
Membrane Peak Day Net Flux Rate	32 gfd
Maximum Transmembrane Pressure prior to Membrane Cleaning	3.0 psi
Membrane Tank Mixed Liquor Concentration	8,000 to 18,000 mg/L
pH	6 to 9

   d. Design production capacity shall be based on permeate production, verified by OWNER, ENGINEER and/or CONTRACTOR during membrane guarantee and warranty period. The Vendor at no cost to CONTRACTOR or OWNER is responsible for providing alternatives if performance testing of membrane system fails to meet the design production capacity.
   e. The membrane shall be guaranteed for a minimum cumulative sodium hypochlorite exposure of 500,000 ppm-hours over its lifetime.

3. Process Warranty. The permeate quality from the Membrane Bioreactor Treatment Facility shall meet the discharge requirements as presented in this document. Process warranty shall be for a period of one year.
   a. The analytical process warranty shall be based upon monthly average values for a minimum of four (4) 24-hour composite samples collected at regular intervals over a 30 day period, with testing performed to

applicable industry-approved standards by an analytical laboratory satisfying the requirements of the Florida Department of Environmental Protection. On-line instrumentation provided, and grab sample testing performed are included as indications of the performance of the plant and to assist in the proper operations and control of the system. While these results may include values beyond the stated warranty valves (during process upsets or instruments are poorly or not calibrated, etc.) the results of monthly composite testing shall be performed to establish that the plant is not meeting the performance requirements.

b. For warranty purposes, the key effluent parameters associated with the MBR system process are as follows:

Table 2. Effluent Parameters Applicable to the Process Warranty

Parameter	Effluent Concentration
Total Suspended Solids (TSS)	≤ 5 mg/L
Carbonaceous Biological Oxygen Demand ($CBOD_5$)	≤ 20 mg/L
Total Nitrogen (TN as N)	≤ 7.5 mg/L
Total Phosphorus (TP as P)	≤ 1.0 mg/L
Turbidity	≤ 0.2 NTU— 95-% of the time No sample to exceed 0.5 NTU

Note: Parameters based upon 19 of 20 consecutive samples

c. If the membrane system is not able to meet the required performance criteria during the process performance warranty period of one year, the Vendor shall repair, replace, or supply additional membrane equipment or other equipment as may be necessary, for installation by others, in order for the system to perform as warranted.

d. If the process is not able to meet the performance guarantee in terms of produce water flow rate, then the Vendor will be required to clean the membranes or provide additional membrane area and associated ancillary equipment in order to meet the desired for rate at no additional cost to the Owner.

e. If the water quality criteria is not being met, then the Vendor will provide all additional process equipment required to make the process meet the product water quality criteria, at no additional cost to the OWNER.

3. Exclusions. The MBR System Vendor shall not be liable for any damage/defect caused by chemical or physical conditions, such as (but not limited to) pH, temperature, chemical, or climatic factors outside the recommended operating parameters in appropriate sections of the Operating Manual even where the MBR System Vendor is aware of the existence of these conditions.

a. The process warranty for the system is contingent upon operation of the treatment process according to the MBR System Vendor's Operations Manual. If the water quality criteria is not being met, then the Vendor will provide all additional process equipment required to make the process meet the product water quality criteria, at no additional cost to the OWNER.

b. The membrane warranty is also contingent on operation of the system with proper feed pre-treatment and screening equipment installed and operated at all times as approved by the MBR System Vendor. Failure to comply with requirements from this section will void the membrane warranty.

1.06 PATENTS AND LICENSES

A. The MBR System Vendor shall be responsible for all patents or licenses that exist because of the equipment or treatment process that may be provided.

B. The manufacturer shall assume all costs of patent fees or licenses for the equipment or process, and shall safeguard and save harmless the OWNER from all damages, judgments, claims, and expenses arising from license fees, or claimed infringement of any letters, patent or patent rights, or fees for the use of any equipment or process structural feature or arrangement of any of the component parts of the installation, and the price bid shall be deemed to include payment of all such patent fees, licenses or other costs pertaining thereto.

1.07 ADHEARANCE TO CONTRACT DOCUMENTS

A. The CONTRACT DOCUMENTS have been prepared in accordance with submitted information from the named manufacturers during the design of this facility. Adjustment or amendment required to the drawings and specifications to accommodate the MBR System Supplier resulting in rework or redesign of any measure shall be a no cost change to the Owner and/or Engineer. Further, the MBR System Supplier and/or Contractor shall bear the cost of these changes which may include but is not limited to:
1. Adjustment of design drawings and specifications to accommodate equipment
2. Additional construction materials (i.e. concrete, metals, controls, piping, asphalt, storm structures, earthwork, roofing, etc.)
3. Additional permitting required to accommodate changes

B. Under no circumstance shall changes to the design impact the warranties described herein or the facility's ability to meet the effluent limitations as outlined.

C. All changes shall be subject to Review and Approval by the Engineer of Record.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specific requirements, manufacturers offering products which may be incorporated in Work include:

- Kubota
- OVIVO
- Or approved equal.

2.02 DESIGN AND ENGINEERING SERVICES

A. The MBR System Supplier will provide the following services for items in their Scope of Supply:

1. Biological Process Design Verification – The MBR Supplier shall support the Engineer in providing analysis and verification of the biological process design using ~~EnviroSim BioWin~~GPS-X Hydromantis wastewater modeling software and the customer's influent mass loading, diurnal flow curves, peak flow/loading

numbers, and permit limits. The Suppler shall verify basin volumes, recycle rates, aerations requirements, chemical dosing requirements, and waste solids projections. The supplier shall provide a written report summarizing the modeling results.

2. Piping Hydraulic Analysis and Design – The MBR Supplier shall provide a detailed hydraulic analysis and mechanical design of each process subsystem. Using Pipe-Flo simulation software, subsystem piping designs shall be analyzed to verify flow distribution between membrane units, pump duty points and turn down, and flow control valve Cv and rangeability. The supplier shall supply piping design of each system in 3D using AutoDesk Inventor, utilizing 1:1 representation of all fittings, instruments, and equipment. Piping design files shall be provided to the Engineer for integration into the design package. The subsystems included in the hydraulic analysis shall include:

   a. Recycle systems
   b. Process air distribution systems
   c. Scour air distributions systems
   d. Permeate systems
   e. WAS systems
   f. Feed forward pump systems

3. Equipment Sizing and Installation Details – Based on the Biological Process Design and Piping Hydraulic analysis, the MBR Supplier shall verify duty points and turn-down, supply voltages, materials of construction, communications IO, equipment access and serviceability, area classifications, and pressure ratings for the system's pumps, blowers, mixers, and valves. In addition to identifying manufacturers and specific part numbers for each component, installation details and 2D/3D CAD blocks shall be provided for integration into the Engineer's design package.

4. Instrumentation Design – The MBR Supplier shall provide the Engineer with complete specification and documentation of all project instrumentation. Each instrument's manufacturer, model, size, range, power, communications protocol, units, materials, connections, and area classification shall be documented in ISA Specification forms. Installation details shall be provided in AutoCAD format for integration into the Engineer's design package.

5. Controls Design – The MBR Supplier shall supply Process and Instrumentation Diagrams utilizing the Supplier's standard symbols and tagging schemes, control panel layout/fabrication details, and control panel wiring schematics in AutoCAD for integration into the Engineer's design package. Additional controls documentation shall include PLC architecture diagrams, control panel BOM, panel IO arrangement, loop drawings, and a control narrative of the overall plant control scheme.

6. Specifications - Using CSI MasterFormat 2004, the MBR System Supplier shall provide the Engineer with complete bid specifications for the MBR and all supporting equipment, instrumentation, piping systems, valves, and control systems for integration into the Engineer's contract and bid documents.

2.03 SYSTEM DESCRIPTION

A. A membrane bioreactor filtration process is to be provided for the production of high

quality treated wastewater. The system will filter mixed liquor from biological aeration tanks. The raw sewage will be screened using 2 mm perforated plate screens prior to entering the biological treatment tanks. The filtered water will be discharged from the system using centrifugal permeate pumps. The filtered water will meet the effluent specifications in Table 2.2.

B. The membranes will be located in specifically designed membrane filtration compartments, separate from the biological process tanks. The membranes will be immersed directly into the mixed liquor contained within the membrane basins. Inline filtration skids are not acceptable.

2.04 SYSTEM PERFORMANCE REQUIREMENTS

A. The MBR System tankage and pumping systems will be sized to hydraulically convey the seasonal and diurnal flows shown in Table 2-1.

Table 2-1: Plant Hydraulic Loading Criteria

Parameter	Influent		Event Duration	Frequency	Total Duration
Average Annual Daily Flow (AADF)	1.0	MGD	275 days	1/yr	265 days
Maximum Month Daily Flow (MMF)	1.2	MGD	30 days	3/yr	90 days
Peak Daily Flow (PDF)[3]	1.8	MGD	24 hr	10/yr	10 days
Peak Hourly Flow (PHF)	3.0	MGD	4 hr	1/cycle	--

B. Operation outside the flow ranges described in Table 2-1 is permissible provided membrane permeability does not decrease below 4.0 gfd/psi and/or TMP does not increase above 3.0 psi for more than six hours of operation in any calendar year of operation.

C. The MBR System shall be capable of treating raw wastewater at listed flows to the specified effluent criteria shown in Table 2-2.

Table 2-2: Plant Pollutant Loading and Effluent Criteria

Parameter	Influent[1]		Plant Loading @ Average Flow		Effluent Limit/ Performance Requirement
Average Annual $CBOD_5$	175	mg/l	1,460	lb/day	<5.0 mg/l
Maximum Month $CBOD_5$	250	mg/l	2,502	lb/day	<5.0 mg/l
Average Annual TSS[4]	175	mg/l	1,460	lb/day	<5.0 mg/l
Maximum Month Daily Average TSS[4, 5, 7]	250	mg/l	2,502	lb/day	<5.0 mg/l
Average Annual Daily TKN	32	mg/l	267	lb/day	<1.0 mg/l
Maximum Month Daily Average TKN	60	mg/l	600	lb/day	<1.0 mg/l
Average Annual Daily TP	5	mg/l	42	lb/day	<1.0 mg/l
Maximum Month Daily Average TP	10	mg/l	100	lb/day	<1.0 mg/l
Maximum Month Daily Average Total N NH3-N	60	mg/l	600	lb/day	<7.5 mg/l <1 mg/l
Turbidity[3]	--	--	--	--	<0.2 NTU (ave.) <0.5 NTU (max.)

Minimum Daily Average Temperature (AAF)	20	Deg C	--	--	--
Minimum Daily Average Temperature (MMF)	20	Deg C	--	--	--

Notes:
1. Influent loading shall be within ± 25% of design value
2. A minimum 4:1 BOD:N ratio is required to meet nitrogen levels
3. Measured turbidity shall be less than or equal to 0.2 NTU on 9 of 10 consecutive samples and no sample shall exceed 0.5 NTU
4. Measured TSS shall be less than or equal to 2 mg/L on 9 of 10 consecutive samples and no sample shall exceed 5 mg/L
5. Influent shall be screened so that at least 90% of solids with any 2 dimensions greater than or equal to 3mm in length are removed.
6. Effluent limits are based on measurements using *Standard Methods for the Examination of Water and Wastewater (Latest Edition).*
7. Concentration of grit, defined as particles having a specific gravity of >1.6 and unable to pass through a 65-mesch screen (0.21mm), shall be less than 5 mg/l.

D. System Configuration

1. The headworks will consist of one duty and one standby fine screen, with one additional screen to be installed in the future, each identically sized with sufficient capacity to handle 100% of the maximum hydraulic flow as stated in Table 2-1.

2. The process system shall consist of:
   a. Two anaerobic basins with a minimum volume of 17,100 gallons each.
   b. Two anoxic/equalization basins with a minimum volume of 118,300 gallons each.
   c. Two aeration basins with a minimum volume of 127,600 gallons each.
   d. Four Membrane basins with a minimum volume of 17,600 gallons each.

E. The minimum sludge retention time (SRT) shall be 18 days.

F. The design MLSS in the MBR shall be 11,500 mg/L.

G. The MBR system shall be capable of handling the peak daily flow listed in Table 2-1 for a period of 24 consecutive hours without loss of treatment efficiency or damage to the system.

H. The allowable MLSS concentration in the Membrane Zones shall range between 8,000 mg/l and 18,000 mg/L.

I. An MBR shall be considered part of the biological process when calculating aerobic volume requirements.

J. The MBR shall be designed to operate at or below a trans-membrane pressure (TMP) of 3 psig.

K. Each in-place cleaning shall not require the MBR to be drained.

L. Each in-place cleaning shall not require the MBR to be taken out of service for more than 6 hours.

M. The MBR shall utilize self-priming centrifugal pumps to filter water. No additional components such as vacuum pumps and air separators shall be required for filtrations

purposes.

N. Site Conditions

1. Ambient air temperatures shall be between 32 °F and 100 °F.

2. Relative humidity shall not exceed 95%.

3. The elevation above sea level is 25 ft.

4. Influent wastewater shall contain less than 20 mg/L fats, oils and grease (FOG).

5. No substances shall be placed in the system in quantities which are not biodegradable or toxic to the biological system.

6. The influent wastewater pH shall be between 6-8 SU.

7. Water hardness shall not exceed 300 mg/L as $CaCO_3$.

2.05 MBR SYSTEM COMPONENTS

A. Flat Plate Membrane

The membrane modules shall be comprised of flat plate membranes. The membranes modules shall be attached to common manifolds in groups called racks or cassettes. Each rack/cassettes shall contain filtration and air manifolds. Each of the membrane tanks shall be large enough to contain the required number of membrane racks/cassettes and be separated from the remainder of the process volume required for biological reactions. The membrane tanks shall form part of the aerobic biological treatment volume and oxygen transfer credit will be given for air scour of membranes. The mixed liquor shall be gravity fed from the aeration basins and MLSS recycle will be gravity fed from the MBR basins back to the anoxic basins.

Each flat plate membrane cartridge shall be comprised of a solid ABS plastic support plate with a spacer layer between it and an ultrasonically welded flat-sheet membrane on both sides. Each panel shall have 8.6 ft^2 of membrane area with a nominal pore size of 0.4 microns.

B. Permeate Pump System

All the racks/cassettes in each membrane tank shall be connected to a common filtrate header, which is connected to the filtration pump. The Permeate Pump System shall meet the requirements specified in Section 11220 – Self-Priming Centrifugal Pumps.

C. Diffused Aeration System

Aeration equipment shall include all piping, valves, valve actuators and associated equipment to deliver adequate oxygen and mixing to the MBRs as required by the given flow and loading. Blowers shall meet requirements specified in Section 11600 – Positive Displacement Blowers.

D. Clean-In-Place System

The system shall include tanks and equipment to allow membranes to be chemically ~~Cleaned~~ cleaned in place (CIP) – CIP system shall include sufficient piping and valves to

allow automatic flushing of all manifolds with cleaning chemicals. Each membrane train shall be isolated for regular membrane CIP.

1. A maximum of 48-hours of in-place cleanings per year shall be sufficient to maintain the submerged membranes.

2. Each in-place cleaning shall not require each MBR basin to be taken out of service for more than 6 hours.

3. Aside from air scouring, no daily cleaning of any kind with chemicals shall be employed to maintain the submerged membranes. Integral air diffuser assemblies shall provide continuous, or cycle cleaning air (as required) to ensure stable operating conditions and minimize membrane fouling.

4. The CIP system shall be designed to allow the isolation of all piping such that no chlorine solution will be conveyed to any downstream process at any time.

E. Process and Instrumentation

The MBR System Vendor shall furnish a fully automatic control system to control the operation of the MBR system and other plant equipment as specified in Division 13. The system shall integrate all plant wide control functions required. The MBR System Vendor shall supply all equipment and custom software programming required for a fully automatic and operational system and shall provide all necessary hardware/software to allow for remote monitoring of the MBR System.

F. Actuated Control Valves: In order to reduce operating noise levels to nearby residents, it is preferred that all valves be electric actuated valves. The following list of actuated process control valves shall be supplied by MBR system vendor.

1. Actuated Diffuser Cleaning Control Valves
   a. Pratt 6 inch plug valve with flanged end connection, 316 stainless steel stem, epoxy coated cast iron body, 80% port area, Buna coating, welded nickel seat, and elastomer coated plug.
   b. Rotork IQ Series Actuator. 120 Volt with single phase run motor and overload protection, open/close actuator, and suitable for intended service.

2. Process Air Actuated Air Flow Control Valves
   a. Keystone 6 inch wafer style butterfly valve with ductile iron body, aluminum bronze disc, 316 stainless steel stem, and EPDM molded in liner.
   b. Rotork IQ Series Actuator. 120 Volt with single phase run motor and overload protection, modulating solid state actuator, and suitable for intended service.

~~5~~3. MBR Air Scour Actuated Air Flow Control Valves
   a. Keystone 6 inch wafer style butterfly valve with ductile iron body, aluminum bronze disc, 316 stainless steel stem, and EPDM molded in liner.
   b. Rotork IQ Series Actuator. 120 Volt with single phase run motor and overload protection, modulating solid state actuator, and suitable for intended service.

G. Permeate Vent Valves: The following permeate vent valves shall be supplied by MBR

system vendor.

1. Solenoid Permeate Vent Valves
   The actuated permeate vent valves shall be Magnatrol 1 inch Series K normally closed solenoid actuated with 304 stainless steel full port globe body type, 305 stainless steel construction, 120 volts, and epoxy coated cast iron coil enclosure. Provide manufacturer recommended accessories suitable for the application.

2. Manual Vent Valves
   The manual permeate vent valves shall be FNW Figure 200G 1-inch stainless steel, full port, threaded NPT ends, and vinyl handle.

2.06 MATERIALS AND EQUIPMENT MBR SYSTEM COMPONENTS

A. Membrane Filtration System: The MBR System Supplier shall provide membrane equipment that meets the following requirements:

1. Membranes:
   a. Membranes shall allow product water (permeate) to be drawn through from the outside surface of the membrane to the inside. Membranes shall be a supported flat plate type. The membranes shall be a proven design of a membrane manufacturer engaged in the production of membrane of this type.
   b. The membranes, membrane modules, and membrane cassettes shall be by one manufacturer.
   c. Membranes shall be constructed of chemically resistant materials and shall be capable of being washed repeated in high chlorine solutions (minimum 100 mg/l and maximum 5,000 mg/l) for up to 24 hours, and low pH (range 2 to 3) and high pH wash solutions (range 10 to 11) for up to 24 hours respectively.
   d. Membranes shall be chemically resistant to chemicals used to precipitate phosphorus such as ferric chloride, sodium aluminate and aluminum chlorohydrate.
   e. Membranes shall be physically strong enough to withstand the operating conditions associated with continuous operation in an aerated tank of mixed liquor at concentrations of up to 18,000 mg/l.

2. Membrane Modules/Cassettes:
   a. The membrane cassette shall include connection points for agitation air and permeate water.
   b. All steel components of each membrane cassette shall be manufactured from stainless steel, with a minimum grade of at least type 304. All connection hardware shall be type 316 stainless steel.
   c. All non-steel components of the membrane modules shall be UV resistant and have a chemical resistance at least equal to that of the membranes. The pipe connections between the membrane cassettes and the manifold header pipe work shall be UV resistant pipe capable of operating at the positive and negative pressures expected for this system.
   d. It shall be possible to isolate and remove each membrane cassette/rack from the manifold header pipework while the system is in operation without the need to shut down, remove or drain additional membrane cassettes/racks.
   e. Each cassette shall be constructed to allow removal using a lifting bracket assembly. Provide one lifting bracket assembly to allow each

membrane cassette to be lifted into and out of the membrane basin/mixed liquor and transported away from the membrane compartment to a maintenance area.

3. Permeate Pump System**:** Provide Permeate Pump System as specified in Section 11220 – Self Priming Centrifugal Pump.

4. Air Scour System**:** The MBR blowers shall provide cleaning air for the membranes only. Air for biological processes (i.e., fine bubble diffused aeration) shall be provided by other blowers. The blowers shall be complete with motors, base plates, intake air filter, inlet silencers, discharge silencers, check valves, pressure relief valves, butterfly valves, flexible connections, pressure and temperature gauges, vibration isolation pads, inlet filter restriction indicator, enclosures and spare parts. Blowers shall meet noise and other requirements listed in Specification 11600 – Positive Displacement Blowers.

5. Clean-In-Place System: The membranes shall be cleaned "in-place" by backwashing with sodium hypochlorite and/or citric acid, without removal from the membrane tank. All membranes cleaning procedures will be carried out by taking one basin off line and backfilling with chemical cleaning solution. The system shall consist of a chemical transfer system including injector, true union actuated ball valve, rotameter, and pressure regulator. Cleaning Systems shall be inclusive of all chemical feed day tanks, chemical feed pumps, valves, instrumentation, controls, and all other ancillary equipment necessary for a complete cleaning operation

6. Process Control and Instrumentation: The MBR System Vendor shall furnish a fully automatic control system to control the MBR system and the ancillary plant equipment as specified in Division 13. The system shall integrate all functions required. The MBR System Vendor shall supply all equipment and custom software programming required for a fully automatic and operational system, and shall provide the necessary hardware/software to allow for remote monitoring of the MBR System. All field instruments shall have easily accessible, non-corrodible identification tags established by the MBR supplier and approved by the Engineer.
   a. One control panel and control system shall be furnished for controlling the MBR and other plant equipment. The MBR shall be controlled via a programmable logic controller as specified in Section 13453 – MBR Control System.
   b. Power to the control panel shall be 120 V. All wires inside the panel shall be routed in conduits.
   c. The power, control and signal wires shall be routed in separate conduits within the panel.
   d. Wires to the control panel shall be terminated to Allen Bradley FlexLogix. Splices will not be permitted in cabinet wiring. Each end of each conductor shall be identified with the opposites and destination marked on plastic wire sleeves.
   e. The PLC input/output and CPU shall be sized for 20 percent active spares. The PLC and associated mounting rack, CPU, power supply, input/output cards, and interface devices shall all be installed in the control cabinet.

2.07 PIPING, VALVES, AND APPURTENANCES

A. The MBR System Vendor is responsible for providing all piping, connections, fittings and

any valving inside each membrane basin.

B. Manual shutoff/isolation valves, and unions, or similar easily disassembled connections shall be provided for the inlet and outlet of each membrane cassette unit and shall meet or exceed requirements listed in Section 15200 – Process Piping and Valves.

C. All in-basin piping/valving and associated appurtenances shall be made to withstand corrosion due to the use of sodium hypochlorite, citric acid and hydrogen sulfide.

D. All factory installed pipe and valves shall be properly supported and anchored.

E. MBR Air Diffusion System Piping: The MBR System Vendor shall furnish all piping include drop pipes, submerged manifolds, diffusers, laterals, pipe supports, drain line and purge system for the MBR basins.

1. All piping related to the air diffusing system shall be 316-L Stainless Steel. Other non-welded parts and pieces as nuts, bolts, washers, supports, follower flanges, and anchor bolts shall be made from 316 stainless steel. 316L Stainless Steel shall be provided for all in basin MBR piping which is located above the liquid level.

2. All stainless steel threaded fittings shall be as specified in Section 15200 - Process Piping and Valves.

3. Pipe for diffusers shall be provided with factory installed, high strength Schedule 80 PVC. Diffuser laterals shall be drilled and tapped as required for installation of diffusers. Threads shall be of such a quality that pipe sealants are not required when diffusers are installed. All diffuser piping shall be installed in the membranes cassettes/racks.

4. The laterals will be piped to allow purging of debris before operation and to allow periodic cleaning during operation. Piping assemblies shall be designed to withstand expansion and contraction from the specified field operating conditions.

F. All necessary anchor bolts, plates, nuts, washers and other hardware shall be Type 316L Stainless Steel per Section 11005 – Process Equipment General Requirements, unless otherwise noted.

G. Nameplates shall be securely attached to all equipment and motors. MBR vendor shall provide all anchor bolts to secure membrane filtration equipment inside the membrane basins. Unless otherwise specified. All anchor bolts shall be provided by installing CONTRACTOR.

H. Each piece of equipment, its motor(s) and drive unit(s) shall be designed and constructed to operate at any point between no-load and full load without overloading the motor or drive or decreasing any service factor; causing noise or vibration that exceeds the specified limits or government regulations, whichever is less. Pumps and drives shall not exceed the vibration limits of the Hydraulic Institute, when measured at the top of the motor.

2.08 ASSEMBLY

A. The membrane units shall be delivered pre-assembled to be installed by the CONTRACTOR on the site. The control panel, including those controls required for

automatic operation, shall be assembled, wired, and tested prior to shipment.

B. The submersible mixers, feed forward pumps, permeate pumps, return activated sludge pumps, air blowers, instruments external to control enclosure and other non-skid mounted process equipments shall be furnished loose for field installation by the CONTRACTOR.

2.09 SPARE PARTS AND SPECIAL TOOLS

A. One set of special tools required for normal operations and maintenance, and manufacturer recommended spare parts, shall be provided for each piece of equipment. Spare parts shall be effectively protected from moisture and corrosion with appropriate wrappings or coatings or a combination thereof. Spare parts shall be furnished in sturdy labeled boxes.

B. Provide one lifting assembly to raise/lower membrane cassettes/racks in and out of membrane basins.

C. Provide spare parts as specified in the referenced equipment sections or as recommended by the equipment supplier.

D. Provide spare parts as recommended by equipment suppliers for MBR vendor supplied valves and actuators.

PART 3 – EXECUTION

3.01 GENERAL

The Membrane Cassettes shall be installed in the MBR basins in strict accordance with the manufacturer's recommendations. Support all equipment, piping and accessories where necessary. All supports and support hardware shall be sized by the MBR system manufacturer's recommendation subject to ENGINEER approval.

3.02 SHIPPING AND STORAGE

A. MBR System Vendor shall deliver equipment to the OWNER'S project site per the schedule outlined in the Agreement.

B. Insofar as is practical, the equipment specified herein shall be factory assembled. The parts and assemblies that are required to be shipped unassembled shall be packaged and tagged in a manner that will protect the equipment from damage and facilitate the final assembly in the field. Generally, machined and unpainted parts shall be protected from damage by the elements with the application of a strippable protective coating.

C. To prevent drying out of the membranes due to prolonged storage, these shall be shipped separately from the rest of the equipment and delivered to the project site, once the process tank installation has been completed and just before the tank is ready to be wet tested. The membranes shall be shipped in crates and must remain packed in crates until ready for installation. Proper project coordination will be required for timely shipping and to ensure membrane arrival just prior to wet testing of the tanks. Under no circumstances shall the membranes be permitted to remain dry or unduly exposed to the elements.

D. The instruments shall be kept indoors in a warm, dry and secure area, inside their packing cases and crates until ready to be installed.

3.03 TESTING

Prior to plant startup, all equipment shall be inspected for proper alignment, proper connection, and satisfactory performance. All pumps shall be checked for rotation prior to operation. When pumps and blowers are put into service, amperage drawn on each phase of motor windings shall be checked and recorded. Refer to Section 01650 – Starting and Placing Equipment into Operation for details.

3.04 INSTALLATION AND START-UP SUPPORT

A. The services of a factory trained representative from the MBR System Vendor shall be provided to supervise the installation of the equipment, test the equipment, supervise the initial operation of the treatment system, and to instruct the OWNER's personnel in the operation of the equipment. The Vendor shall supply a minimum on-site field installation and start-up services according to the following schedule:

Schedule of Field Service Representative On Site Time		
Service	**Minimum On Site Time**	**Trips to Site**
Project Coordination Meetings	3 Days	3
Mechanical Inspection	4 Days	2
Membrane Installation	4 Days	1
Blower, Pumps, and other Equipment Installation Instructions	As specified in Equipment Specifications	
Field Testing and Startup	30 Days	6

Note: Each on-site day shall be defined as no less than 8 hours on-site and shall not include any travel time.

B. The general requirements for system testing, check out, initial start-up, certification, and instruction of plant personnel are contained in Section 01600 – Material and Equipment and 01800 - Training.

C. After completion of the installation, the manufacturer's representative shall inspect the installation of all equipment installed in this Section. Following field testing, the manufacturer's representative shall inspect the equipment to verify that the mechanism operates properly and that there was no damage to the equipment during installation and testing. The manufacturer's representative shall furnish the ENGINEER with a certified inspection report to document the equipment is ready for start-up.

D. The MBR vendor may provide field installation, startup support, and training for any equipment furnished by the vendor so long as written authorization for such services is provided by the original equipment supplier and is acceptable to the ENGINEER and OWNER.

E. Provide additional services at no cost to the OWNER to correct any operational problems as determined by the ENGINEER or CONTRACTOR.

3.05 TRAINING

A. Training sessions to instruct the OWNER'S personnel in the operations and maintenance of the MBR treatment system shall be as prescribed in Section 01800 - Training. Training of the OWNER'S personnel shall be done by an experienced ENGINEER APPROVED technical representative of the VENDOR. The Vendor shall supply a minimum on-site field training services according to the following schedule:

Schedule of Field Service Representative On Site Time		
Service	**On Site Time**	**Trips to Site**
Instruction of Field Personnel at Start-up	5 Days	1
Instruction of Field Personnel at 6 Months Post Start-up	5 Days	1
Instruction of Field Personnel at 12 Months Post Start-up	5 Days	1

Note: The training identified above shall be in addition to any training on MBR vendor provided equipment identified in the Division 11, 13 or 15 sections.

B. Training shall not take place until startup is completed, the equipment is fully operational, and final equipment Operations and Maintenance Manuals have been approved by the ENGINEER.

END OF SECTION

SECTION 11600
POSITIVE DISPLACEMENT BLOWERS

PART I – GENERAL

1.01 GENERAL REQUIREMENTS

A. The CONTRACTOR shall furnish all labor, materials, tools, equipment, and supervision required to furnish and install Rotary-Lobe Positive Displacement Blower equipment, as indicated on the Drawings and specified herein, and all other work incidental thereto, except as otherwise noted.

B. The work under this section is intended to include the necessary materials and workmanship that are required for the completion of this equipment to meet the objectives as outlined in Work and as shown on the Drawings, unless otherwise specified.

C. The Work shall be complete and ready for satisfactory operation whether or not each and every item is shown on the Drawings or specifically mentioned in these Specifications.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 specification Sections, apply to this Section.

B. Additional requirements related to work specified in this Section include, but are not limited to, the following:

1. Section 09900: Painting and Special Coatings
2. Section 11005: Process Equipment General Requirements
3. Section 11500: MBR System
4. Section 15200: Process Piping and Valves

1.03 QUALITY STANDARDS

A. Manufacturers' Qualifications

All equipment furnished under this section shall be furnished by a single manufacturer who shall assume complete responsibility for the design and performance of the equipment. The manufacturer shall have a minimum of five (5) years experience in producing blower equipment and shall produce evidence of at least five (5) installations of similar size in satisfactory operation in the United States.

B. Reference Standards

Comply with all applicable provisions and recommendations of the following or equivalent IEC standards, except as otherwise shown or specified.

1. NEC - National Electrical Code
2. NEMA - National Electrical Manufacturers Association
3. AGMA - American Gear Manufacturers Association
4. OSHA - Occupational Safety and Health Act
5. ASTM - American Society of Testing and Materials
6. AWS - American Welding Society

7. AISC - American Institute of Steel Construction
8. AFBMA - Anti-Friction Bearing Manufacturers Association

1.04 ELECTRICAL REQUIREMENTS

A. Electrical equipment, wiring, etc. included in this section of the Specifications shall comply with Division 16 of these specifications.

B. All wire and conduit provided shall meet the requirements of the Electrical Sections of these Specifications.

C. Wire and terminal numbering and wire color requirements shall be as specified in the Electrical Sections of these Specifications. Wiring diagrams are required in the form called for in the Electrical Sections of these Specifications.

D. Control panels, motor starters, variable frequency drives, and other electrical devices furnished as part of this equipment shall meet the requirements of Division 16 of these Specifications.

1.05 SUBMITTALS

A. Shop Drawings

Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section including, but not limited to, equipment, motors, couplings, drive components, included product literature, drawings showing dimensions and required clearances, weights of equipment, performance curves, installation details, factory and field testing procedures and criteria for acceptance, any deviations from drawings and specifications, etc.

B. Certification

The manufacturer shall provide an affidavit of compliance with all applicable provisions of this specification.

C. Factory Testing

The manufacturer shall submit for approval the results of the Factory Testing described in Section 3.01 prior to shipping the unit to the project site.

D. Test and Inspection Report

A written report shall be submitted to ENGINEER documenting testing and/or inspection results. The report shall be prepared as noted under Section 01600.

E. Operation and Maintenance Manuals

Submit in accordance with requirements of Section 01730, operation and maintenance manuals for items included under this Section.

F. Warranty

Submit in accordance with requirements of Section 01740, warranties covering the items included under this Section.

1.06 NOISE CRITERIA

All steady and cyclical noise levels produced by the blower equipment in a free field at all points five (5) feet from the equipment shall not exceed 85 decibels when measured by a sound level meter meeting ANSI S1.4-1971, "Specification for General Purpose Sound Level Meters" set to "A" weighting and slow response.

1.07 WARRANTY

The warranty period for all items by this section of the Specifications shall be for two (2) years from the date of equipment acceptance as specified in the General Conditions.

1.08 WORK INCLUDED

Each blower package shall be a skid mounted assembly complete with all appurtenances specified herein or shown on the Drawings.

1.09 ANCHORS

Each outdoor mounted blower shall be mounted in accordance with the current edition of the Florida Building Code. The CONTRACTR shall provide certification that calculations have been performed and signed by a structural or civil engineer registered in the State of Florida confirming that the anchorage system provided is within allowable shear and tension limits. The anchorage system shall be designed to withstand a wind load of 150 miles per hour.

PART 2 – PRODUCTS

2.01 GENERAL

A. Each blower package shall be a complete assembly including a positive displacement blower with electric motor and v-belt drive, inlet filter/silencer with differential pressure gauge, outdoor inlet filter, discharge silencer, pressure relief valve, automatic unloading valve, discharge check valve, flexible connectors, pressure gauge, temperature gauge, vibration isolators and package control panel. The assembled unit shall be housed in a sound attenuation and weather protection enclosure suitable for outdoor service complete with integral ventilation system and easy open access panels.

B. The package assembly shall be designed such that all maintenance is performed from the front or accessible from that side. Assemblies shall be suitable for the mounting arrangements and space limitations indicated on the Drawings.

2.02 BLOWERS

A. The blowers shall be positive displacement rotary tri-lobe design with an equalization chamber integral to the blower housing suitable for air service, and belt driven via electric motor.

B. Materials

1. Materials of construction for the blowers shall be the manufacturer’s standard unless otherwise specified herein.

2. AISI, ASTM, etc. numbers, types, and grades specified are typical of material composition and quality.

C. Casing

The casing shall be made of high strength, close grained, cast iron construction with DIN inlet and outlet connections. The casing shall be adequately ribbed to resist deflection and facilitate cooling. The casing shall be precision machined to allow for minimum clearances and provided with a built-in "equalization" chamber. The drive-end head-plate shall be integral to the cylinder.

D. Rotor Assembly

1. The rotor assemblies shall be one piece, and precision machined from high strength, close grain, spheroidal graphite ductile iron allowing smooth, efficient operation at all rated speeds and pressures. The stiff shaft shall be designed with the first lateral critical speed at least 120% of the maximum allowable speed. Any torsional natural frequency shall be at least 10% above or 10% below the operating speed range of the blower. The rotors shall be solid or having closed ends. Rotors shall have an integral sealing strip for improved efficiency.

2. The blower rotors shall be balanced according to ISO 1940 class Q 2.5. With respect to acceptable vibration levels, the blowers must operate between effective vibration speeds of 2.8 to 7.0 mm/sec. (0.11 to 0.276 inches/sec.) measured at the bearing housing per VDI standard 2056. For acceptance, all blowers must conform to ISO 2373, Machine Group T.

E. End Plates

1. The end plates shall be of heavy duty cast iron construction, and designed for long life, and maximum machine noise attenuation. Bearing fits shall be precision machined to ensure accurate positioning of the rotors in the casing.

2. The end plates shall be equipped with dowel pins to ensure accurate alignment with the blower casing.

3. The end plate covers shall be cast iron construction with a precision machined sealing face and breather points.

F. Timing Gears

1. Spur type, precision ground, hardened and carburized, AGMA Grade 11 equivalent quality with minimum service factor of 1.7 at the maximum operating point.

2. Gears shall be secured by bolting and interference fit on precision ground tapered shaft ends.

3. Each timing gear shall be measured and marked to identify the location and value of its largest radial dimension. The timing gear set shall be matched and assembled such that one gear’s largest radial dimension is located in the same direction as it’s mating gear’s largest radial dimension for optimum performance

at high speeds and maximum machine noise attenuation in all applications. The timing gear set shall be taper mounted on the rotors for improved rebuild-ability and accurate timing.

G. Bearings

Shaft support locations shall incorporate large, heavy duty cylindrical roller bearings, or heavy duty angular contact double row ball bearings designed to handle extreme radial loads without sacrificing product integrity and reliability. The bearings shall have a L-10 lift of at least 40,000 hours at maximum speed and maximum differential pressure.

H. Lubrication

Both the gear end and the drive end of the blowers shall be oil splash lubricated for minimal maintenance and long service life. Grease lubricated bearings are not acceptable. The lubrication design shall ensure adequate lubrication of the timing gears and bearings.

I. Seals

The seals at both ends of each shaft shall be non-rubbing, vented, labyrinth-type seals. Each seal assembly shall consist of four (4) hardened steel piston rings, an oil deflector, a grooved labyrinth sleeve, and casing wear ring. There are a total of (16) sixteen piston ring seals. Provision for venting to atmosphere between the oil-side and the air-side seals shall be included. The use of lip-type seals for internal rotor shaft sealing is not acceptable. Replaceable casing wear rings to protect the seal bores in the headplates are required.

J. Input Shaft Lip Seal

The input shaft seal shall be a lip type seal. The seal assembly must include a shaft sleeve, precision ground, with a titanium dioxide coating and a relief taper at the dust lip to reduce friction and heat. The seal assembly must be fully serviceable without removing the front oil chamber cover.

2.03 BLOWER PACKAGE

A. The packaged blowers shall be standard engineered designs of a manufacturer regularly engaged in the production of packaged blowers to ensure single source accountability and shall include the following standard features:

1. Each blower shall be driven through V-belts and sheaves with 3V or 5V profile. The drive assembly shall be of the heavy duty high capacity type, oil and heat resistant, with a 1.5 safety factor.

2. Automatic tensioning of the V-belts by use of a pivoting, swing frame motor base with adjustable spring assistance and visual indication of V-belt tension shall be provided to insure the V-belts remain properly tensioned with minimal maintenance and to extend V-belt, sheave, and bearing life. Adjustment of the tensioning device shall be accomplished without removal of the guard or loosening of the motor mounting bolts.

3. The drive guard shall be the manufacturer’s standard sheet metal with provision for ventilation. The installed guard shall be fully enclosed, easily removable, and

designed to meet current OSHA recommendations and CE standards.

4. The base shall be an elevated, rigid, fabricated steel design with a solid sub-base. The discharge silencer must be integral to the frame in order to minimize space requirements.

5. The blower shall be mounted horizontally for a compact frame and discharge downward to prevent accumulation of contaminates in the blower cylinder. Flange-mounting of the blower to the discharge silencer is not allowed. The blower must be supported by the base frame to prevent nozzle loading of the blower casing and silencer shell.

6. To prevent transmission of vibration and noise, the base shall include vibration isolators made of rubber in a steel footing. The vibration isolators are to be mounted between the blower base and the package sub-base.

7. Oil drains from the blower drive-end and gear-end lubricating oil sumps shall be piped to the front of the base and shall include valves for ease of maintenance. The drain valves shall be 90° stainless steel ball valves with Teflon™ elastomers. Each valve assembly is to include a fully retained and gasketed threaded cap to prevent accidental discharge of the blower lubricant.

8. The inlet filter shall be integral to the inlet silencer and shall include a polyester element for minimal pressure drop. The filter maintenance cover and element must be removable by hand (without the use of tools).

9. The inlet silencer shall be of the absorptive type, directly connected to the inlet port of the blower, and shall be mounted horizontally.

10. The discharge silencer shall be directly connected to the outlet port of the blower. The discharge silencer shall be mounted horizontally and shall be integral to the base frame. The discharge silencer shall incorporate a combination of absorption, reflection, and diffusion as noise control techniques.

11. The relief valve shall be spring-loaded and factory installed in the shell of the discharge silencer to protect the blower from excessive differential pressures. The relief valve exhaust shall be piped out of the enclosure.

12. A swing-type check valve is to be provided and factory installed on the package to prevent backflow through the blower. The check valve is cast aluminum with high temperature silicone elastomers. The valve must be designed so that, in the event of failure, the valve element is retained in the body. Butterfly or center-hinge designs are not acceptable.

13. An unloaded start valve shall be provided, and factory installed to allow the motor to accelerate prior to system pressurization and eliminate pneumatic shock.

14. An elastomeric compensator/flex connector shall be provided for connection of the packaged blower to the system piping to reduce transmission of structure borne noise as well as prevent unacceptable loading of the silencer connection.

15. A sound enclosure shall be provided as standard, shipped fully assembled and shall be the product of the blower manufacturer to insure proper integration. The sound enclosure shall be sheet steel construction with powder coat finish. It shall have acoustic foam insulation and shall provide sound attenuation of up to 20

dB(A). The sound absorbing material must be self-extinguishing and meet the standard of UL 94, Section HFI. The enclosure shall have hinged panels and removable panels to allow maintenance access. Panels shall incorporate locking closures. At least one integral ventilation fan, sized to provide adequate cooling of the package, shall be provided. An enclosure high temperature alarm shall be provided back to the plant PLC.

16. A pressure gauge shall be provided, pre-piped and panel mounted, on the sound enclosure.

17. A temperature gauge, with adjustable switching point and contact, shall be provided pre-piped and panel mounted on the sound enclosure. A high temperature alarm shall be provided to the plant PLC.

18. A filter differential pressure gauge shall be provided pre-piped and panel mounted on the sound enclosure.

19. The blower package shall be designed to allow all preventive maintenance to be performed from the front of the package. All utility connections and process connections shall be at the rear of the package.

20. The blower package shall be capable of being installed directly adjacent to another blower packages of similar design and shall be capable of mounting next to the wall without maintenance interference.

B. Motors

1. All blower motors shall be supplied mounted, aligned and with totally enclosed and fan cooled enclosures.
   a. The motors shall be suitable for 3-phase, 60-hertz service. Insulation Class F and limited to Class B rise.
   b. The blower motors shall be Efficiency 1, EPAct Compliant, and have a top conduit box with adapters for either metric or US conduit connections.
   c. The blower motors shall be suitable for Full Load/Direct On-Line starting, Solid State Ramp starting, and Wye-Delta reduced current starting.
   d. All blower motors shall be inverter-rated as defined by NEMA -MG part 31.4.
   e. All blower motors shall include three (3) PTC (Positive Temperature Coefficient) Thermistors to protect the motor windings from excessive temperatures. Connection of the PTC Thermistors to the control system and signal processing is the responsibility of the control system provider.
   f. Blower motors up to and including 40HP shall have 12 leads, a 1.15 Service Factor when wired for 230 or 460 volt, and 1.0 Service Factor when wired for 208 volt service.
   g. Blower motors 50 HP and larger shall have 6 leads, 1.15 Service Factor, and 460 volt.

2. Enclosure cooling fan motors shall be supplied mounted and suitable for 460 Volt, 60HZ, and 3-Phase service unless specified differently.
   a. The sound attenuating enclosure shall have one or two ventilating fans positioned at the enclosure exhaust louvers near the top of the package.
   b. Each fan must be driven by a separate motor to ensure adequate cooling at all blower operating speeds. The starter/overload protection for fan motors is the responsibility of the blower package control panel supplier.

c. The electrically-operated fans that circulate cooling air are mounted inside the enclosure and must be wired to exhaust air out through the exhaust louvers near the top of the package. Usually, the fans are wired to turn “on” when the main motor starts and turn “off” when the main motor stops.

d. Wiring and circuit protection for these fan motors shall be provided from the MCC. A dedicated branch circuit complete with starter and overload protection for the cooling air fan motors shall be provided, if required, by the local electrical code.

2.04 CORROSION PROTECTION

A. Blower – Receives one (1) shop prime coat of chromate free primer followed by two (2) finish coats of a medium-long oil alkyd.

B. Motor – Coated with original manufacturer’s standard machinery enamel.

C. Sound Enclosure – Degreasing, zinc or ferro phosphatizing, and Powder Coat to 80 µm ± 20 µm.

2.05 SERVICE CONDITIONS

A. Each blower package shall be designed to operate under the following conditions without overloading the motor:

1. Elevation: 25 feet

2. Design summer temperature: 120ºF

3. Design winter temperature: 40ºF

4. Relative humidity: 95%

5. Inlet Pressure: 14.7 psia

B. The capacity discharge pressure and motor horsepower of each blower shall be as indicated in the following schedule:

The following schedule shall apply to the Phase A project.

Name	Tag Number	Quantity	Capacity (ICFM)	Discharge Pressure (psig)*	Motor HP**
Pre-Aeration Blower	BLR-100101A BLR-100102A	2	750	11	40
MBR Blower	BLR-090101A BLR-090102A	2			
Common Standby Blower	BLR-090103A	1			
Sludge Storage Blower	BLR-110101A BLR-110102A	2	600	11	50

Notes:

1. The blower discharge pressure indicated for each blower does not include allowances for internal losses (filter, silencer, and discharge valves). The blower manufacturer shall adjust the discharge pressure at the blower prior to internal components as required for actual internal losses.

2. The motor horsepower indicated are minimum motor horsepower required. The blower manufacturer shall determine actual horsepower required for non-overloading operation throughout the range of service conditions specified herein and accounting for actual blower system internal losses.

3. Motor sizing shall also provide for the increased discharge pressure required to operate the blower pressure relief valve.

2.06 ACCEPTABLE MANUFACTURERS

The manufacturer shall have a minimum of five (5) years experience in producing blower equipment and shall produce evidence of at least five (5) installations of similar size in satisfactory operation in the United States

Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

- Gardner Denver, Inc.
- Kaeser Compressors, Inc.
- Aerzen
- OR approved equal.

PART 3 – EXECUTION

3.01 FACTORY TESTS

A. All critical dimensions of the blower components shall be verified and documented prior to assembly.

B. The rotating parts of each blower shall be statically and dynamically balanced before final assembly. The Blower alone shall operate without vibration in excess of the limits stated in the latest revision of NEMA MG-1.

C. Each blower provided by the manufacturer shall be slip tested. The Slip RPM shall be documented.

D. Each blower provided by the manufacturer shall be operated at its maximum rated speed and differential pressure for thirty 30 minutes.

E. Upon completion of final assembly of the packaged blower and prior to shipment, each packaged blower shall be mechanically run for a minimum of fifteen (15) minutes.

F. A document certifying that the supplied blowers deliver the specified air flow and discharge pressure and conform to the specifications shall be provided to the ENGINEER for approval prior to shipment of the equipment.

3.02 INSTALLATION

A. Installation of the packaged blowers shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the drawings. Anchor bolts shall be provided and set by the CONTRACTOR in accordance with the manufacturer's recommendations.

B. The packaged blowers shall be accurately anchored into position on the foundation, leveled, and aligned so that the completed installation is free from stress and distortion. All necessary anchor bolts, nuts, plates, and washers provided and installed by the CONTRACTOR shall conform to the recommendations and instructions of the blower package manufacturer.

3.03 PROTECTION OF FINISHED WORK

A. The blower equipment must be cleaned upon completion of installation.

B. Provide protective coverings, barriers, devices, signs, or such other methods or procedures to protect the work form damage or deterioration.

C. Maintain protective measures throughout remainder of construction period.

3.04 FIELD TESTS

A. After the packaged blowers have been completely installed, such tests as are necessary to indicate that the packaged blower installations and performance conform to the specifications shall be conducted by the CONTRACTOR in the presence of the ENGINEER and the OWNER.

B. A minimum of forty-eight (48) hours notification is required prior to testing. Field tests are to include all units provided under this specification.

C. The CONTRACTOR shall be responsible for providing all electric power, labor, equipment, and incidentals required to complete the field tests.

D. The following tests shall be required:

1. Function Test: Prior to system startup, all packaged blowers shall be inspected for proper alignment, proper connection, and proper function by means of a startup checklist.

2. Performance Test: The CONTRACTOR shall perform tests to demonstrate that the packaged blowers conform to the specifications to the satisfaction of the ENGINEER. Blower performance shall be documented by obtaining concurrent readings showing supply voltage, motor amperage, blower speed, blower inlet pressure, blower outlet pressure, blower inlet temperature, and blower outlet temperature. Each packaged blower motor leads shall be checked for proper current balance.

3.05 MANUFACTURER'S FIELD SERVICES

A. Provide services of a factory representative for a minimum of two (2) eight hour on-site days to inspect, test, and adjust the equipment after installation to verify the mechanical,

structural, and electrical integrity and conformance to the equipment specifications. Provide written certification that the equipment is properly installed following the initial site visit.

B. Provide services of a factory representative for two (2) eight hour on-site days to verify the proper operating of the equipment and to instruct OWNER's personnel on operation and maintenance.

B. Provide additional services at no cost to the OWNER to correct any operational problems due to the design and/or fabrication of the equipment.

END OF SECTION

SECTION 11655
SLUDGE STORAGE TANK DIFFUSER SYSTEM

PART I – GENERAL

1.01 GENERAL REQUIREMENTS

A. The CONTRACTOR shall furnish all labor, materials, tools, equipment, and supervision required to install the coarse bubble sludge holding tank aeration diffuser systems equipment, as indicated on the Drawings and specified herein, and all other work incidental thereto, except as otherwise noted.

B. The work under this section is intended to include the necessary materials and workmanship that are required for the completion of this equipment, as shown on the Drawings, unless otherwise specified.

C. The work shall be complete and ready for satisfactory operation whether or not each and every item is shown on the Drawings or specifically mentioned in these Specifications.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 specification Sections, apply to this Section.

B. Additional requirements related to work specified in this Section include, but are not limited to, the following:

1. Section 09900: Painting and Special Coatings
2. Section 11005: Process Equipment General Requirements
3. Section 15200: Process Piping and Valves

1.03 QUALITY ASSURANCE

A. The equipment manufacturer shall modify his standard equipment to meet the minimum values specified for dimensions, design and the intent of this specification.

B. Manufacturers shall be regularly engaged in the manufacture of the aeration diffuser equipment as specified herein and can demonstrate a minimum of ten (10) equipment installations of this specified design, in actual service for a period of not less than five (5) years.

1.04 SUBMITTALS

A. Shop Drawings and Product Data

Submit shop drawings showing all system components and equipment in elevation and section. Shop drawing submittals shall include:

1. Diffuser headloss and certified OTE test results based on a minimum of three (3) tests conducted in accordance with ASCE Clean Water Test procedure.

2. Component details including diffusers, mounting adapters, gaskets, retaining rings, joints, and supports.

3. Materials and manufacturing specifications.

4. Dimensional layouts showing plan, elevation and cross-section of the piping, manufactured and field assembled joints, expansion joints, and supports.

B. Certification and Testing

Prior to start-up the manufacture shall certify, in writing, that the completed installation is in accordance with his recommendations.

C. Operation and Maintenance Data

Submit operating instructions, repair parts listing and recommended maintenance schedule of inspection, and cleaning.

1.05 DESIGN REQUIREMENTS

A. Design the aeration system for installation in the following tanks.

Tank Dimensions	23’ x 34’ x 21.5’
Sidewater Depth (ft.)	19

B. Design aeration system to provide mixing and aeration in clean water at the specified submergence, air rate and pressure.

Air Rate (scfm)	550
Pressure @ Top of Drop Pipe (psig)	8.0
Diffuser Submergence (ft.)	18

1.06 WARRANTY

The warranty period for all items by this section of the Specifications shall be for one year from the date of equipment acceptance as specified in the General Conditions.

PART 2 – PRODUCTS

2.01 GENERAL

A. The design, fabrication, and installation of the diffuser equipment shall be such that, upon completion of installation, all diffusers fed from a common air main are leveled to within ± ¼ inch of a common horizontal plane.

B. The entire system shall be designed to allow for expansion and contraction over a temperature range of 35 to 125 degrees F when installed.

2.02 DROP PIPES

Provide a minimum 12 gauge stainless steel drop pipe, manifold and headers.

A. Provide a stainless steel flange with a 150-pound drilling at the top connection.

B. Provide a stainless steel gasketed coupling for connection to the manifold or air

distribution header.

C. Fabricate all welded parts and assemblies from sheets and plates of 304L stainless steel with a 2D finish conforming to ASTM A240, 554, 774, 778.

D. Fabricate non-welded parts and flanges from sheets, plates or bars of 304 stainless steel conforming to ASTM A240 or ASTM A276.

E. Weld in the factory with ER 316L filler wire using MIG, TIG or plasma-arc inert gas welding processes. Provide a cross section equal to or greater than the parent metal.

F. Clean all welded stainless steel surfaces and welds after fabrication to remove weld splatter and finish clean all interior and exterior welds by full immersion pickling and rinse with water to remove all carbon deposits and contaminants to regenerate a uniform corrosion resistant chromium oxide film per ASTM A380 Section 6.2.11, Table A2.1 Annex A2.

2.03 MANIFOLDS AND AIR DISTRIBUTION HEADERS

A. Fabricate maximum 45 feet long manifolds and air distribution headers with flanged joints or expansion joints.

B. Design piping with eccentric reducers for changes in diameter to maintain constant invert elevation.

C. Provide piping with removable end caps. Air distribution headers shall have removal end caps to allow access for cleaning of header pipe.

D. Design piping, pipe joints and supports to resist expansion/contraction thrust forces of the air distribution headers over a temperature range of 125° F.

E. Provide piping fabricated of stainless steel material.

2.04 PIPE SUPPORTS

A. Support spacing to be limited to a maximum of 18 feet with pipe supports at 5 foot intervals preferred.

B. Design all supports to allow for thermal expansion and contraction forces over a temperature range of 35° F to 125° F and to minimize stress build up in the piping system.

C. Design supports to be adjustable without removing the air distribution header from the support.

D. Design supports to include hold down guide straps, support structure and two anchor bolts.

E. Design guide straps with a 2 inch minimum width to eliminate point load on piping and minimize binding.

F. Design support for a total of 1 inch lateral adjustment and 4 inch vertical adjustment for leveling within 3/8 inch of a common plane.

G. Attach supports to tank floor with stainless steel anchor bolts.

2.05 DIFFUSER ASSEMBLIES

A. Air Diffuser

1. Provide diffuser fabricated of stainless steel material.

2. Design diffuser with cast stainless steel alloy equivalent to 304 stainless steel schedule 80 – ¾ inch NPT threaded nozzle, air reservoir, air exit ports and bottom deflector.

3. Diffuser shall be designed with backflow prevention capability to prevent solids from entering the header pipe upon shutdown of air flow.

B. Diffuser Connectors

1. Design diffuser connector for two diffusers.

2. Furnish PVC plugs for all unused diffuser connectors.

3. Design diffuser connector with cast stainless steel alloy equivalent to 316L stainless steel.

4. Provide connector so that air exiting the diffusers does not interfere with the air distribution header.

5. Factory weld connector to the invert centerline of the air distribution header with a full penetration butt weld.

6. Reinforce the connector header weld joint by providing and continuously welding gussets between the vertical side wall of the header and the connector ends to limit long term flexure failure. Minimum gusset thickness to be 1/8 inch.

7. Design connector to resist a vertical dead load applied to the threaded end of the connector that results in a bending moment of 1000 inch-lbs without exceeding 24,000 psi design stress in any part of the air distribution header wall or connector.

2.06 ANCHOR BOLTS

Design a mechanical or adhesive anchor bolt system for embedment in 4000 psi concrete with a pullout safety factor of 4.

2.07 MANUFACTURER

The Sludge Storage Tank Aeration Diffuser System, including coarse bubble diffusers, aeration piping, and supports, shall be manufactured by:

- D2, Evoqua
- Sanitaire, Xylem
- or Approved Equal

PART 3 – EXECUTION

3.01 FABRICATION

A. All stainless steel and PVC joints shall be factory welded.

B. Continuously weld both sides of face rings and flanges. All welding on the aeration equipment shall be completed in the factory. Field welding will not be permitted. All stainless steel welding shall be by the shielded arc, inert gas, MIG, or TIG method. Filler wire shall be added to all welds to provide a cross section of weld metal equal to, or greater than, the parent metal. Butt welds shall have full penetration to the interior surface, and gas shielding shall be provided to the interior and exterior of the joint.

C. Interior weld beads shall be smooth, evenly distributed, with an interior project not exceeding 1/16 inch beyond the inner diameter of the air header or fitting.

D. All outside weld areas shall be wire-brushed to remove weld splatter. Brushes shall be of stainless steel and used only on stainless steel.

3.02 SHIPMENT

The aeration equipment shall be packaged and shipped by the Manufacturer ready for unloading, storage, and installation by the Installation Contractor in accordance with the Manufacturer's recommendations.

3.03 INSTALLATION

The equipment shall be installed properly to provide a complete working system. Installation shall follow the manufacturer's recommendations, including sequencing, layout and installation of equipment.

Level aeration system such that all diffusers connected to a common header are within ± ¼ inch of a common horizontal plane.

3.04 CLEAN WATER FUNCTIONAL TESTS

After installation of the diffuser aeration equipment is complete, witness functional testing conducted by the installation Contractor to check for leaks, uniformity of air release, and verification of level installation. Functional testing shall be performed with clean water at a depth over the diffusers as recommended by the aeration system manufacturer. Any leaks in the headers, diffusers, pipes, or any part of the system shall be repaired by the Installation Contractor. The test shall be repeated until the installation is void of air leaks.

3.05 INSPECTION AND TRAINING REQUIREMENTS

A factory representative employed by each manufacturer shall visit the site prior to equipment start-up to verify the proper installation of the equipment. The factory representative shall return to the site during the Startup and Testing of the equipment to verify proper operation and to instruct the Owner's operating personnel in the maintenance and operation of these units.

END OF SECTION

SECTION 11700
GRIT REMOVAL SYSTEM

PART I – GENERAL

1.01 WORK INCLUDED

A. The Manufacturer shall provide all materials, equipment and incidentals required to furnish, transport, and place into operation the Grit Removal, Washing, and Dewatering System. The system must be complete and operational with motors, base plates, control equipment and accessories as shown on the contract drawings and specified in this section.

B. The Grit Removal, Washing, and Dewatering System shall be furnished by a single MANUFACTURER having overall system responsibility to ensure coordination of and compatibility of all major components of the system. Overall system responsibility shall include start-up, training, calibration, and ultimately successful operation of the equipment in conformance with the performance criteria of the specification.

C. The Grit Removal, Washing, and Dewatering System shall be installed by the General CONTRACTOR. The CONTRACTOR shall provide interconnecting piping, conduit, wiring, concrete work, anchoring devices and installation services.

1.02 SPECIFICATION CONFORMANCE

A. Where specific MANUFACTURERS are identified for a specified item in the Specifications, the equipment of the named MANUFACTURER or MANUFACTURERS have been used as the basis of design. Substitution of the named MANUFACTURER'S equipment shall not be allowed unless prior written approval is granted by the ENGINEER.

B. Equipment of other MANUFACTURERS that is approved as equal to that specified will be acceptable on the basis that any revisions in design or construction of the structure, piping or appurtenant equipment required to accommodate such a substitution shall be made at no additional cost to the OWNER, meet the requirements set forth in the Specifications, and be approved by the ENGINEER.

1.03 SYSTEM DESCRIPTION

A. The Grit Removal, Washing, and Dewatering Systems shall include one (1) expandable HEADCELL™ Grit Concentrator unit, one (1) GRITCUP™ Grit Washing / Classification unit, one (1) SPIRASNAIL™ Grit Dewatering Conveyor unit, two (2) grit pumps, and necessary control panels and appurtenances.

B. The HEADCELL™ unit shall be placed in a concrete tank and receive the incoming screened flow. The HEADCELL™ shall provide sufficient surface area to remove the specified grit particles from the specified peak flow and concentrating the grit in a sump at the bottom of the unit. Effluent from the HEADCELL™ unit shall be weir discharged as shown on the drawings.

C. Supplied grit pumps shall remove the grit from the sump and transport the grit slurry from the HEADCELL™ unit to the GRITCUP™ for separation of organics.

D. The GRITCUP™ unit shall be mounted above and discharge a concentrated grit slurry to

the SPIRASNAIL™ unit.

E. The SPIRASNAIL™ unit shall allow the washed grit to settle in its integral clarifier. A slow-moving conveyor shall carry the grit to the point of discharge at the spiral screw conveyor allowing it to dewater during transport. The washed and dewatered grit shall be discharged to the spiral screw conveyor for transport to a dewatered grit receptacle. The connection between the SPIRASNAIL™ unit and the spiral screw conveyor shall be coordinated between manufacturers and installed per the Drawings.

F. The dewatered grit receptacle shall have a drain and be provided by OTHERS.

1.04 QUALITY ASSURANCE

A. The Grit Removal, Washing, and Dewatering System MANUFACTURER shall inspect components of the system as required prior to shipment in order to detect any defects in materials or workmanship.

B. MANUFACTURER shall be successful in the experience of manufacture, operation, and servicing of grit removal systems of type, size, quality, performance, and reliability equal to that specified for a period of not less than five (5) years. The MANUFACTURER shall submit evidence of experience having supplied a minimum of five (5) installations within the United States of similar size to the proposed system with a surface loading rate of 12.3 gpm/square feet or less to achieve the specified performance requirement.

C. In the absence of verifiable experience, the MANUFACTURER shall be required to provide an extended warranty and subsequent Performance Bond for the same number of years that the MANUFACTURER was found lacking in experience from the specified five (5) year period. The performance bond shall commence with acceptance of the equipment and time described herein and beyond the standard warranty period.

1.05 SUBMITTALS

A. The MANUFACTURER shall submit a general arrangement drawing that illustrates layout of the equipment, principle dimensions and other related data including descriptive literature, electrical control drawings, catalog cut sheets for individual component and drive motor data.

B. Provide weight of each unit and weights of all components.

C. The submittal shall include performance data as specified below.

D. Submit complete instruction for operation and maintenance of Grit Removal, Washing, and Dewatering System components. Include the following data:

- Alignment, adjustment, and repair instructions.
- MANUFACTURER'S installation instructions.
- Assembly diagrams.
- Troubleshooting guide.
- Lubrication instructions.
- Recommended spare parts lists and predicted life of parts subject to wear.

1.06 DELIVERY, STORAGE AND HANDLING

A. The equipment, material, and spare parts shall be shipped complete except where partial

disassembly is required by transportation regulations or for protection of components.

B. Spare parts shall be packed in containers bearing labels clearly designating contents and pieces of equipment for which they are intended.

C. The CONTRACTOR shall unload, store and safeguard equipment, materials, and spare parts in accordance with MANUFACTURERS recommendations

1.07 WARRANTY

A. The manufacturer shall warrant that all Equipment shall be free of defects caused by faulty material or workmanship and shall replace those parts for a period of two (2) years from the date of startup by the MANUFACTURER.

B. The equipment shall be under warranty to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced at no expense to the OWNER.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. The grit removal system shall be the manufactured by Hydro International, 2925 NW Aloclek Drive #140, Hillsboro, Oregon, 97124, telephone 503-615-8130.

B. The system shall be furnished by a manufacturer who is ISO 9001:2000 Certified.

2.02 EQUIPMENT PERFORMANCE

A. General

1. The Grit Removal, Washing, and Dewatering System shall be designed to remove, classify, wash, and dewater grit from screened wastewater.

2. The system shall include four individual components including a Grit Concentrator, a Grit Washing / Classification unit, a Grit Dewatering Conveyor, and a control panel.

3. The system shall be designed to handle a flow of:
   a. Initial Peak Flow of 3.0 mgd.
   b. Future Peak Flow of 9.0 mgd.

B. Grit Concentrator

1. The Grit Concentrator unit shall be designed to operate at a Peak Flow of 9.0 mgd with a headloss of no more than 12 inches.

2. The unit shall remove minimum 95% of all grit equal to and larger than 125 micron (specific gravity 2.6) in size at all flow ranges.

3. The Grit Concentrator unit shall consist of a stack of eight (8) 9 foot diameter nested trays with no less than 508 ft^2 of settling surface.

4. The Grit Concentrator shall have a maximum surface loading rate of 12.3 gpm/square foot to insure adequate surface area for settling and specified

particle removal efficiency. No exceptions shall be allowed.

5. The Grit Concentrator shall be characterized by a controlled boundary layer flow to enhance settleable solids concentration and removal.
6. The Grit Concentrator shall be all-hydraulic consisting of self cleaning corrosion resistant, non-metallic trays with no moving parts within the unit.

C. Grit Pump

1. The pumps shall be designed for continuous operation and will be operated continuously under normal service.

D. Grit Washing / Classification Unit

1. The Grit Washing / Classification unit shall be designed to handle grit slurry underflow from the Grit Concentrator.

2. The Grit Washing / Classification unit shall be designed to operate continuously. At steady state design flow conditions, the unit shall remove minimum 95% of all grit equal to and larger than 50 micron (specific gravity 2.6) in size.

3. The Grit Washing / Classification unit shall be designed to process a flow of 200 gpm with a minimum headloss.

4. The Grit Washing / Classification unit shall be characterized by a dominant, strong free vortex which utilizes hydro-dynamic, gravitational forces and secondary boundary layer velocities to affect the separation, collection and classification of grit from the unit's inflow.

5. Defining characteristics of the tangentially introduced dominant hydro-dynamic flow / secondary boundary layer velocity type units are as follows:
   a. Increasing tangential velocity profile toward the center of the unit.
   b. No requirements for electrical or mechanical components, flow deflecting / guiding weirs or baffles, or compressed air lines within the unit to meet the specified performance.
   c. Continuous removal of washed, clean grit.

6. The Grit Washing / Classification unit shall be all-hydraulic with no moving parts within the unit.

7. Vortex grit units which do not have a dominant, strong free vortex / secondary boundary layer velocity and whose performance decreases with increasing flow shall not be allowed.

E. Grit Dewatering Conveyor Unit

1. The Grit Dewatering Conveyor unit shall be designed to dewater concentrated, washed grit slurry from the Grit Washing / Classification unit. At steady state design flow conditions, the unit shall remove minimum 95% of all grit equal to and larger than 106 micron (specific gravity 2.6) in size.

2. The Grit Dewatering Conveyor unit clarifier shall be designed based on a settling rate not to exceed 3.2 gpm/ft^2.

3. The Grit Dewatering Conveyor unit shall have a capacity of 0.75 yd^3/hr of

dewatered grit.

4. Grasshoppers, reciprocating rakes and similar type of units shall not be allowed.

2.03 MATERIALS AND CONSTRUCTION

A. Grit Concentrator

1. One (1) Grit Concentrator unit shall be supplied.

2. The Grit Concentrator unit shall consist of a stack of eight (8) nested trays with no less than 508 ft^2 of settling surface.

3. The Grit Concentrator trays shall be nominally 108 inches in diameter and shall be fabricated from corrosion resistant, non-metallic materials.

4. All flow passages shall be self-cleaning and free of sharp projections or fittings that may snag stringy or fibrous materials.

5. Grit Concentrator trays shall be constructed with a minimum ¼ inch thick material on the pans and sidewalls.

6. The stack of trays will securely fit into a 304 SS support frame. The support frame will fit and secure to the bottom of the CONTRACTOR supplied concrete support structure.

7. A grit sump shall be provided with the Grit Concentrator for collection and removal of settled solids to the respective Grit Separation / Classification /Washing unit. The grit sump shall be installed in the CONTRACTOR supplied concrete tank.

8. Water shall be continuously supplied to the solids underflow sump.

9. A manually actuated SS 1” globe valve, a manually actuated SS 1” ball valve to isolated the underflow, and a 2-20 gpm acrylic rotometer shall be provided to regulate and isolate the fluidizing water flow rate.

10. A SS 1.5” NEMA 7 solenoid valve shall be supplied to automate the spray system

11. The CONTRACTOR shall furnish the concrete structure and all interconnecting piping.

12. Water requirements for the Grit Concentrator unit are outlined in Section 2.04 UTILITY REQUIREMENTS.

B. Grit Washing / Classification Unit

1. One (1) Grit Washing / Classification unit will be supplied.

2. The Grit Washing / Classification unit shall be designed to operate continuously. At steady state design flow conditions, the unit shall remove minimum 95% of all grit equal to and larger than 106 micron (specific gravity 2.6) in size.

3. The Grit Washing / Classification unit shall be 30 inches in diameter and shall be fabricated from 304 stainless steel. Welding shall conform to the most current

standards of the American Welding Society. The steel shall conform to materials specifications, as detailed in Section 2.05A.

4. The Grit Washing / Classification unit shall be fabricated from 304 stainless steel. The vessel walls shall be 3/16 inch thick. Exterior surfaces shall be finished in accordance with specifications described in Section 2.05B.

5. The unit shall have one 4" flanged inlet connection and one 6" flanged outlet connection. Flanges will be rotatable and conform to ANSI B16.1 bolt patterns.

6. The Grit Separation / Classification unit shall be designed to withstand a maximum working pressure of 14.7 psig. The actual maximum pressure at the inlet will be no more than 14.7 psig.

7. A minimum 18 inch diameter access shall be provided in the top of the Grit Washing / Classification unit. All internal elements shall be removable from inside the unit.

8. The Grit Washing / Classification unit shall be free standing on three legs and mounted above a Grit Dewatering Conveyor unit. Clearance shall be provided between the bottom of the grit underflow pipe and the Dewatering Unit clarifier surface.

9. The grit underflow from the Grit Washing / Classification unit shall be transported by gravity to the Grit Dewatering Conveyor unit.

C. Grit Dewatering Conveyor

1. One (1) Grit Dewatering Conveyor unit will be supplied.

2. The Grit Dewatering Conveyor unit shall have a dewatering capacity of 0.75 yd^3/hr.

3. The Grit Dewatering Conveyor unit clarifier design shall be based on a settling rate of 3.2 gpm/ft^2.

4. The Grit Dewatering Conveyor shall be provided with an integral clarifier. The clarifier shall be manufactured of 304 SS. The clarifier shall have minimum 23.7 ft^3 of free water surface area and walls sloping at least 45 degrees from the horizontal. The clarifier shall provide at least 3 inches of freeboard. The clarifier shall be fitted with an overflow a 6 inch flanged pipe overflow discharge connection.

5. The Grit Dewatering Conveyor shall be provided with an integral circular clarifier which shall provide at least 3 inches of freeboard.

6. The conveying screw shall have 3/16 inch thick flights mounted on a 3 1/2 diameter schedule 40 pipe.

7. The housing for the Grit Dewatering Conveyor auger shall be fitted under the clarifier. The housing for the Grit Dewatering Conveyor auger shall be stainless steel and shall be inclined at 25 degrees.

8. The clarifier and auger housing shall be fully covered. All covers and hardware shall be stainless steel.

9. The auger housing shall be provided with one (1) threaded drain.

10. The Grit Dewatering Conveyor unit support structure shall be as shown on the general arrangement drawing and anchored to a stable base.

11. All flanges shall be spinning flanges, a minimum of 1/2 inch thick, and drilled to match ANSI 150 lb. pipe flanges.

12. The Grit Dewatering Conveyor unit shall be supplied as standard with access to ease maintenance:
    a) Externally accessible bearing unit.
    b) Swiveling conveyor housing to aid access to base of clarifier and lower auger.
    c) Clarifier observation and maintenance hatches.
    d) Rodding/Flushing water access point opposite of the unit drain.

13. The Grit Dewatering Conveyor unit support structure shall be as shown on the general arrangement drawing and anchored to a stable base.

14. Drive Unit

    a. The drive unit consisting of the motor and the helical gear reducer shall be mounted as a single integrated unit. Bearings shall be anti-friction, ball. or roller type.
    b. The motor shall be 1 HP, 3 phase, 230/460 VAC, 60 Hz, NEMA Design B, XPFC enclosure, Inverter Duty Motor with a 1.0 Service Factor.
    c. The helical gear reducer will have hardened alloy steel gears accurately cut to shape.
    d. The drive speed shall be adjusted by a variable speed drive that will be housed in the control enclosure. Screw speed shall be adjustable from 1-10 ft/min.

D. Grit Pumps

1. Since this pump will be used to pump abrasive grit and other solids, the pump shall be specifically designed to both optimize wear resistance and then maintain hydraulic performance as wear occurs.

2. The pump shall be fully recessed and mounted completely out of the flow path between the pump inlet and discharge connection, so that solids are not required to flow through the impeller.

3. Performance:
    a. Capacity: 200 gpm
    b. TDH: 15 Feet
    c. Motor HP: 0.5 HP
    d. Max. Pump RPM: 1800 RPM

4. Design:
    a. Casing: the pump casing shall consist of a one piece casting with integral suction and discharge nozzles plus a back plate with integral wear element. The casing will have cast on feet, which will fully support the volute, to allow removal of the complete rotating assembly, without disturbing suction and discharge piping. Casing thickness shall be a

minimum of 0.5 inch for 3" pumps, 0.75 inch for 4" & 6" pumps, and 1.0 inch for 8" pumps with normal casting tolerance.). Casing shall be made from Super Ni-Hard ASTM A532 with minimum hardness of 650 BHN.

b. Impeller: Impellers shall be fully recessed out of the casing passage and must be a heavy duty radial vane design. Impellers shall be fitted with full back pump out vanes to restrict flow behind the impeller and shall be keyed to the shaft and secured by a shrouded securing bolt and lock washer. The minimum thickness at the front edge of the impeller vane shall be 0.5 inches. Impeller shall be made from Super Ni-Hard ASTM A532 with minimum hardness of 650 BHN.

c. Wear Element: Pumps with radial vane impellers shall be fitted with a rear casing wear plate and integral radial wear element, which will protect the area behind and at the periphery of the impeller from the brunt of abrasive wear. The radial wear element will be of a tapered design to promote flow of solids out of the impeller recess. Minimum thickness at the base of the radial wear element shall be 1.125 inches. Minimum thickness at the tip of the radial wear element shall be 0.75“. Wear elements should be self centering, with jacking screws provided to facilitate removal. Wear elements shall be made from Super Ni-Hard ASTM A532 with minimum hardness of 650 BHN.

d. Shaft: The shaft shall be constructed of 4140 steel protected through the seal area by a renewable 410 Stainless steel hardened hook type shaft sleeve . An O-ring between the sleeve and shaft will prevent pump fluid contacting the pump shaft.

e. Stuffing Box: The stuffing box shall be constructed of Cast Iron A-48 Class 30, designed to accommodate a single or double mechanical seal. Any leakage will be retained by a drainable reservoir integral with the bearing housing. A 0.75" NPT hole will be provided to connect seal water drainage piping.

f. Bearing Frame: The bearing frame will be manufactured from Cast Iron and shall be fitted with a constant level sight glass oiler and vent and drain plugs for oil lubrication or grease nipples for grease lubrication.

g. Bearing lives are to be rated for a minimum of 100,000 Hrs L 10 life, based on calculated loads due to hydraulic thrust at the duty point, as well as other mechanical loading due to belt drives or shaft and impeller weight.

h. Pump and Motor Base: The pump shall be supported by an independent pedestal base fabricated from steel or cast iron, designed to provide rigid support of the pump and motor. The independent pump support pedestal shall be designed for easy access to the handhole cleanout and such that the suction elbow can be removed for maintenance without having to remove or dismantle any of the pump components. Each base shall be furnished with suitable bolt and grout holes to facilitate mounting at site.

i. The pumps shall be tagged by the MANUFACTURER as approved by the ENGINEER.

E. Controls and Instrumentation

1. One (1) control panel shall be furnished, completely pre-wired and tested, requiring only mounting and connection to external wiring in the field by the electrical CONTRACTOR.

2. The control panel shall have a NEMA 4X, 304 stainless steel enclosure, and shall be rated at three phase, 460 VAC, 15 amp power supply. The panel shall be relay logic based and contain all timers, starters, switches, a variable frequency drive,

and indicator lights to operate, one (1) Grit Washing / Classification unit, one (1) Grit Dewatering Conveyor unit, and two (2) grit pumps in either fully automated or manual mode.

3. The control panel shall be supplied with a Transformer with 480 volt primary winding and 120 volt secondary winding with fused secondary.

4. The control panel shall be supplied with applicable control relays and time delay relays with a minimum one extra normally closed and one extra normally opened contact is provided for each relay.

5. The Control Panel shall include the following items:
   a. Front panel mounted combination main disconnect switch and circuit breaker
   b. System Power Indicator
   c. Grit Separation / Classification three position HOA switch
   d. Grit Separation / Classification supply water three position HOA switch.
   e. Grit Separation / Classification supply water valve OPEN indicating light
   f. Grit Separation / Classification backwash water valve OPEN indicating light
   g. Grit Separation / Classification backwash water valve three position HOA switch
   h. Grit Separation / Classification auxiliary backwash pushbutton
   i. SYSTEM BLOWDOWN three position HOA switch
   j. Grit Dewatering Conveyor running light
   k. Grit Dewatering Conveyor three position HOA switch
   l. Grit Dewatering Conveyor fail indicating light
   m. Grit Dewatering Conveyor reset push button
   n. Grit Dewatering Conveyor manual STOP push button
   o. Grit Dewatering Conveyor manual START push button
   p. Grit Dewatering Conveyor manual speed potentiometer
   q. Grit Dewatering Conveyor rinse water valve three position HOA switch
   r. Grit Dewatering Conveyor rinse water valve OPEN indicating light
   s. 2x Grit Pump three position HOA switch
   t. 2x Grit Pump running light
   u. 2x Grit Pump fail light

6. The following Instruments shall be provided:
   a. Pressure gauges furnished, for each unit, shall include:
      i. One (1) 0-100 psig pressure gauge to monitor the supply water delivery pressure.
   b. Flow meters supplied:
      i. One 2-20 gpm flow meter for the Grit Concentrator fluidizing water.

F. Sequence of Operation

1. The unit will be controlled to provide automatic or manual operation, manual starting and stopping, operation of the spray wash system and system shut down when a fault is detected.

2. Grit Concentrator Floatables Spray System - Periodically, (typically once per hour), the spray system activates and directs floatable material on the water surface of the Grit Concentrator towards the effluent weir. This rinse typically lasts up to five minutes and keeps floating material from accumulating within the

unit.

3. The Grit Washing / Classification unit
   a. Grit slurry shall be pumped to the Grit Washing / Classification unit continuously.
   b. During operation, a small volume of washed/classified grit slurry shall continuously underflow from the Grit Washing / Classification unit. Control of the grit slurry underflow rate is via the Hydro-Brake Valve mounted on the bottom of the unit.

4. Grit Dewatering Conveyor unit
   a. The Grit Dewatering conveyor shall run whenever grit slurry is being delivered to the unit.
   b. The screw speed will be adjustable via a manual speed control potentiometer on the control panel or by remote signal (4-20ma) from the plant DCS.
   c. The Grit Dewatering conveyor shall run for a minimum amount of time after a System Shut Down occurs to allow the belt to remove and dewater all grit accumulated in the clarifier. The off delay timer shall be adjustable from 0-60 minutes with a typically delay off time of 15 minutes. Water will be directed to the tailroll self cleaning mechanism and grit rinse system while the dewatering unit is running.

2.04 UTILITY REQUIREMENTS

A. Water

1. The Grit Concentrator unit will require clarified non-potable for fluidizing. Minimum 11 gpm at 50 psig shall be supplied to the grit sump via a 1" NPT connection. A manually actuated bronze ball valve shall be provided to regulate the system water flow rate. The CONTRACTOR shall provide interconnecting piping to the 1" NPT water connection.

2. The Grit Concentrator unit will require clarified non-potable for the spray system. Minimum 16 gpm intermittently at 50 psig shall be supplied to the spray system via a 1.5" NPT connection. The CONTRACTOR shall provide interconnecting piping to the 1" NPT water connection.

3. The Grit Pump (if not a flushless seal) shall require a minimum 0.5-1.0 gpm regulated to 5-10 psi over the max pump discharge pressure (15 psi over seal housing pressure).

2.05 MATERIALS AND FINISHES

A. Materials:

304 STAINLESS STEEL	
Plate and Sheet	ASTM A 167
	ASTM A 240
Bar	ASTM A 276
	ASTM A 479
Tube	ASTM A 312

B. Exterior Surfaces Finishes
   1. Surface Finishing: Acid Washed and Glass Bead Blasted to a uniform finish

PART 3 – EXECUTION

3.01 INSTALLATION

Installation of the Grit Removal System shall be performed by the CONTRACTOR in accordance with the MANUFACTURER instructions.

3.02 START-UP, TRAINING, AND MANUFACTURER'S SERVICES

The MANUFACTURER shall provide one (1) man during maximum two (2) trips to the jobsite for installation review, start-up and training for maximum of four (4) days total.

END OF SECTION

SECTION 11740

BIOLOGICAL ODOR CONTROL SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install and test the biotrickling filter odor control system (System) for the Headworks, MBR Anoxic and Sludge Holding Tanks of the Palm Bay WWTP in Palm Bay Florida. System shall be complete with all appurtenances as specified herein.

1. Manufacturer shall furnish biotrickling filter equipment including blower, biotrickling filter vessel, Interconnecting ductwork, flexible connectors, manual airflow dampers, nutrient addition system, water addition system and control panel along with instrumentation and controls for a fully functioning system.

2. The System is designed as a once-through, non-recirculating system. If a recirculating system is proposed, any additional equipment, duty/standby pumps, pH probe and transmitters, etc. will be provided for a complete and operating system. The Manufacturer will be responsible for all changes or modifications to the equipment shown on the project plans.

3. Manufacturer shall provide shop drawings and Operation and Maintenance manuals.

4. Manufacturer shall provide startup and performance acceptance testing services as specified herein.

5. Placement, installation, bolting to the pad and connection of ductwork, water piping, drainage piping, power and control wiring provided by Contractor.

B. The System shall comprise of the following major components:

1. Single or multi-stage biotrickling filter vessel. The FRP vessel shall be comprised of at least one main module and one top piece and may contain additional modules as the design conditions require. Each media module shall house the structured synthetic media in series and contain a single water/nutrient injection spray system.

2. Structured, engineered, plastic, synthetic media to optimize mass transfer and facilitate the growth of bacteria necessary for biological oxidation of odorous compounds. The media bed shall be uniform and structured throughout and made entirely of a plastic, synthetic, non-reactive material.

3. A UL, factory-labeled electrical control panel housing a single Programmable Logic Controller (PLC) system and other components required for the control and

monitoring of the System.

4. A water panel that houses all components necessary for the control and monitoring of the media irrigation system, including an Automatic Flow Control system with capability to automatically compensate for water supply pressure changes.

5. A single-pass irrigation system to allow the development of heterotrophic bacteria in the upper media zone. Systems that require recirculation may be proposed as an alternate and may be considered after the bid.

6. Odor control blower (s) to move the odorous air from the source and be able to compensate for all pressure losses at the design airflow.

1.02 CONTRACTOR RESPONSIBILITY

A. Installation of all Manufacturer supplied equipment components, which includes among others, receiving, offloading, placement and bolting of all equipment to the concrete pad, connection of ductwork, water piping, drainage piping, and power and control wiring, all in accordance with the Manufacturer's installation instructions.

B. If applicable, onsite storage of all equipment, suitably protected, per the Manufacturers written instructions, from weather and any conditions that could adversely affect the material from its intended function.

C. Supply of all odorous air ductwork including flex connectors and damper valves upstream of the blower.

D. Site preparation and clearing.

E. Construction of concrete equipment pad for placement of the biotrickling filter(s) and supply of system anchor bolts.

F. External water piping and drain piping to and from the biotrickling filter(s) and Water Control Panels.

G. Power supply to the electrical control panel, power to the odor control blowers and connection of all ancillary instrumentation mounted remotely to the System Control Panels.

H. Installation of any additional items as noted on the contract drawings.

I. Heat tracing and insulation of any air ductwork and/or water pipes as required by this Specification or elsewhere in the Contract Documents.

J. Adjusting and Balancing of all upstream odor sources.

K. Temporary piping for startup of the system.

1.03 PROCESS DESCRIPTION

The odor control system shall remove hydrogen sulfide, organic reduced sulfur compounds (RSCs) and other odorous compounds from the foul air stream, as required per Section 2.04 below, using a biotrickling filter operating in a counter-current fashion. Co-current systems shall not be allowed.

The foul air shall enter the system at the bottom of each reactor and flow upward through each of the media layers. The media bed shall be intermittently irrigated from above using suitable reclaimed plant effluent or potable water in a once through fashion. The water then trickles through the media and is collected in a sump at the bottom of the reactor. The drain water from the system will pass from the sump in the bottom of the reactor vessel and be piped to a discharge point as detailed on the Contract drawings.

The hydrogen sulfide is oxidized by the autotrophic bacteria resident on the lower media layer(s). Because of the once-through irrigation configuration, a neutral-pH area of the media will be established, near the top of the media, providing conditions suitable for heterotrophic bacteria to oxidize other organic odorous compounds. The airstream is then released to the atmosphere via the exhaust stack at the top of the reactor.

1.04 REFERENCES

The following is a list of standards which may be referenced in this section:

A. ASTM E679: “Standard Practice of Odor and Taste Thresholds By a Forced-Choice Ascending Concentration Series Method of Limits”.

B. EN13725-2003 - Air Quality - Determination of Odor Thresholds by Dynamic Dilution Olfactometry

C. ASTM D-2563: “Recommended Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts”.

D. ASTM D-2583: “Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor”.

E. ASTM C582: “Revision of C582-02 Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment”.

F. ASTM D-883: “Definition of Terms Relating to Plastics”.

G. ASTM D-3299: “Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks”.

H. ASTM D-2996: “Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Pipe

I. ASTM D 4167 – Standard Specification for Fiber-Reinforced Plastic Fans and Blowers

J. ASTM D-4097: “Standard Specification for Contact Molded Glass Fiber Reinforced Thermoset Resin Corrosion-Resistant Tanks”.

K. ASTM D-3982: “Standard Specification for Contact Molded Fiberglass Ducts”.

L. PS 15-69: National Bureau of Standards Voluntary Product Standard “Custom Contact Molded Reinforced Polyester Chemical Resistant Process Equipment”.

M. American National Standards Institute (ANSI).

N. American Society of Mechanical Engineers (ASME).

O. Institute of Electrical and Electronic Engineers (IEEE).

P. National Electrical Manufacturers Association (NEMA).

Q. National Electrical Code (NEC).

R. National Fire Protection Agency (NFPA).

S. National Bureau of Standards (NBS).

T. Underwriters Laboratories (UL).

U. American Society for Testing and Materials (ASTM).

1.05 SUBMITTALS

A. The Manufacturer shall submit information as required to show complete compliance with these specifications. Submittals shall be provided as one (1) hard copy and one (1) digital copy. At a minimum this information should include the following:

1. A detailed list of any and all deviations and/or exceptions from this specification along with an explanation for the deviation/exception. Clearly list all benefits to the owner. And the dollar ($) figure refund due to the owner for the exception .

2. References for ten (10) systems using the proposed media, treating a minimum of 10,000 cfm and that have been in operation for at least five (5) years.

3. Manufacturer’s catalog/data sheets and descriptive literature for each piece of equipment supplied.

4. Technical data on each major piece of equipment including weights of all items greater than 200 Lbs.

5. Structural calculations and drawings for the main reactor vessel, to include wind and seismic load calculations, Dead loads, Live loads and anchor bolt sizing. Consideration shall be given to the effect of all cutouts and openings in the vessel. Calculations shall be signed and sealed by a Professional Engineer licensed in the State of Florida.

6. Modeling results, in graphical format, with velocity contour plots at 24” media height over the entire media cross section shall be provided to confirm that the airflow through the media is homogeneous at the average airflow rate. For the purpose of this specification, homogeneous is defined as being when the upflow velocity over the entire media cross sectional area is equal to the average upflow velocity ± 10%.

7. Performance data from a minimum of three (3) operating systems demonstrating media elimination capacity ≥ 10% greater than the proposed system loading.

8. Detailed bill of material complete with material of construction.

9. Dimensional drawings showing elevation and plan views of the System and all applicable connections.

10. Process and Instrumentation Diagram (P&ID) showing all main equipment components, flow rates and instrumentation.

11. Process control narrative.

12. Complete details on the Electrical and Water Control Panels:

    a. Heat calculations pertinent to installation in Florida

    b. Indemnification certificate for all control strategies and programs made out to the owner

    c. Confirmation that all programming is done in-house and programs are the property of the Manufacturer

    d. Details on the in-house Factory Acceptance Testing (FAT) procedures for review and approval of the engineer.

    e. Description of Automatic Flow Control equipment to demonstrate compliance with Section 2.05.D.3.

13. A list of the Manufacturers recommended Spare Parts for one (1) year’s operation

14. Equipment offloading and installation instructions with sufficient detail to allow the Contractor to complete the mechanical and electrical installation of all System components.

15. Annual utility and nutrient usage calculations (if applicable).

16. Statement of Manufacturer’s Warranty.

17. Information on hazards associated with the System and appropriate safety precautions, including applicable Material Safety Data Sheets (MSDS).

18. Proposed Performance Testing Plan, to include a list of sampling and logging equipment and all sampling and testing methods and protocols.

B. The Manufacturer shall submit the following information, as a minimum, for the Operation and Maintenance Manuals.

1. As-built dimensional drawings showing plan and elevation views of the System and all applicable connections.

2. As-built Process and Instrumentation Diagrams (P&IDs).

3. Detailed bill of material along with specification of System components and materials of construction. The list to include the make, model number and descriptive literature of all items furnished by the Manufacturer.

4. Performance data for the odor control blower, to include curves showing capacity, pressure, horsepower demand and efficiency over the entire operating range, including blower manufacturer's descriptive literature and blower model number(s).

5. Special precautions for any components or materials associated with the System and its operation that should be subject to particular safety precautions, including MSDS.

6. Manufacturer's Service Department contact information and service order form.

7. Statement of Manufacturer's Warranty.

8. System startup and restart instructions.

9. Detailed information on proper settings and operation of the Automatic Flow Control System.

10. Special maintenance procedures, including recommended weekly, monthly and annual preventative maintenance requirements.

11. Troubleshooting guide.

12. Individual Operation and Maintenance instructions for all major system components.

13. O&M manual shall be provided in digital copy for review/comment/approval. After approval, the Manufacturer shall provide two (2) hard copies for the owner's records.

1.06 SHIPPING, DELIVERY, STORAGE & HANDLING

A. All equipment and materials shall be properly protected such that no damage will occur from the time of shipment until the time of installation.

B. All exposed openings shall be protected to prevent entrance of debris, moisture or water during transportation and storage.

C. Contractor shall be responsible for offloading all shipped equipment and shall inspect all equipment upon arrival. Contractor shall notify the Manufacturer within 24 hours of any damage to equipment or surface finish due to shipping.

D. Contractor shall store all equipment such that, for the duration of the storage period, there will be no deterioration in equipment appearance or performance. Manufacturer shall supply detailed storage instructions, as necessary, at the time of shipment.

1.07 WARRANTY

The biotrickling filter Manufacturer shall warrant that the equipment supplied meets these specifications and the performances detailed in section 2.04 and that it is new and unused, free from defects in materials and/or workmanship. This warranty shall be for 18 months from equipment delivery to the job site or 12 months from equipment handover, whichever comes first. In the event that it is determined that a defect exists, at the Manufacturer's discretion, the Manufacturer shall repair or replace the defective components, provided that any such defect was not the result of misuse of the component by the Owner or his agents.

The biotrickling filter Manufacturer shall warrant the plastic, synthetic media against defects in material and workmanship for five (5) years from equipment delivery. In addition, the manufacturer shall warrant the media against shrinking, swelling or plugging (such that the design airflow cannot be achieved) for a period of five (5) years. In the event that it is determined that a defect exists, at the Manufacturer's discretion, the Manufacturer shall repair or replace the defective components, provided that any such defect was not the result of misuse of the component by the Owner or his agents. The inability of the System blower (s) to provide the full design airflow will indicate failure of the media.

The biotrickling filter Manufacturer shall warrant that the irrigation spray nozzles shall remain clog and maintenance free for ten (10) years.

All System Warrantees are predicated on operation and maintenance of the System being in accordance with the Manufacturers written O&M manual and inlet conditions being in-line with these specifications. Demonstration of the above will be provided through written logs and records provided by the owner.

PART 2 - PRODUCTS

2.01 GENERAL

The odor control equipment supplied under this section must be provided by a single Manufacturer who will be solely responsible for the design, delivery and performance of

the system. The equipment must be new and unused and meet the detailed specifications and warranty requirements stated herein.

2.02 QUALITY ASSURANCE

The Manufacturer shall be an industry recognized process company specializing in the design, manufacture and operation of biological odor and air emissions equipment utilizing a once-through (non-recirculated) irrigation system.

The System Manufacturer shall have the following full-time employees on staff to ensure proper system support: mechanical engineer, environmental engineer, electrical engineer and a dedicated service department.

Any manufacturer whose main business is FRP manufacturing will not be accepted as a supplier for the odor control system specified herein.

The biotrickling filter Manufacturer is responsible for the coordination of all equipment specified herein. Systems shall be as manufactured by BioAir Solutions, LLC. or approved equal only. Proposal of an unnamed Manufacturer after the bid will not be considered.

A. Experience Requirements

The biological odor control system Manufacturer shall be experienced in the design, manufacture, installation and operation of biotrickling filters designed to remove hydrogen sulfide and organic RSCs from municipal water and wastewater odor sources. The System Manufacturer shall have a minimum of ten (10) years of experience producing substantially similar equipment and shall show evidence of at least twenty (20) systems (using the media specified herein) in satisfactory operation for at least five (5) years in the United States.

2.03 OPERATING CONDITIONS

The System shall be suitable to treat air coming from a continuous supply from the odor source and all equipment must be suited to the operating conditions to which it will be subjected and the various compounds/substances with which they will reasonably be expected to come into contact. The operating conditions, at a minimum, include the following:

Duty	Continuous air supply and odor source
Location	Outdoors
Inlet air temperature	55 – 100°F
Inlet relative humidity	60 – 100%
Contaminants	Hydrogen sulfide, organic RSC’s, ammonia.

2.04 DESIGN REQUIREMENTS

At a minimum, the System shall treat the following and meet the following minimum

performance criteria:

Number of vessels	One (1)
Flowrate	9,000 cfm
Design pressure drop across vessel	2.8 “w.c.
Contaminant concentration:	
Average hydrogen sulfide concentration	200 ppmv
Peak hydrogen sulfide concentration	400 ppmv
Irrigation water flow	80 gpm
Available Irrigation water pressure (dynamic)	65 psi

Performance requirements (H_2S):
The system shall have passed the performance test if either one of the following conditions is true:

- Average H_2S removal efficiency is ≥ 99% for inlet air H2S concentrations ≥ 50 ppmv but ≤ 400 ppmv
- Average Outlet H_2S concentration is ≤ 0.5 ppmv for inlet air H2S concentrations ≤ 50 ppmv

- *All control components located with 3 feet of odorous air/sewer gas shall be UL listed for Class 1, Div. 2 hazardous areas.*

2.05 SYSTEM COMPONENTS

A. Biotrickling Filter Vessel

The biotrickling filter vessel shall be free standing and of vertical “tower” configuration operating in a counter-current manner. Each vessel shall consist of one (1) or more modules containing EcoBase® plastic, structured media and one (1) top piece. Each module shall be constructed from Fiberglass Reinforced Plastic (FRP) and be designed with adequate strength to support the number of required modules. Each FRP module shall contain, as a minimum, a 100 mil vinyl ester resin corrosion barrier. The structural layer shall consist of isophthalic resin with chop strand and continuous glass. The exterior top coat shall be isophthalic resin with UV resistant pigment (minimum service life of 10 years). The exterior color shall be CCP base white enamel (W005).

Biotrickling filter vessels shall not provide access to any area beneath the media or any location within the vessel where there is a chance for dripping acidic filtrate or hydrogen sulfide gas.

The reactor vessels shall be provided with 316 stainless steel hold down lugs to account for all anticipated loads to comply with local wind code requirements.

B. Media

The structured media shall be high porosity, chemically resistant, engineered, plastic, synthetic porous material made from polyvinyl chloride, polyethylene or

polyurethane. Organic media, carbon derived lava rock or lava rock media and/or random synthetic or non-synthetic inorganic media materials shall not be allowed.

The media characteristics (available surface area, density, and pressure drop) shall be structured and uniform throughout the media bed with pre-manufactured, engineered flow channels. Random media types (chips, clay balls, foam cubes, etc.) shall not be allowed.

The media shall have a minimum available specific surface area of 230 ft^2/ft^3 and a void opening of more than 96%. Pressure drop shall not exceed 0.37" w.g. per ft of media depth.

The media shall be guaranteed not to clog or require cleaning, scrubbing, backwashing, acid-washing or replacement for a period of ten (10) years.

Media beds / stages shall be self-supporting, enclosed in a shell or otherwise removal as a single piece. Entry into the vessel shall not be necessary for media removal.

Media shall resist compaction or swelling due to varying moisture levels and shall not degrade when subjected to low pH (i.e. pH < 2) conditions.

The uniform structure of the media shall minimize the potential for short circuiting and encourage a uniform water and air flow pattern over the entire media cross sectional area.

The manufacturer shall provide evidence that the airflow through the media at 24" height from the bottom of the media is homogeneous at the average airflow rate. For purposes of this specification, homogeneous is defined as being when the upflow velocity over the entire media cross sectional area is equal to the average upflow velocity ± 10%. The airflow modeling results with velocity contour plots at 24" media height over the entire cross section shall be provided in graphical format as part of the Submittal requirements.

Sufficient media shall be provided to ensure the performance requirements listed in section 2.04 are met.

Media shall be pre-installed in the FRP module (s) by the system manufacturer prior to shipment to the job site. Medias that require a contractor for installation or placement are not permitted.

C. Irrigation System

Each reactor shall be configured with at least one (1) irrigation point which shall distribute the irrigation water evenly over the entire upper surface of the media layer.

The irrigation system, as designed, is a once-through system. Recirculated systems that meet the full requirements of this specification and can demonstrate the required experience may be considered for this application.

Spray nozzles shall be 316 Stainless Steel, without exception and shall be warranted to not clog or require maintenance for a ten (10) year period.

Each spray nozzle shall be tested by the Manufacturer and a certificate of conformity supplied with the shop drawings to show that the nozzle has been tested and meets the specified standards for uniform distribution.

Spray nozzle array systems with multiple nozzles, shall not be acceptable.

If applicable, the irrigation system shall be supplied with a nutrient addition system to provide the macro and micronutrients required by the bacteria for optimal metabolism of the odorous compounds being treated.

D. Control System

1. Electrical Control Panel (ECP)

The ECP enclosure shall be NEMA 4X and constructed of 316SS, and the panel shall come with a 316SS panel stand.

The ECP shall house the necessary electronic components and an Allen Bradley MicroLogix 1400 PLC with PanelView 800 (HMI) for the control and monitoring of the irrigation system. Dry contacts shall be provided for external notification of alarm status. Alarms, at a minimum, shall be provided for low irrigation water flow, high irrigation water flow, no nutrient flow (if applicable) and blower fail. An Ethernet connection shall be provided to allow for remote monitoring/control of the system. There shall be an allowance to manually open the irrigation spray valve (located in the water control panel) for the purpose of routine maintenance checks but the valve should be normally closed.

The system shall contain a PLC with an Ethernet/IP port, two (2) serial ports, on-line editing capability, a built-in backlit LCD screen, and a built-in high speed counter. The PLC shall be expandable with up to seven (7) additional input/output modules.

The ECP shall monitor and log water flow and provide the following summary –
Daily water consumption
Weekly water consumption, etc.

The ECP shall require a single electrical connection of 480V/3Phase/60Hz. Transformers shall be provided as necessary for power and control voltages. A 120 volt, GFCI convenience outlet shall be provided in the ECP.

2. Water Control Panel (WCP)

The Water Control Panel shall be constructed of 316SS and be mounted on the common 316SS panel stand, back-to-back with the ECP.

The WCP shall contain a panel heater, valves, motorized ball valves, strainers, instruments and piping for the control of the irrigation system and shall operate

from control signals from the ECP.

The WCP shall contain, without exception, a pulse generating, paddlewheel water flow meter. Irrigation water flow shall be monitored and recorded to ensure proper operation and aid in trouble-shooting. Monitoring irrigation water pressure alone is not acceptable.

The WCP shall allow for a single connection to either a potable water source or suitable final effluent plant water source.

The WCP shall house a nutrient addition system.

The WCP shall also contain a flexible spray hose with a hand trigger to allow for convenient rinsing of the strainer, filling of the nutrient barrel, and general convenience. A dedicated ball valve shall be provided in front of the spray hose to allow for the operation of the water panel while simultaneously allowing for isolation in case of a leak in the hose.

3. Automatic Flow Control System

Without exception, the ECP and WCP shall contain the necessary programming, circuitry, and hardware for an Automatic Flow Control System, which shall have the following features and shall be capable of meeting the Automatic Flow Control System performance test outlined in Section 3.05.E:

a. The system will periodically monitor the irrigation water flow rate during the irrigation sequence.
b. If the irrigation water flow rate is outside of the target flow range the irrigation valve will automatically adjust to correct the irrigation water flow rate.
c. The following parameters shall be operator-adjustable:
    1. Target irrigation flow rate
    2. Allowable flow error
    3. Amount of valve adjustment when error is detected
    4. Flow evaluation period
d. The following non-adjustable readings shall be shown on the ECP HMI:
    1. Instantaneous irrigation water flow rate
    2. Actual irrigation valve open %

The following will NOT be considered to be meeting the Automatic Flow Control Systems requirements:

a. Systems using irrigation valves that are only capable of fully-open or fully-closed operation. Solenoid Valves do not meet this requirement and are not allowed.
b. Systems using mechanical-only means of adjusting the irrigation water flow such as manual diaphragm valves, globe valves, pressure reducing or adjusting valves.
c. Systems that require operator interaction in order to correct the irrigation water flow.

E. Odor Control Blower

1. The blower(s) shall be single-width wheel, single-inlet as designed and manufactured by Verantis, The New York Blower Company or approved equal.

2. The blower shall be constructed such that all surfaces in contact with the odorous airstream are to be made of corrosion resistant FRP.

3. All nuts, bolts and fasteners in contact with the gas stream shall type 316 SS.

4. Blowers shall be AMCA Arrangement 9 or 10. AMCA Arrangement 4, which places the motor shaft in the odorous airstream, is not allowed.

5. Blower ratings shall be based on tests made in accordance with AMCA Standard 210 and licensed to bear the AMCA Certified Ratings Seal for Air Performance. Blowers not licensed to bear the AMCA Seal for performance shall be tested, at Contractor's expense, in an AMCA Registered Laboratory.

6. Blower shall be constructed in accordance with ASTM D-4167 standard specification for FRP blowers and blowers to ensure structural integrity.

7. Blower housing shall be constructed of polyester resin.

8. Wheel shall be radial, or backwardly-inclined, non-overloading design. Wheel shall be fabricated of vinyl ester resin.

9. Wheel hub shall be securely fastened to the shaft and completely encapsulated in FRP to ensure corrosion-resistant integrity. Wheels shall be ground and polished carbon steel, encapsulated in FRP.

10. The blower motor shall be a standard efficiency, explosion proof, 480V/3Phase/60Hz electric motor as manufactured by US Electric Motors, Baldor, Reliance or approved equal.

11. Blower shall be equipped with a Teflon shaft seal.

F. Recirculating Irrigation Systems (if provided)

At a minimum, recirculating irrigation systems shall include the following:

1. Each unit shall have a recirculation pump that is suitable for pumping blowdown from the bottom of the biotrickling filter through the water panel and back to the top of the media. The recirculation pump shall be a horizontal, magnetic drive, seal-less, centrifugal-type pump composed of CPVC, polypropylene or FRP for corrosion resistance and long service life. No seal water shall be required. The pump shall be suitable for solutions having a pH ranging from 1 to 4 and shall have a stainless steel one (1)-piece rotor drive shaft covered with a one (1)-piece sleeve and impeller. Pump shall NOT have any liquid to metal contact, seals, pump bearings, bushings, or wearing parts.

2. Two, Duty/Standby, recirculation pumps shall be provided, controlled and automatically rotated by the odor control Electrical Control Panel. Duty/Standby rotation shall be operator adjustable.
3. All pumps will be statically and dynamically balanced at the factory.
4. Pumps shall be Vanton Chem-Gard or pre-approved equal.
5. All recirculation system piping conveying low pH irrigation water shall be double containment piping, such as Pro-Lock™.
6. Pressurized, low pH irrigation systems shall include an automatic leak detection system able to shut down the recirculation pump in the event of a leak.

Recirculating systems shall be provided with a combination emergency shower and eyewash station (to be installed by the Contractor).

2.06. EQUIPMENT NAME PLATES

Each separate piece of equipment shall be furnished with a unique name plate identifying the Manufacturer, model & serial number, date of manufacture and, if applicable, capacity and any performance limitations. The nameplates shall be Gravograph Gravoply 2 ply plastic and firmly affixed to the exterior surface of the equipment and in a location that is accessible and easily read.

2.07. SPARE PARTS

At a minimum, the following spare parts shall be supplied with the equipment.
One (1) set of fuses, one (1) for each fuse rating.
One (1) set of lamp lenses.
One (1) strainer.
Spare parts shall be stored, by the Contractor, on site and shall be handed over to the Owner at equipment handover.

PART 3 - EXECUTION

3.01 FACTORY ACCEPTANCE TEST

A. Reactor Vessel

FRP reactor vessel shall be inspected prior to shipping for conformance to the following:

1. Dimensions match those shown on submittal drawings and are within Manufacturer's specified tolerances.

2. Flanges and connections between reactor parts fit securely without improper bending or stressing of parts.

3. Damage or imperfections to paint or fiberglass work, including cracking/crazing are minimal and in accordance with FRP specifications in Section 2.05A.

4. Manufacturer shall keep a record of the quality control document for each reactor vessel(s) that is available to the Engineer upon request.

B. Electrical Control Panel

Electrical control panel shall be inspected prior to shipping for conformance to the following:

1. NEMA rating according to Section 2.05D and bear the UL508 label.

2. PLC program and HMI shall be tested for proper communication and functionality.

3. PLC digital and analog inputs shall be electrically tested to ensure input recognition in the proper area of the PLC program.

4. All wiring between panel components and terminal strips shall be checked for proper labeling and connection.

C. Water Panel

All water panel piping and/or other pre-installed piping shall be tested prior to shipping for conformance to the following:

1. System shall have no leaks when subjected to a pressure test at 80 psi for a minimum of 1 hour.

2. All installed instruments, sensors, pumps, actuated valves, and other electrical components shall be tested for proper operation.

3. All wiring from terminal strips to all electrical components shall be tested to ensure proper wiring.

D. Spray nozzle

Spray nozzle shall be factory tested to ensure compliance with Manufacturer standards for uniform distribution.

E. Factory Acceptance Test (FAT) log

Prior to release for shipment, the Manufacturer shall Submit to the engineer for approval the results of the FAT demonstrating that Testing is complete and that the controls are ready for shipment and installation.

3.03 INSTALLATION & EQUIPMENT STARTUP

As far as is reasonably possible, all equipment should be pre-assembled prior to shipment, to minimize the need for on-site assembly. Media should be pre-installed by the Manufacturer and certified to meet the specified performance requirements.

Installation of all equipment will be conducted by the Contractor and must be in accordance with Manufacturer’s written installation and startup instructions and by workers experienced in the handling of fiberglass vessels, electrical work, plumbing and

instrumentation. The final installation must be certified by the Manufacturer as complete and correct.

The Manufacturer shall provide the Contractor with required clearances, tolerances and limitations, such as smoothness/flatness of concrete pad and shall be available to answer questions prior to and during the installation of the equipment.

Once the installation has been certified by the Manufacturer, the Contractor, with assistance from the Manufacturer, shall start the System to begin the biological acclimation period. This startup period shall take no longer than six (6) weeks but at any point during this startup period, at the discretion and direction of the Manufacturer, the contractor shall switch the system over to normal operation. Any minor re-piping or plumbing required will be clearly detailed in the Manufacturer's installation and startup manual and will be performed by the Contractor.

Any special tools or materials required for this startup/acclimation period shall be provided by the Manufacturer.

After satisfactory startup and the corresponding switch over to normal operation, the Contractor shall, in the presence of the Engineer, conduct the performance test as detailed in section 3.05 below.

3.04 FIELD PAINTING & CORROSION PROTECTION

If painted surfaces are damaged during shipment, off-loading or installation, as long as the damage is surface only and in no way affects the integrity of the equipment or its ability to perform, these blemishes, scratches or other imperfections shall be touched up by the Contractor in accordance with instructions from the Manufacturer. Materials used shall me compatible with the original coating material in quality and color.

3.05 PERFORMANCE TESTING

Performance testing shall not commence until the Manufacturer and Engineer agree that they system has been satisfactorily started-up and sufficient time has been allowed for the acclimation of the bacteria.

After the odor control system has been satisfactorily started-up and switched to normal operation, the Contractor shall, in the presence of the Engineer, demonstrate that the system will perform as specified in section 2.04 of this specification.

The Contractor shall provide the Engineer with a written test protocol and the performance test may not be conducted until the test protocol has been reviewed and approved by the Engineer.

The Manufacturer may be present during the performance test and, at its own discretion, may conduct a parallel performance test as long as they do not interfere with the performance test being conducted by the Contractor.

The Contractor shall supply, install and operate all equipment, sensors and instrumentation required to complete the performance test.

A. H_2S Testing procedure

1. Measure airflow into each unit and, if necessary, adjust to the design airflow of 9,000 cfm +/- 10%. Airflow balancing can be conducted by BioAir and witnessed by the Engineer and/or Contractor if desired. Airflow shall be measured at the beginning of the test period. The set position on the damper(s) will be marked or noted. Airflow will not change as long as damper(s) remain in position.

2. Measure pressure drop across each biotrickling filter at beginning of test period.

3. Measure temperature of the inlet, outlet and ambient air.

4. Performance test period to begin at a noted time and last for four (4) hours. H_2S data from the common inlet location and from the outlet of each odor control system will be measured and logged once every 10 minutes to demonstrate performance during test period.

    a. The inlet H_2S data will be logged with a pre-calibrated OdaLog gas data logger with appropriate range and accuracy for the inlet air stream (0-1000 ppmv or 0 - 200 ppmv range, 1 ppm display resolution or 0.0 - 50.0 ppmv range, 0.1 ppmv display resolution).

    b. The outlet H_2S data will be logged with a pre-calibrated OdaLog gas data logger with appropriate range and accuracy for the outlet air stream. (0.00 - 2.00 ppmv range, 0.01 ppmv display resolution or 0.0 - 50.0 ppmv range, 0.1 ppmv display resolution).

B. H_2S Acceptance criteria:

The System's H_2S removal efficiency shall be determined by calculating the average inlet H_2S concentration and the average outlet H_2S concentration and using the following formula: H_2S removal efficiency (%) = (1 – (average outlet H_2S concentration/average inlet H_2S concentration)) x 100. The system shall have passed the H_2S performance test if the H_2S removal efficiency is 99% or more for inlet air H_2S concentrations ≥ 50 ppmv but ≤ 400 ppmv, or the average outlet air H_2S concentration is ≤ 0.5ppmv, whichever is greater.

In the event that the average inlet H_2S concentration during the four (4) hour test period exceeds the specified aveage inlet H_2S concentration as listed in this Specification, or the maximum inlet H_2S concentration during the four (4) hour test period exceeds the specified maximum inlet H_2S concentration as listed in this Specification, the H_2S acceptance criteria shall not apply and the system shall be considered to have passed the performance test.

C. Automatic Flow Control System testing procedure

In the presence of the Engineer, the Manufacturer shall demonstrate the operation of the Automatic Flow Control System as given below.

1. Review the requirements list given in Section 2.05.D.3 and prove or demonstrate compliance with each point.
2. The following procedure shall be followed for each irrigation valve in the system. The cycle time shall be minimized to allow the procedure to be completed within 30 minutes.
   a. Open all manually controlled valves allow for maximum flow through the WCP. Set the target irrigation flow rate to 3x the normal irrigation flow rate (to allow the irrigation valve to fully open). Demonstrate that the valve will reach 100% open status within 20 s during irrigation.
   b. In between irrigation cycles, while the irrigation valve is CLOSED, set the target irrigation flow rate to the proper design irrigation flow rate. Demonstrate that the irrigation valve will automatically close in order to reach the design flow rate within 30 s during its next irrigation cycle.
   c. Repeat steps a. and b. above for a minimum of 3 additional set points both above and below the normal target irrigation flow rate.
   d. Set the target irrigation flow rate to the normal target irrigation flow rate. Partially close at least one valve upstream of the modulating ball valve and demonstrate that the irrigation valve will automatically adjust to a more open position in order to reach the design flow rate within 30 s during its next irrigation cycle.
   e. Return all Automatic Flow Control settings to their normal positions and fully open all upstream and downstream valves. Demonstrate that the system will return to normal flow control operation.

3.06 MANUFACTURER'S SERVICES

In addition to being available by phone to assist the Contractor during the offloading, installation, and startup of the equipment, the following Manufacturer's services shall be provided with the number of trips and days on site as a minimum.

Startup assistance	One (1) trip, two (2) days on site
Performance testing assistance/training	One (1) trip, one (1) day on site

Notwithstanding the above, the Manufacturer shall continue to assist the Contractor with questions, issues and remote assistance until the system is properly installed, running satisfactorily and handed over to the Owner.

END OF SECTION

SECTION 11800
FINE BUBBLE DIFFUSERS

PART I – GENERAL

1.01 GENERAL REQUIREMENTS

A. The Contractor shall furnish all labor, materials, tools, equipment, and supervision required to install the Fine Bubble Aeration Diffuser Systems equipment, as indicated on the Drawings and specified herein, and all other work incidental thereto, except as otherwise noted.

B. The work under this section is intended to include the necessary materials and workmanship that are required for the completion of this equipment, as shown on the Drawings, unless otherwise specified.

C. The work shall be complete and ready for satisfactory operation whether or not each and every item is shown on the Drawings or specifically mentioned in these Specifications.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 1 specification Sections, apply to this Section.

B. Additional requirements related to work specified in this Section include, but are not limited to, the following:

1. Section 09900: Painting and Special Coatings
2. Section 11005: Process Equipment General Requirements
3. Section 11500: MBR System
4. Section 11600: Positive Displacement Blowers
5. Section 15200: Process Piping and Valves

1.03 SCOPE OF WORK

A. This section includes the fine pore aeration system including in-basin aeration components as shown on the Drawings and as specified herein to support the design, manufacture, installation and start-up of a flexible membrane biological wastewater treatment system.

B. The aeration system manufacturer shall provide single source responsibility for the complete aeration system including in-basin piping, diffuser assemblies and support components.

1.04 DEFINITIONS

A. Tank: Vertical walled reactor within which aeration occurs.

B. Diffuser Unit: Fabricated unit including diffuser support frame and flexible membrane which releases air to the water.

C. Diffuser Assembly: Fabricated assembly including diffuser units and assembly mounting

components.

D. Air Drop Pipe: Vertical piping section from out-of-basin header stub to in-basin aeration system.

E. Air Manifold Piping: Air distribution piping from drop pipe to air distribution headers.

F. Air Header Distribution Piping: Air distribution piping from air manifold and diffuser assemblies.

G. Air Header Piping: Out-of-basin air distribution piping from the blower building to the header stubs.

H. Blower Manifold Piping: Air distribution piping between the blower discharge and air header piping.

I. Aeration Grid: Associated piping and diffuser components connected to a single drop pipe.

J. Standard Cubic Feet per Minute (scfm): Air at 68°F, 14.7 psia and 36% relative humidity.

K. Maximum Pressure: Pressure in blower manifold piping at the specified airflow rate.

L. Oxygen Transfer Efficiency: Percent of oxygen in the air stream that is dissolved to the wastewater under specified conditions of temperature, barometric pressure, airflow rate, and dissolved oxygen concentration.

M. Standard Oxygen Transfer Efficiency: Percent of oxygen in the air stream that is dissolved to clean water under conditions of 68°F, 14.7 psia, and zero dissolved oxygen.

N. Air Distribution Uniformity: Variation in air distribution between diffuser assemblies.

1.05 SYSTEM DESCRIPTION

A. Design Requirements:

1. Design in-basin air piping and diffusers to diffuse air throughout the aeration tank(s) in accordance with the specifications.

2. Design each diffuser assembly to provide uniform air release over the specified airflow range.

3. Design the aeration system to provide the specified oxygen transfer at the specified conditions.

1.06 QUALITY ASSURANCE

A. The equipment manufacturer shall modify his standard equipment to meet the minimum values specified for dimensions, design and the intent of this specification.

B. Manufacturers shall be regularly engaged in the manufacture of the Process Tanks Aeration Diffuser equipment as specified herein and who can demonstrate a minimum of 10 equipment installations of this specified design, in actual service for a period of not less than 5 years.

1.07 SUBMITTALS

A. General:

A detailed engineering submittal package shall be provided in sufficient detail and scope to confirm compliance with the requirements of this section. Submittals shall be complete for all required components. Partial submittals will not be accepted.

B. Shop Drawings:

1. Detailed layout drawings for in-basin aeration components. Layout drawings shall include:
   a. Layout and configuration of aeration system.
   b. Detail drawings of diffuser assemblies showing components, method of construction, and attachment mechanism to air header distribution piping.
   c. Detail drawings of all piping connections including drop to manifold, manifold to header and inline connections for manifold and headers.
   d. Detail drawings of pipe support components.

C. Product Data:

1. Detailed listing of materials and materials of construction.

2. Product literature.

3. A complete bill of materials.

4. Detailed list of any exceptions taken to these specifications. Include specification reference and proposed alternative with reason stated for exception.

D. System Design and Performance Data:

1. The recommended minimum, average, peak, and maximum air flow per diffuser.

2. Design AOR (actual oxygenation rate) to SOR (standard oxygenation rate) calculations according to EPA method for fine bubble diffuser design showing air flow rate in SCFM and SOTE at the design conditions listed in this specification for the following:
   a. Average AOR
   b. Peak AOR

3. Design calculations according to the EPA method for fine bubble diffusers showing AOR for the proposed system at the design conditions listed in this specification for the following:
   a. Minimum air flow rate per diffuser
   b. Maximum air flow rate per diffuser

4. A curve showing the oxygen transfer efficiency of the proposed system for air flux rates between the minimum and maximum air flow rates per diffuser at design conditions.

5. Include complete air headloss calculations for the aeration equipment from the top of the dropleg to the farthest diffuser bubble release point.

6. Design calculations showing uniform air distribution (+10% maximum variation)

between any two diffuser units.

7. Design calculations for piping and support components.

8. Quality Assurance Testing:
   a. The membrane diffuser shall be sampled and tested for air distribution uniformity, dynamic wet pressure, and dimensional tolerances.
   b. Test samples shall be selected from the membrane lots to be used on the project. A minimum of 1% random samples shall be selected from each lot.
   c. Sampling and testing shall be conducted in the supplier's shop.
   d. Dynamic wet pressure and dimensional tolerance test samples shall be drawn from the sample lot selected for uniformity testing.
   e. Test diffuser elements for dynamic wet pressure by submerging a diffuser unit at least two inches in tap water and operate at an air rate equal to the design maximum flow rate per diffuser ±10%. DWP values shall be within ±10% of average value. DWP is defined as the pressure to operate at the specified conditions minus submergence and flow control losses.
   f. Dimensional Tolerances:
      All supplied equipment shall be manufactured within dimensional tolerances that ensure proper operation of the supplied equipment.

9. Endurance Testing:
   a. Certified endurance test data shall be supplied for the diffuser units proposed in accordance with the following test conditions:
      i. Operate diffuser unit while submerged 12 inches in clean water through at least 500,000 cycles on/off shall be supplied.
      ii. The flux rate for endurance testing shall be at least twice the design flux rate of the system.
      iii. Cycles shall be at least 5 second duration.
      iv. Membranes shall retain initial headloss, dimensional tolerances, SOTE and visual characteristics.

10. Shop Oxygen Transfer Test
   a. Conduct a performance test to demonstrate capability of the aeration equipment to meet the specified oxygen transfer requirements.
   b. Base all tests on the following criteria:
      i. A minimum of 3 tests for each specified condition in complete accordance with ASCE Clean Water Test Procedure (1992 or latest edition)
      ii. Conduct tests by an independent aeration testing firm in a full scale aeration test tank (minimum of 200 ft².) at the specified submergence and water depth with a diffuser density equivalent to the specified tank configuration. Diffuser density is defined as the ratio of the total tank surface area to the total active diffuser surface area.
      iii. Conduct shop test with air rate and mass rate of oxygen transfer directly proportional to the ratio of the shop test tank volume and the design tank volume.
      iv. Plot of pounds of oxygen per day per 1000 cubic feet of tank volume versus air per 1000 cubic feet of tank volume in tap water at 14.7 psia, 20°C and zero dissolved oxygen at the specified submergence.
   c. Certify and stamp all tests by a Professional Engineer in the state where

the manufacturer is based.

d. Include all costs for testing (exclusive of witness's expenses) in the equipment price. All tests may be witnessed at Owner/Engineer option. Cost of travel and living expenses for Owner/Engineer to be paid by the Owner.

e. Submit all test data from oxygen transfer tests for approval by the Engineer prior to manufacturing equipment.

11. Product Experience:

a. The supplier shall have experience in the design, manufacture, supply and commissioning of fine pore, flexible membrane aeration equipment identical to the type specified for this project.

b. The equipment submitted shall be of proven design and shall be referenced by at least three installations of similar size and treatment technology, having been in successful operation for a period of not less than five (5) years prior to bid date.

12. Warranty:

All equipment and workmanship furnished under this contract shall be guaranteed to be free of defects in materials and workmanship for a period of two (2) years from the date of system start-up or thirty (36) months from the date of shipment, whichever occurs first. Any such defects, which occur within the stipulated guaranty period, shall be repaired, replaced or made good at no cost to the OWNER.

E. Installation Instructions:

1. Installation requirements and guidelines for all proposed equipment shall be provided.

2. Design air distributors with centerline spacing not to exceed 4 feet to maximize oxygen transfer efficiency and mixing efficiency to minimize solids deposition between air distributors.

3. Information on the aeration system shall include but not be limited to:

a. Diffuser unit assembly.
b. Diffuser assembly attachment.
c. Piping components and assembly.
d. Piping support components.
e. Any other information required to properly install the system provided.

F. Certification and Testing

Prior to start-up the Manufacture shall certify, in writing, that the completed installation is in accordance with his recommendations.

G. Operation and Maintenance Data:

1. Operations and maintenance data for all proposed equipment shall be provided.

2. A testing plan designed to ensure consistently good quality and uniformity of the aerator assemblies.

3. Information on the aeration system shall include but not be limited to:

a. Air flow balancing.
b. Diffuser assembly operations, maintenance, cleaning, and membrane replacement.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

The following manufacturers are acceptable provided they meet the requirements of this specification.

- Sanitaire, Xylem
- Or equal.

2.02 MATERIALS AND FABRICATION

A. Welded Stainless Steel Components:

1. Sheets and plates of Type 316 stainless steel with 2D finish conforming to AISI 304 and ASTM A240, 554, 774, and 778.

2. Limit carbon content to 0.30% maximum.

B. Non-welded Stainless Steel Components:

1. Sheets and plates of Type 316 stainless steel conforming to AISI 304 and ASTM A240, A276, 554, 774, and 778.

C. Fasteners and Anchorage Components:

1. 316L series stainless steel.

D. PVC Pipe and Fittings (Schedule 80):

1. Base material shall be ASTM D-1784.

2. Pipe shall be manufactured in accordance with ASTM D-1785 and ASTM D-2665 and shall have a minimum tensile strength of 7000 psi.

3. Factory solvent weld all PVC joints and fittings.

E. EPDM Membrane Diffusers and Gaskets

1. Manufacture membrane diffuser with integral O-ring of EPDM synthetic rubber compound with precision die formed slits. Thermoplastic materials (i.e. plasticized PVC or polyurethane) are not acceptable.

2. Add carbon black to the material for resistance to ultraviolet light.

3. Design diffuser as a one piece injection molded part.

4. Limit the maximum tensile strength of the diffuser to 10 psi when operating at 2.4 SCFM/ft² of material. Furnish proportionately thicker material for larger diameter diffusers to limit the maximum tensile stress and to resist stretching.
5. Produce diffusers free of tears, voids, bubbles, creases or other structural defects.

6. Furnish diffuser material to meet the following:

Item	Value/Units	ASTM
Base Polymer	EPDM	D573
UV Resistance	Carbon Black	
Specific Gravity	1.25 or less	
Durometer – Minimum	58% ± 5%	D2240
Modulus of Elasticity	500 psi	D412
Ozone Resistance (72 hrs: 40°C pphm)	No cracks @ 2X magnification	D1171 Test A
Tensile Strength	1200 psi	D412
Elongation - % - Retained 70 hrs @ 100°C - minimum at break	 75% Max 350%	 D573 D412

7. Quality Control – Test diffuser using primary sampling criteria outlined in Military Standard 105E.

i. Welds & Welding Procedure

1. Weld in the factory with ER 316L filler wire using MIG, TIG or plasma-arc inert gas welding processes. Provide a cross section equal to or greater than the parent metal.

1. Provide full penetration butt welds to the interior surface with gas shielding of interior and exterior of joint.

2. Continuously weld both sides of face rings and flanges to eliminate potential for crevice corrosion.

ii. Corrosion Protection and Finishing

Clean all welded stainless steel surfaces and welds after fabrication by using the following procedure:

a. Pre-clean all outside weld areas to remove weld splatter with stainless steel brushes and/or deburring and finish grinding wheels.

b. Finish clean all interior and exterior welds and piping by full immersion pickling and rinse with water to remove all carbon deposits and contaminants to regenerate a uniform corrosion resistant chromium oxide film per ASTM A380 Section 6.2.11, Table A2.1 Annex A2 and Section 8.3.

c. Corrosion protection techniques not utilizing full immersion methods are unacceptable and will be cause for rejection of the equipment.

2.03 AERATION EQUIPMENT

A. System Performance:

1. The aeration-mixing system(s) shall be designed per basin to meet the following conditions:

System Name	Aeration Diffuser Grid
Peak AOR	81.9 lbs O_2/hr
Average AOR	68.3 lbs O_2/hr
Peak Dissolved Oxygen Concentration	5 mg/L
Average Dissolved Oxygen Concentration	2 mg/L
Minimum SOTE	2% per foot submergence
Minimum Wastewater Temperature	20 ° C
Elevation	35 feet
Number of Basins	2
Basin Length	39 feet
Basin Width	29.75 feet
Side Water Depth	19.5 feet

Note: Each Aeration Basin shall be provided with a minimum of 225 sq ft of active diffuser surface area

B. Flexible Membrane, Fine Pore Diffusers:

1. The diffuser unit shall be fully capable of operating under continuous or intermittent conditions and shall be designed with check valve capabilities to prevent entry of mixed liquor into the diffuser unit or air piping on air shutdown or interruption of air supply.

2. Membrane shall be elastic and allow openings to close when the air supply is interrupted.

3. Use of independent or internal check valve components is not acceptable.

4. Diffuser assemblies shall be completely factory assembled.

5. Field solvent welding or assembly of diffuser unit is not acceptable.

6. Diffuser assemblies shall be shipped to the jobsite assembled and properly crated and protected for shipment and handling.

C. Aeration System Piping:

1. Out-of-basin air piping including blower manifold, air header, header stubs, and drop leg isolating/balancing valve are required and are to be supplied by others.

2. Drop pipe shall be provided with a flanged top connection
   a. Drop pipe shall extend to the isolating/balancing valve bottom flange.
   b. Material of construction for the drop pipe shall be 316 stainless steel Sch. 5 to the aeration manifold connection

3. All submerged manifolds and header components shall be PVC Schedule 80 minimum. Use of PVC piping shall only be employed when diffuser mounting system reinforces pipe wall at each mounting location.

4. Pipe supports shall be 316 stainless steel construction.
   a. Supports shall accommodate longitudinal movement in the piping components due to the thermal expansion and contraction over a temperature range of 125°F.
   b. Supports shall restrain the axial and rotational movement of the pipe

while providing for unrestrained longitudinal movement.

c. Supports shall allow leveling of the air piping with 2 inch minimum vertical adjustment at each support.

d. Each pipe support shall be connected to basin floor by at least 2 anchor bolts.

e. The integrated pipe support assembly shall be designed to withstand the associated uplift force of the piping and diffuser assemblies with a minimum design factor of safety equal to ten (10).

f. In no case shall be the spacing between supports exceed 6 ft.

D. Spare Parts:

1. The CONTRACTOR shall furnish one (1) year worth of spare parts in addition to the following and store as directed:

a. Five diffuser assemblies completely factory assembled.

b. Ten replaceable membranes to be installed on existing diffuser assemblies including any hardware or clamps required for membrane replacement.

c. Five air distribution supports.

d. Furnish any manufacturer's recommended spare parts.

PART 3 – EXECUTION

3.01 EXAMINATION

A. The Manufacturer shall examine areas, foundations, and conditions with CONTRACTOR and ENGINEER present for compliance with requirements, installation tolerances, and other conditions affecting performance of the fine bubble membrane grid aeration system. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. The Manufacturer shall prepare a written report, endorsed by the CONTRACTOR, listing dimensional discrepancies and conditions detrimental to the performance of the fine bubble membrane grid aeration system and the date of correction.

3.02 ERECTION

A. Follow equipment manufacturer's recommendations for sequencing of equipment installation.

B. Layout and install support anchors in accordance with equipment manufacturer's recommendations and anchor setting plan.

C. Level aeration system such that all diffusers connected to a header are within plus or minus 1/4 inch of a common horizontal plane.

D. CONTRACTOR shall provide all valves, air header piping, wall sleeves with seals, wall pipes, and concrete pedestals as necessary to complete the system as shown on the plans.

E. Air piping including blower manifold, header, and in-basin piping must be clean prior to delivering air up the diffusers.

F. CONTRACTOR shall be responsible for cleanliness of piping and may be required to manually clean pipe, or air or water flush piping as required.

3.03 START-UP

A. After installation is completed, the CONTRACTOR shall perform the following field tests in the presence of the ENGINEER and the OWNER.

1. Fill the reactor to the bottom of the diffuser assemblies.

2. Adjust the pipe supports and diffuser assemblies such that all diffuser units are installed within ±1/2 inches of the design diffuser elevation.

3. Fill the reactor to a level of 2 feet above the top of the diffusers.

4. Release air to the system and inspect the system for air leaks at all piping or diffuser connections.

5. Check all membrane for cuts or tears that may have occurred during the installation.

6. Adjust any piping or diffusers that show leaks or disproportionate amount of airflow.

7. Operate the blowers at the design air rate and observe air release and air distribution patterns.

8. All water, air, power and labor associated with testing and adjustment of diffuser assemblies are to be supplied by CONTRACTOR.

3.04 PROTECTION OF FINISHED WORK

A. The fine bubble membrane grid aeration system must be cleaned upon completion of erection.

B. Provide protective coverings, barriers, devices, signs, or such other methods or procedures to protect the work form damage or deterioration.

C. Maintain protective measures throughout remainder of construction period.

3.05 MANUFACTURER'S FIELD SERVICES

A. Provide services of a factory representative for two (2) days on-site to examine areas for compliance with requirements prior to installation.

B. Provide services of a factory representative for two (2) days on-site to verify the proper installation of the equipment.

C. Provide services of a factory representative for one (1) day on-site to instruct owner’s personnel on operation and maintenance.

D. Provide written certification that the equipment is properly installed.

END OF SECTION

SECTION 11900
BAFFLES AND SUPPORTS

PART 1 - GENERAL

This specification shall govern all work necessary to furnish and install the stainless-steel baffle system as required to achieve the objective of the Chlorine Contact Tank. The work to be done under this specification includes all labor, equipment and materials for the construction and installation of the stainless-steel baffle walls.

1.01 SCOPE OF WORK

A. Under this section of the specification, the Contractor shall provide and install baffles in the chlorine contact tank, including the baffle walls with flow diffusers, rotating bottom planks and supports as shown in the contract drawings and as described herein.

B. To assure system integrity and responsibility, this equipment shall be provided as an integral package by a single manufacturer regularly engaged in the production of this equipment who shall take responsibility for coordination of all components to assure proper functioning of the equipment as a system.

1.02 RELATED WORK

A. This Specification shall be used in conjunction with the following other specifications and related Contract Documents to form the complete requirements:

1. Division 1
2. Section 01300: Submittals
3. Section 01730: Operation and Maintenance Manual
4. Section 03300: Cast-In-Place Concrete
5. Section 03600: Mortar and Grout
6. Section 05500: Metal Fabrication
7. Section 09900: Painting and Special Coatings

1.03 SUBMITTALS

A. The Contractor shall provide product data, drawings and calculations as follows:

1. Basin design, layout and sections including inlet arrangement, baffles, and support structures.

2. A certificate of NSF-61 approval for the baffle walls that are being proposed. Certificates for materials only will not be acceptable

3. A statement of terms of the warranties

4. List of spare parts to be provided and kept on hand

5. All ancillary equipment to be provided by the manufacturer shall be listed.

6. Complete shop drawings of all equipment furnished including cut-sheets describing sub-components with the specific components highlighted.

7. Operation & Maintenance Manuals

1.04 DELIVERY, STORAGE AND HANDLING

A. Baffles and supports shall be shipped on flat bed trucks to allow access by crane provided by the Contractor.

B. Equipment shall be stored and protected in accordance with the manufacturer's recommendations.

C. The Contractor shall provide a complete submittal documentation package including material specifications, product data, and shop drawings, installation instructions and installation drawings in accordance with the Submittals Section.

1.05 SKILLED SUPERVISION

A. Manufacturer shall have a skilled representative available for installation, supervision and start-up services as specified.

1.06 QUALITY ASSURANCE

A. Basis of Design

1. Award for this project shall be based on the baffle system as shown on the Drawings and listed in these Specifications.

2. Any costs resulting from changes to the structure, piping etc., required for alternate equipment shall be borne by the CONTRACTOR.

B. Acceptable Manufacturers

1. Baffle system as manufactured by Meurer Research, Inc. or approved equal.

1.07 SUPPLIER QUALIFICATIONS AND EXPERIENCE

A. Manufacturer shall have been in continuous business for a period of at least 15 years, engaged in the manufacture of water treatment equipment for municipalities.

B. The manufacturer shall provide a reference list of at least twenty (20) all stainless steel baffle system installations of a design complying with these specifications and used in municipal applications. Provide names and phone numbers of at least five references in operation for at least five years to be contacted. This minimum level of experience shall also require the manufacturer to demonstrate to the satisfaction of the Engineer that the manufacturer has served as the primary engineering designer for the equipment under consideration and that the manufacturer has performed all of the fabrication and manufacturing functions related to the equipment being offered to meet the experience clause.

1.08 GUARANTEES

A. The manufacturer shall guarantee all components including buy-out items for a period of twelve (12) months commencing from the date the equipment is put into service, or eighteen (18) months from delivery of the equipment, whichever comes first.

PART 2 – PRODUCTS

2.01 DESIGN AND SCOPE OF WORK

A. General

1. Under this section, the Contractor shall provide and install baffles as shown in the contract drawings and as specified herein.

2. The baffle system shall comprise structural support members including columns and beams, rotating bottom planks, all necessary fasteners, appurtenances and baffle planks. All structures, baffle planks, and fasteners shall be manufactured of type 316 stainless steel.

2.02 PROCESS DESIGN AND CONDITIONS

A. Design Conditions

1. Design flow rate: 3 MGD
2. Peak flow rate: 9 MGD
3. Number of basins: 2
4. Number of baffles per basin: 1
5. Size of baffles: 9’-0” tall x 6’-0” long
6. Number of distribution ports per basin: 24
7. Size of distribution ports: 5” x 3”

2.03 PRODUCTS

A. All components of the baffle system shall be designed and fabricated by a single manufacturer to insure a uniform and finished appearance as well as component compatibility and overall structural integrity.

B. Each plank shall be installed without the need of drilling or fastening. The panels shall be removable without the need of loosening fasteners or any other mechanical device.

C. The planks shall be supported in a channel shaped frame on each end. Such frame shall hold the baffle planks for maximum strength and load bearing capability. The channel frames shall be manufactured of T-316 stainless steel and be integral with the baffle planks.

D. The baffle panel size shall be as indicated in the drawings. The planks, when mounted in their structural support system, shall be square and accurately sized to minimize gaps between the frame members and said panels.

E. The bottom plank of each baffle section shall be hinged at the top, so it can rotate to an open position and allow the Hoseless Sludge Collector scrapers to pass through and remove any settled solids that may accumulate there.

2.04 PHYSICAL PROPERTIES

A. General

1. The baffle system shall be certified by NSF under ANSI/NSF Standard 61. The baffle manufacturer shall provide proof of NSF certifications

B. Baffle Planks

1. The baffle planks shall be formed of type 316 stainless steel sheets, having a thickness to be determined by the manufacturer.
2. Each plank shall be manufactured with an edge thickness of not less than 1 ½ inches.
3. The stainless steel shall have the following properties:
4. Tensile strength (psi) 80,000
5. Yield strength (psi) 35,000
6. Modulus of elasticity ($lb/in^2 \times 10^6$) 29
7. Hardness (min) 160
8. The bottom plank shall be hinged at the top to allow the plank to “rotate” forward and back to allow the Hoseless Sludge Collector to enter the area behind the distribution wall and remove any settled solids that may have accumulated there.

C. Supports

1. The baffle supports shall consist of T-316 stainless steel columns to which are attached channel shaped members manufactured to exactly fit the baffle panels and hold them securely without excess movement during operation. Said channels shall allow the baffle planks to slide freely into place and shall be specifically manufactured for this purpose. If planks are attached to concrete columns or concrete walls, the support channels shall be provided for purpose of securing panels to the concrete as required.

2. The support columns shall be designed to support the baffle design load. The columns shall be attached to the floor or the wall of the basin by means of specified concrete anchors.

2.05 Design Properties:

A. The baffle wall(s) shall be manufactured so as to withstand a loading of 2.5 inch water differential.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Care should be taken during storage and installation of the baffles to protect them from environmental extremes, iron contamination and highly concentrated loads.

B. All equipment shall be installed in accordance with approved shop drawings, manufacturer's instructions, and local codes.

C. The method of installation shall be outlined by the baffle manufacturer.

D. The Contractor shall make all necessary changes, modifications, and/or adjustments required to assure satisfactory operation.

3.02 INSPECTION AND START-UP

A. The equipment manufacturer shall provide the services of a qualified factory service technician prior to initial operation and testing to inspect the installation and certify that the equipment has been installed in accordance with their recommendations.

B. Include one trip of a minimum of two (2) eight-hour days for inspection, startup, adjustment and training.

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END OF SECTION

SECTION 13050
RECTANGULAR ABOVE GROUND
DIESEL FUEL STORAGE TANKS AND PIPING

PART I – GENERAL

1.01 SCOPE

The work of this section includes all labor, materials and equipment required for the installation and testing of the fuel storage and piping system complete and ready for operation. The system will include a new aboveground fuel storage tank, fuel piping system, fuel storage tank level gauge system and accessories.

1.02 RELATED WORK

A. Related work specified in other sections:

1. Section 16231: Electric Standby Generator

1.03 REQUIREMENTS OF REGULATORY AGENCIES

A. All work shall conform to the applicable requirements of the city, county, state and federal codes. Where the requirements of such agencies are more stringent than specified herein, abide by such requirements and consider this specification as supplementary to those requirements.

B. All work shall conform to the applicable requirements of the following: National Fire Protection Association (NFPA) 30-Flammable and Combustible Liquids Code; and NFPA 321 - Basic Classification of Flammable and Combustible Liquid.

C. All work shall conform to the applicable requirements of the following: Department of Environmental Prevention, Chapter 62-61; Chapters 4A-16 and 4A-33 of the State Fire Marshall's Rules and Regulations (Florida Fire Prevention Code); Southern Fire Prevention Code, Chapter 20; and the Standard Building Code, 1985 Edition with 1986 revisions.

D. The tank shall meet the current requirements of Underwriters Laboratories (UL) Standard 142. All components of the fuel distribution system shall be UL listed, unless otherwise specified, or approved by the Engineer.

E. The tank and fuel system shall be designed and fabricated according to best practices and methods available to date.

1.04 QUALIFICATIONS

A. Installer shall have had supervisory experience with two similar fuel systems in the past three years and shall hold a valid pollution control contracting license as required by the State of Florida, Department of Environmental Protection (FDEP). A copy of the license shall be submitted, prior to proceeding with construction.

B. Tank installers shall be certified in writing by the tank manufacturer as being qualified to install the equipment. A copy of the certificate shall be submitted, prior to proceeding with construction.

1.05 SUBMITTALS

A. Complete shop drawings shall be submitted, including certification of shop test to the Engineer for review.

1. The shop drawings shall include sufficient information to demonstrate compliance with the specified tank design standards, including copies of applicable sections of the specified design standards, manufacturer's catalog data and descriptive literature for the tank, fully dimensioned shop layout drawing (1/4" = 1' scale or larger) showing all piping, manholes, valves, equipment connections, tank outline dimensions, platform and stair dimensions, nozzle locations and foundation requirements. recommended tank installation and test procedures.

2. The shop drawings for pipe, fittings, and each item listed in the Specifications shall include manufacturer's catalog data and descriptive literature, fully dimensioned shop layout drawing (1/4" = 1' scale or larger) showing all piping, manholes, valves, equipment connections, nozzle locations and installation clearance requirements.

3. Submit all manufacturer's recommended installation and test procedures for all equipment including tanks, piping, etc.

4. Submit manufacturer's Test Reports (vessel fabrication, coating integrity and tank leakage, etc.) for each tank and specific service application.

5. Anchor certification.

B. Certification

The Manufacturer shall provide an affidavit of compliance will all applicable provisions of this specification.

C. Testing and Inspection Reports

A written report shall be submitted to the OWNER'S REPRESENTAIVE documenting the testing and/or inspection results.

D. Operations and Maintenance Manuals

Submit operations and maintenance manuals for items included under this section.

E. Warranty

Submit warranties covering the items included under this section.

1.06 PRODUCT HANDLING

A. Deliver materials and equipment to project site in manufacturer's original, unopened containers with labels intact and legible. Labels shall indicate manufacturer's name and model number. Store equipment in dry protected area. All damaged items shall be replaced with new at no additional cost to Owner.

B. Piping shall be supplied to the site with sealed end caps which shall remain in place until installation. Tanks shall be delivered to the site with all openings sealed which shall

remain in place until installation. The tanks shall be properly supported during transportation to the site and during installation in accordance with the manufacturer's instructions.

1.07 ANCHOR DESIGN

The tank shall be anchored in accordance with the current edition of the Florida Building Code. The Contractor shall provide certification that calculations have been performed and signed by a structural or civil engineer registered in the State of Florida confirming that the anchorage system provided is within allowable shear and tension limits. The anchorage system shall be designed to withstand a wind load of 150 miles per hour and a submergence up to the 100 year flood elevation.

PART 2 – PRODUCTS

2.01 ABOVEGROUND FUEL OIL STORAGE TANK

A. Storage Tank (6000 Gallon)

1. Steel (primary) Tank: listed by UL as an aboveground tank for flammable and combustible liquids and manufactured in accordance with UL 142 and UL Standard 2085 with a two-hour fire rating.

2. Emergency Vent: as required by NFPA 30 with no size reduction allowed for concrete encasement (insulation).

3. Normal Vent: independent of the emergency vent as required by NFPA 30.

4. Steel Tank Openings: threaded and located in the top of tank.

5. Steel Tank (rectangular and low profile in shape): with two (2) lugs for connecting ground conductors for lightning protection in accordance with NFPA 78.

6. Steel tank shall be pressure tested at the tank factory at 5 psi per UL 142.

7. Outer Surface of Steel Tank: covered by a minimum of 1/4 inch thick insulating spacer panels of polystyrene, or equally acceptable thermal insulation, which melts on contact with leaking petroleum products.

8. Secondary Containment: 30 mil. high density polyethylene geomembrane, or equally acceptable material (which includes a secondary steel tank). However, a double wall steel tank with 6 inch thick concrete in between the two (2) steel tanks is not permitted.

9. No steel or insulating spacer panels in unit shall come in direct contact with concrete or any other corrosive material. Tank top openings shall be powder coated to resist corrosion.

10. Steel primary tank and secondary containment shall be encased in a homogenous layer of 4,000 psi reinforced concrete 6 inches thick to create a protected (vaulted) tank with no penetrating metal elements except at the top. Concrete encasement (insulation) shall be of a monolithic (seamless) pour and contain no cold joints or direct (heat-transfer) connections between the steel and the outside face of the concrete encasement on bottom or sides.

11. Steel tank shall be pressurized to 5 psi at the casting facility and shall remain

pressurized until concrete sets, to provide expansion space between concrete and steel tank during use. This is in addition to the test required by UL 142.

12. Insulated (vaulted) tank shall have capability of physical monitoring between primary and secondary containment.

13. Insulated (vaulted) tank shall have appropriate warning signs as required by the local jurisdiction.

14. Steel tank shall have an integral seven gallon UL listed spill containment system, as a part of the tank, with internal reservoir and normally closed UL listed drain port.

15. Insulated (vaulted) tank shall be placed on reinforced concrete pad made to manufacturer's specifications, or properly engineering for the weight and conditions.

16. Insulated (vaulted) tank shall have an exterior light reflecting and weather resistant Epoxy Coating.

17. Hurricane restraints shall be installed where required by local jurisdictions.

18. Vault shall be ballistic and vehicle impact resistant.

19. Vaulted tank design shall have been in manufacturing production and commercial use for a minimum of five (5) years.

20. The tank shall be as manufactured by ConVault - Florida, or approved equal.

21. Fill coupling for pressurized tanker.

22. The tank shall have a OSHA approved aluminum ladder to the top of the tank and 2 fabricated steel saddle supports.

B. Tank Accessories

1. A mechanical level gauge system shall be provided to indicate the liquid level within the tank. The level gauge shall have a circular gauge indicator mounted on top of the tank. The tank shall include all openings required for the level gauge system.

2.02 FUEL OIL TANK ACCESSORIES

A. The following equipment shall be furnished along with the necessary piping and fittings required to provide a complete diesel fuel piping system.

1. Observation manholes shall be a 12-inch diameter cast iron manhole body with cast iron cover, labeled "OBSERVATION WELL", OPW model 104-GWO-1012, or approved equal.

2. Vent piping shall be a 2-inch and shall rise on an adjacent wall to as shown on the Drawings.

3. Vent cap shall be of the size indicated on the drawings and shall be constructed

of cast iron with removable stainless steel screen, similar to No. 63 as made by Dover Corp. or approved equal.

4. Butterfly valve shall be 2-inch ID, with bronze body. McMaster-Carr 9798 K16, or approved equal.

5. Fuel resistant boot shall provide flexible secondary containment and incorporate stainless steel clamps. Rivas or approved equal.

2.03 JOINT COMPOUND

Joint compound for steel pipe threaded connections shall be a non-hardening, non-solvent joint sealer No. 55 by Radiator Specialty Company, Charlotte, North Carolina, or approved equal.

2.04 SIGNS

All sides of the fuel storage tanks shall be marked with warning signs in accordance with NFPA 704 (Standard System for the Identification of the Hazards of Materials for Emergency Response). As a minimum, each tank shall include warning signs reading “COMBUSTIBLE,” NO SMOKING”, “DIESEL”.

2.05 PIPE SYSTEM

A. Diesel Fuel Pipe Systems

1. Pipe

Piping shall be schedule 40 black seamless with flexible 316 stainless steel lines at the generator. 1” schedule 40 suction and return piping to 6” of bottom of tank. Provide 1” foot valve on suction pipe.

2. Valves

Provide 120 VAC solenoid valves and bronze ball valves on tank suction line.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General

1. Equipment shall be installed in accordance with the manufacturer's recommendations.

2. All materials and equipment shall be new and free from defects or damage and shall be installed in accordance with the approved recommendations of the manufacturer to conform to the contract documents. The installation shall be accomplished by workmen skilled in this type of work. Equipment shall be erected in a neat manner, shall be aligned, leveled and adjusted to provide satisfactory operation. Installation shall be such that connection and disconnection of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance and repair. Minor deviations from indicated arrangements to provide proper access may be made.

B. Storage Tanks

1. All control, alarm, sensing, etc. panels shall be mounted above the flood elevation.

2. Tanks shall be grounded. Where fittings cause a break in the electrical continuity of the system approval jumpers shall be provided.

3. Any damage to tank coatings or tank exteriors shall be replaced prior to backfilling.

C. Fuel Piping

1. All pipe shall be cut accurately to measurements established at the site and shall be worked into place without forcing or bending. All pipe shall be installed into place without traps or pockets and pitched 1-inch in 40-foot minimum to drain.

2. Piping shall be installed to minimize the quantity of piping joints. Provide unions and/or flexible connections at all equipment connections.

3. Joints shall be fabricated in accordance with standard industry practices and manufacturer's instructions. All joints shall be liquid tight, screwed joints except where flanged connections to equipment or valves are required. Cut pipe square using pipe cutting tool and carefully ream pipe to remove all burrs. Cut a complete thread, using sharp dies properly set and centered, while applying oil graphite cutting lubricant.

4. Lines shall be tested with water and shall be drop tight for a period of two hours under test pressure. Test pressure shall be 100 psi.

D. Flexible Fuel Piping

1. Provide flexible piping connectors at all generator connections, all storage tank connections and all equipment connections.

2. Flexible connections shall be a minimum of 12 inches long or as required for equipment removal or maintenance. Protect flexible connectors where physical damage may occur due to adjacent equipment, other piping, wiring, or where subject to possible damage from operating personnel.

E. Leak Sensor Installation

1. Install all level and leak sensing equipment, monitoring panel interface modules and all wiring, conduit, junction boxes, sealing fittings and other material required for a complete operating system.

2. Install all monitoring equipment in accordance with the manufacturer's instructions including compliance with hazardous locations as defined in the National Electrical Code as locally amended and local codes which have jurisdiction.

3.02 CLEANING

A. At the conclusion of the work thoroughly clean all pipelines to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period.

B. If defective piping or joints are discovered at this time, they shall be repaired or replaced by the Contractor at no cost to the Owner.

3.03 TESTING

A. Piping shall be tested in strict accordance with the manufacturer's testing requirements. The entire piping system shall be pressure tested with fuel at 25 psig and proved tight at this pressure for a period of 4 hours. Defective work or material shall be replaced and retested. The system shall be test plugged or capped prior to testing to prevent test pressure from reaching any equipment or storage tank.

B. Storage tanks shall be pressure tested at 5 psi and all fittings soaped for a period of at least 12 hours. Tanks under test pressure shall not be left unattended.

C. Contractor shall provide fuel for any required testing and retesting. If the fuel subsequently becomes contaminated, Contractor shall dispose of the fuel at no cost to the Owner and in accordance with all FDEP regulations. Upon completion of the testing and prior final acceptance of the system, the Contractor shall fill the tanks to capacity.

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END OF SECTION

SECTION 13140
FIBERGLASS REINFORCED POLYMER BUILDING

PART I – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Freestanding, shop fabricated and assembled fiberglass reinforced polymer (FRP) insulated composite buildings.

2. Includes fasteners, anchors, doors and frames, vents, windows, and gasketing.

1.02 SYSTEM DESCRIPTION

A. Design Requirements:

1. Buildings shall conform to dimensions shown on drawings with a minimum eave height of 7.5 ft.
2. Buildings shall be completely waterproof, watertight, corrosion and chemical resistant, lightweight, and environmentally aesthetic.
3. Design to sustain superimposed loads for load combinations in accordance with ASCE 7-98.
   a. Design Loads:
      i. Dead Load of building, self weight
      ii. Roof Live Load= 30 pounds per square foot
      iii. Wind Load:
         (1) Basic wind speed (3 second gust) = 150 mph
         (2) Wind Exposure Category C
         (3) Importance factor 1.15

4. During installation of the composite FRP structure, a single concentrated load not exceeding 250 pounds may be placed on any portion of the roof. The concentrated load shall not be applied to the roof id other loads are present.
   a. Stresses produced by specified load conditions shall be determined consistent with recognized methods of analysis.
   b. Average R-value of assembled building shall be a minimum of R-7.
   c. Manufacturer's standard color chart showing a range of colors available for each type of finish coat is required.

B. Structural Standards – Minimum structural standards of the finished laminate shall be as follows:

1. Tensile Strength: ASTM D-638: 8,180
2. Flexural Properties: ASTM-D790: 6,040
3. Tangent Modules of Elasticity: 407.3
4. Compressive Strength: ASTM D-695: 19,350
5. Water Absorption: ASTM D570-59aT: 5%
6. Charpy Impact Test: 3.0
7. Impact Resistance: ASTM D-244: 37.5
8. Flammability Tests: ASTM D-635 Self Extinguishing

1.03 SUBMITTALS

A. Product Data:

1. Resin and glass manufactures' material specification.

B. Shop Drawings:

1. Include plans and elevations, fabrication details indicating laminate thickness and section depths and widths, location of openings and equipment supports, material properties/ specifications, size and location for anchor bolts, and gasketing details.

1.04 QUALITY ASSURANCE

A. Buildings provided shall be end product of one manufacturer to achieve standardization for appearance.

1. Manufacturers Qualifications: Building shall be manufactured and erected by a firm with minimum of 5 years of experience in structures of sixe and character specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Section Includes:

1. Freestanding, shop fabricated and assembled fiberglass reinforced polymer (FRP) insulated composite buildings.

2. Includes fasteners, anchors, doors and frames, vents, windows, gasketing, and lighting.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- MEKCO Manufacturing, Inc.,
- Bebco Industries,
- Engineered Fluid, Inc.

A. Products: Products manufactured by MEKCO Manufacturing, Inc., are specified by name and number in order to establish a minimum standard of quality required for the Work, and are accepted for use on this Project.

2.02 LAMINATE MATERIALS

A. Resins, Gel Coat, Glass Reinforcing, Insulation

1. Resins - resins shall be thermosetting, medium reactivity, rigid fire resistant polyester containing a maximum monomer content of 42% and a maximum of 1% Thixotropic additive.

2. Glass Fiber - Glass fiber reinforcing shall be K filament type E Borosilicateglass having high performance chrome-complex or saline finish compatible with polyester resin.

3. Gelcoat - Exterior surface coating shall be ultraviolet light stabilized, weather resistant, polyester base containing fade resistant color pigment volume concentration less than 20%. Dry film thickness shall be 0.014 in (mil).

4. Interior coating - Interior laminate coating when required shall be a pigmented heat resistant high gloss polyester base surfacing sealer.

5. Visual Standards - Visual standards of the finished laminate shall conform to Table 5 – Visual Acceptance Criteria – ASTM C-582.

2.03 HARDWARE

A. Doors - Doors shall be of identical material and construction as enclosures. Door latching provisions shall result in snug fit of door to frame, with means provided on each door for padlock.

B. Hardware - All door and exterior hardware shall be constructed of 316 stainless steel and/or ABD bronze casting.

C. Ventilators- Ventilators shall be of size, number, and locations as specified to allow proper transfer of air through the enclosure. Perforated screens of 316 stainless steel shall be backed with suitable internal baffles to resist entrance of foreign objects.

2.04 MISCELLANEOUS MATERIALS

A. Concrete Anchors, Doors, Fasteners and Gasketing, to be provided by the manufacturer.

B. Permanently fused building assembly yielding a watertight one-piece Structure.

2.05 FABRICATION

Form individual segments on high gloss molds ensuring consistent dimensions of finished parts. Cast each segment in one piece. Laminate shall consist of chopped roving impregnated with resin. Form panel flanges and perimeter anchoring flanges to the interior of the building.

2.06 ASSEMBLY

Shop assemble complete building. Flanges between adjacent panels shall be factory bonded together with structural adhesive. Seal exterior edge of adjacent panels with color matched silicon sealant. Fit and bond appurtenances, formed separately, into openings cut in finished panel or integrally mold to panel. Bond attachments with glass fibers and resin from interior of panel according to manufactures recommendations. Resin seal all cut or drilled edges.

PART 3 – EXECUTION

3.01 EXAMINATION

Examine surface to receive building for acceptable installation conditions. Do not start installation unless acceptable conditions are provided.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved submittals. Field erect panels. Flanges between adjacent panels shall be bolted and gasketed. Use washers to avoid localized stresses. Seal exterior edges of adjacent panels with color matched silicon sealant.

B. Install continuous neoprene gasket between perimeter anchoring flange and where panels rest on supporting structure. Resin seal cut or drilled edges. Repair damaged panels. Minimum spacing and edge distances of concrete anchors shall conform to requirements of the manufacturer.

END OF SECTION

SECTION 13200
PRESTRESSED CONCRETE STORAGE TANK

PART 1 GENERAL

1.01 WORK INCLUDED

A. This section specifies the design and construction of an ANSI/AWWA D110 wire-wound prestressed concrete storage tank with a Type II core wall and galvanized steel diaphragm including all reinforcing, concrete work, accessories, disinfection and testing directly related to the tank.

B. The tank contractor is responsible for furnishing all labor, materials, tools and equipment necessary to design and construct the prestressed concrete storage tank as indicated on the drawings and as described in this specification.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Section 02200 – General Earthwork.
2. Section 15200 – Process Piping and Valves.
3. Appendix A – Geotechnical Report.

1.03 DEFINITIONS

A. ACI 117-10 Specification for Tolerances for Concrete Construction and Materials

B. ACI 301/301M-10 – Specifications for Structural Concrete for Buildings.

C. ACI 305R-10 – Guide to Hot Weather Concreting.

D. ACI 306R-10 – Guide to Cold Weather Concreting.

E. ACI 347R-04 – Guide to Formwork for Concrete.

F. ACI 350/350R-06 – Code Requirements for Environmental Engineering Concrete Structures and Commentary.

G. ACI 350.3-06 – Seismic Design of Liquid-Containing Concrete Structures and Commentary.

H. ACI 372R-03 – Design and Construction of Circular Wire- and Strand-Wrapped Prestressed Concrete Structures.

I. ACI 506R-05 – Guide to Shotcrete.

J. ACI 506.2-95 – Specification for Materials, Proportioning, and Application of Shotcrete.

K. ACI SP4: Formwork for Concrete.

L. ANSI/AWWA C652-11 – Disinfection of Water Storage Facilities.

M. ANSI/AWWA D110-04 – Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks.

N. ASCE Standard 7-10 – Minimum Design Loads for Buildings and Other Structures.

O. ASTM A416/A416M-12a – Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.

P. ASTM A615/A615M-12 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

Q. ASTM A653/653M-11 – Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by Hot Dip Process.

R. ASTM A821/A821M-10 – Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Tanks.

S. ASTM A882/A882M-04(2010) – Standard Specification for Filled Epoxy-Coated Seven-Wire Prestressing Strand.

T. ASTM A884/A884M-12 – Standard Specification for Epoxy Coated Steel Wire and Welded Wire Reinforcement.

U. ASTM A1064/A1064M-12 – Standard Specification for Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

V. ASTM C31/C31M-12 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.

W. ASTM C33/C33M-13 – Standard Specification for Concrete Aggregates.

X. ASTM C39/C39M-12a – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

Y. ASTM C143/C143M-12 – Standard Test Method for Slump of Hydraulic-Cement.

Z. ASTM C172/C172M-10 – Standard Practice for Sampling Freshly Mixed Concrete.

AA. ASTM C231/C231M-10 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

BB. ASTM C881/C881M-10 – Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

CC. ASTM D1056-07 – Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

DD. ASTM D1557-12 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

EE. ASTM F593-13 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

FF. "Earthquake Induced Sloshing in Tanks with Insufficient Freeboard" by P.K. Malhotra, Structural Engineering International, IASBSE, 3/2006 pp 222-225.

1.04 SUBMITTALS

A. Prequalification Data: Provide prequalification data prior to the bid in accordance with Section 1.05 B. of this specification.

B. Shop Drawings: Provide shop drawings with a minimum size of 18" x 24" with a complete plan, elevation, and sectional views showing critical dimensions as follows:

1. Size, location and number of all reinforcing bars.

2. Thickness of all parts of the tank structure including floor, core wall, dome, and covercoat.

3. Prestressing schedule including number and placement of prestressing wires on the tank wall and total applied force per foot of wall height.

4. Location and details of all accessories required.

C. Concrete Data: Submit concrete design mixes including ingredient proportions, minimum cementitious content, and water/cementitious ratio in accordance with Section 2.2 and 2.3 of this specification.

D. Design Data: Submit structural calculations for the tank, signed and sealed by a professional engineer in accordance with Section 1.5 A.3 of this specification.

E. Coating Data: Submit color charts for review by the engineer and owner. Once a color is chosen, submit actual drawdown samples for final approval prior to application of coating.

F. Test Reports: Submit concrete strength reports for 7-day and 28-day breaks taken in accordance with the requirements of Section 3.3 A.1.

G. Warranty Document: Submit warranty document in Owner's name in accordance with Section 1.6 A. of this specification.

H. Cleaning and Disinfection Plan: Submit a cleaning and disinfection plan which complies with Section 3.4 of this specification.

I. Project Record Documents: Record actual location layout and final configuration of tank and accessories on shop drawings and submit to engineer after construction of the tank is complete.

1.05 QUALITY ASSURANCE

A. Qualifications and Experience:

1. Tank Construction Company: Shall be a firm with a minimum of three years of experience in the design and construction of ANSI/AWWA D110 wire-wound, circular prestressed concrete tanks with Type II core walls to ensure the owner that it has the organization, technical skill, quality control, reliability, and financial stability to build and guarantee the tank in accordance with the quality required by these specifications. The tank construction company shall have built with its own resources and have under warranty, a minimum of ten (10) dome-covered prestressed concrete tanks of equal or greater size than that required for this project which meet these specifications and are now providing satisfactory service.

2. Construction: The entire tank, including all portions of the floor, wall, and roof shall be built by the tank construction company, using its own trained personnel and equipment.

3. Design: All design work for the tank shall be performed by a professional engineer with no less than five years of experience in the design and construction of ANSI/AWWA D110 wire-wound, circular prestressed concrete tanks with Type II core walls. The professional engineer shall be a full-time staff member of the tank construction company and shall be licensed to work in the state where the project is located.

4. The diaphragm design and epoxy injection procedure shall have been used in the ten tanks required in Section 1.5 A.1 of this specification.

B. Prequalification:

1. All tank construction companies must be prequalified and meet the criteria stated in Section 1.5 A.1 of this specification to be considered an acceptable tank builder.

2. A complete prequalification package shall be submitted to the Engineer for consideration 14 days prior to the date set for receipt of bids. The prequalification submittal shall include the following items:
   a. Complete construction drawings showing the principal sizes, thicknesses, reinforcing size and spacing for all structural members including: floor, wall, dome shell and dome edge.
   b. Complete details of other structural appurtenances as required by the project drawings showing principal sizes, thickness and reinforcing sizes and spacing.
   c. Complete design calculations which address applicable loads provided in Section 1.7 B. of this specification.
   d. Complete experience record for the tanks used to meet the experience requirement of Section 1.5 A. of this specification that have been designed and built in the tank construction company's own name and shall include only those tanks that are under the company's warranty. The record shall include the size of the tank, name, address and telephone number of the Owner, the year of construction and the name and telephone number of the Engineer for the project.
   e. Experience in prestressed concrete tanks of the type specified herein for the construction superintendent, foreman, and three most experienced tankbuilders. Experience shall be with the bidder during the three previous years.
   f. Construction schedule which details the duration for tank construction.

1.06 WARRANTY

Provide a warranty document for workmanship and materials on the complete structural portion of the tank for a five-year period from the date of acceptance of the work. In case leakage or other defects appear within the five-year period, the tank construction company shall promptly repair the tank at its own expense upon written notice by the Owner that such defects have been found. Leakage is defined as a stream flow of liquid appearing on the exterior of the tank, the source of which is from the inside of the tank. The tank construction company shall not be responsible for, nor liable for, any subsurface condition. This warranty shall not apply to any accessory, equipment or product that is not a structural part of the tank and is manufactured by a company other than the tank construction company.

1.07 DESIGN CRITERIA

A. The design shall be in conformance with applicable portions of American Concrete Institute (ACI) 372R Design and Construction of Circular Wire- and Strand-Wrapped Prestressed Concrete Structures, ANSI/AWWA D110 Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks with Type II core walls, and currently accepted engineering principles and practices for the design of such structures.

B. The following loadings shall be utilized in the design:

1. Capacity: 3,000,000 Gallons

2. Dimensions: 120'0" Inside Diameter
35'6" Water Depth

3. Fluid Loads: Shall be the weight of all liquid when the reservoir is filled to capacity. The unit weight of the liquid material shall be 62.4 lbs/ft^3.

4. Roof Live Loads: Consideration shall be given to all applicable roof design loads in accordance with ANSI/AWWA D110, Section 3.3 and ASCE 7. The minimum roof live load for the structure shall be 30 pounds per square foot.

5. Dead Loads: Consideration shall be given to all permanent imposed loads including concrete and steel.

6. Seismic Loads:
   a. Seismic forces and moments resulting from water sloshing and seismic accelerations of the tank dome, wall, and water loads shall be calculated in accordance with ACI 350.3 or ANSI/AWWA D110.
   b. If sufficient freeboard height is not provided to prevent uplift forces due to sloshing, the impulsive participation shall be increased due to the constrained motion of liquid, and the tank roof and its connection shall be designed to resist the uplift forces in accordance with P.K. Malhotra's "Earthquake Induced Sloshing in Tanks with Insufficient Freeboard".

7. Soil Pressure: Earth loads shall be determined by rational methods of soil mechanics. Soil pressure shall not be used in the design of the core wall to counteract hydraulic loads or provide residual compression in the wall.

8. Differential Backfill Loads: Forces from differential backfill loads shall be considered in the design and shall be based on the at-rest coefficient. Passive resistance shall not be used to resist differential backfill loads.

9. Wind Loads: Wind loads shall be considered in the design in accordance with ASCE.

C. Subbase: A granular base material shall be used beneath the membrane slab when the subgrade materials do not allow free drainage.

1. The base material should consist of a clean, well-compacted, angular or sub-angular material with a minimum thickness of 6 in.

2. The gradation of the base material should be selected to permit free drainage without the loss of fines or intermixing with the subgrade material.

3. The maximum particle size of the base material should be limited to provide a relatively level working surface without potential intrusion of the base materials into the membrane floor slab concrete.

4. Base material should be compacted to 95 percent of the maximum laboratory density determined by ASTM D1557.

D. Floor: The design of the floor for the prestressed concrete tank shall conform to the following:

1. Concrete membrane floors shall be a minimum of 4" thick and have a minimum thickness of 8" of concrete over all pipe encasements and around sumps.

2. A minimum percentage of 0.60% reinforcing steel shall be used in the membrane floor. The minimum percentage shall apply to all thickened sections and shall extend a minimum of 2 ft into the adjacent membrane floor.

E. Core wall:

1. The wire-wound, prestressed concrete tank core wall shall be designed as a thin shell cylindrical element using shotcrete and an embedded, mechanically bonded, galvanized steel shell diaphragm.

2. The design of the core wall shall take into account appropriate edge restraint. To compensate for bending moments, shrinkage, differential drying, and temperature stresses, the following minimum reinforcing steel shall be incorporated into the design:
   a. The top 2 ft of core wall shall have not less than 1% circumferential reinforcing.
   b. The bottom 3 ft of core wall shall have not less than 1% circumferential reinforcing.
   c. Inside Face:
      i. The inside face of the core wall shall utilize the diaphragm as effective reinforcing.
      ii. Additional vertical and horizontal reinforcing steel bars shall be used as required by design computations.
   d. Outside Face:
      i. Vertical reinforcing steel in the outside face of the core wall shall be: minimum of #4 bars at 12" center to center.
      ii. Additional vertical and horizontal reinforcing steel bars shall be used as required by design computations.

3. The minimum core wall thickness shall be 3½".

4. Reinforcing steel used in the core wall shall be designed using a maximum allowable design tensile stress, f_s, of 18,000 psi.

5. Allowable compressive stress in the core wall due to initial prestressing force, f_{gi}, shall be:
   a. 1250 psi + 75t psi/in. with 0.5 f'_{gi} maximum or less (where f'_{gi} is defined as compressive strength at time initial prestressing force is applied and *t* is the thickness of the core wall in inches).
   b. Maximum of 2250 psi.

6. Allowable compressive stress in the core wall due to final prestressing force, f_g, shall be:
   a. 1250 psi + 75t psi/in. with 0.45 f'_g maximum (where f'_g is defined as compressive strength required for final prestressing force and *t* is the thickness of the core wall in inches).
   b. Maximum of 2025 psi.

F. Dome:

1. The dome roof shall be constructed of reinforced concrete and shall be circumferentially prestressed.

2. Dome shell reinforcement shall consist of reinforcing bars or welded wire fabric, not galvanized. Bolsters for wire fabric and reinforcing bars shall be plastic. Wire ties shall be galvanized.

3. The dome ring girder shall be prestressed with sufficient wire to withstand the dome dead load and design live loads. The ring girder shall have cross section suitable to accept the applied prestressing forces.

4. The high water level in the tank shall be permitted to encroach on the dome shell no higher than the upper horizontal plane of the dome ring girder.

5. Overflow outlets or the overflow pipe shall be capable of providing an overflow open area three times the area of the largest influent pipe.

6. Overflow outlets plus the dome ventilator shall be capable of providing an open area three times the area of the largest pipe.

7. The dome shall be designed as a free-span, spherical thin shell with one-tenth rise in accordance with the following:
   a. Typical Dome Design: The typical dome thickness and steel reinforcement shall meet the requirements of ANSI/AWWA D110.
   b. In all cases, the thickness of the dome shall be no less than 3".
   c. Dome Edge Design: The dome edge and upper wall shall be designed to resist the moments, thrusts, and shears that occur in this region due to dome and wall prestressing and loading conditions. The design of the edge region shall conform to the following:

      i. Dome Edge Thickness:
         (a) A determination of the buckle diameter shall be made, as defined by:

$$d_b = 2.5 \cdot \sqrt{r_d \cdot t_d}$$ rounded up to the next foot

Where: d_b = buckle diameter in feet

r_d = dome radius in feet

t_d = typical dome thickness in feet

         (b) Dome edge thickening shall begin at a radial location on the dome, defined as s_2 which is at least one buckle diameter away from the tank wall.

(c) A springline haunch shall be provided, which extends radially from the inside face of the tank wall to radial location s_1 which is defined as:

$s_1 = 0.6 \cdot \sqrt{1.5 \cdot r_d \cdot t_d}$ rounded up to the next foot

Where: s_1 = distance from inside face of wall to haunch in feet
s_2 = distance from inside face of wall to typical dome thickness in feet.

This springline haunch shall begin at the inside face of the tank wall with a springline thickness as required by paragraph (f) below and shall end at radial location s_1 with the following thickness:

$$t_{d1} = 1.33 \cdot t_d$$

Where: t_{d1} = minimum thickness at s_1 in feet

t_d = typical dome thickness in feet at one buckle diameter from tank wall

(d) Beginning at s_1 and continuing to s_2 the dome shell shall have a uniform straight line taper.

(e) Parameters (b), (c), and (d) above are not required for domes where the calculated typical dome thickness is less than 75% of the actual typical dome thickness.

(f) Sufficient concrete thickness at the springline of the dome shall be provided so that no more than 2 ft of the springline haunch is considered in calculating the effective dome edge ring cross sectional area. Compressive stress in this area shall not exceed 1000 psi when subjected to initial prestressing, offset by dead load only.

ii. Dome Edge Steel Reinforcement:

(a) Throughout the dome edge, the percentage of steel reinforcement, both radially and circumferentially, shall be no less than 0.25% of the gross cross sectional area of concrete.

(b) Along the dome edge, steel reinforcement shall be distributed between the upper and lower layers unless finite element analysis calculations indicate that tensile stress does not exist in the concrete along the bottom face of the dome edge. In that case, only top bars are required radially and circumferentially. In addition, radial and circumferential reinforcing bars will not be required along the bottom face of the dome edge where the calculated typical dome thickness is less than 75% of the actual typical dome thickness.

(c) Where reinforcing bars are required in the bottom layer, they shall be placed near the tank wall to insure adequate development at the intersection between dome and wall.

(d) In all cases, the percentage of circumferential steel reinforcement in the effective dome ring shall be no less than one percent of the gross cross sectional area of

concrete. The effective dome ring is defined as ¼ of the haunch length not to exceed 2 ft'.

(e) Where bottom dome edge steel reinforcement is required, vertical steel reinforcement along the inside face of the tank wall shall be no less than 0.5% of the cross sectional area of wall shotcrete.

G. Prestressing:

1. Circumferential prestressing of the tank shall be achieved by the application of cold-drawn, high-carbon steel wire placed under high tension.

2. A substantial allowance shall be made for prestressing losses due to shrinkage and plastic flow in the shotcrete and due to relaxation in the prestressing steel.

3. The prestressing design shall conform to the following minimum requirements:
   a. Working stress for the tank wall, fs, shall be a maximum of 115,000 psi.
   b. Working stress for the dome ring, fsd, shall be a maximum of 120,000 psi.
   c. The allowable design tensile stress in the prestressing wire before losses, fsi shall be 145,600 psi or no greater than 0.63 fu, where fu is defined as the ultimate strength of the wire.
   d. Areas to be prestressed will contain no fewer than 10 wires per foot of wall for 8 gauge and 8 wires per foot of wall for 6 gauge.
   e. A maximum of 24 wires per layer per foot for 8 gauge and 20 wires per layer per foot for 6 gauge will be allowed.

H. Wall Openings:

1. When it is necessary for a pipe to pass through the tank wall, the invert of such pipe or sleeve shall be no less than 18" above the floor slab. The prestressing wires required at the pipe elevation shall be distributed into circumferential bands immediately above and below the opening to maintain the required prestressing force while leaving an unbanded strip around the entire tank.

2. Unbanded strips shall have a vertical dimension of no more than 36" unless an axi-symmetric shell analysis is performed to account for compressive forces plus shear and moments caused by displacement of the prestressing wires into adjacent bands.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- The Crom Corporation
- Precon Corporation

2.02 PERFORMANCE

A. Performance of the materials used in the tank construction shall conform to the minimum requirements of this specification.

B. Substitutions to the materials in this specification may only be made if submitted in writing and approved by the engineer.

2.03 CONCRETE

A. Concrete shall conform to ACI 301/301M.

B. All concrete shall utilize Type I/II Portland cement.

C. A maximum of 25% of cementitious material may be fly ash.

D. Admixtures other than air-entraining and water reducing admixtures will not be permitted unless approved by the engineer.

E. Coarse and fine aggregate shall meet the requirements of ASTM C33/C33M.

F. Concrete mixes used in the construction of the tank shall conform to the following:

Mix	Compressive Strength (psi)	Minimum Cement Content (lbs)	Maximum Aggregate Size (in)	Maximum W/C Ratio	Air Content (%)	Slump (in)
Floor	4000	560	¾	0.45		4"+/-1"
Dome	4000	600	⅜	0.45		4"+/-1"

2.04 SHOTCRETE

A. Shotcrete shall conform to the requirements of ACI 506.2 except as modified herein.

B. All shotcrete mixes shall utilize Type I/II cement.

C. A maximum of 25% of cementitious material may be fly ash.

D. All shotcrete in contact with diaphragm or prestressing wire shall be proportioned to consist of not more than three parts sand to one part Portland cement by weight. All other shotcrete shall be proportioned to consist of not more than four parts sand to one part Portland cement by weight.

E. Admixtures will not contain more than trace amounts of chlorides, fluorides, sulfides or nitrates.

F. Fine aggregate shall meet the requirements of ASTM C33/C33M.

G. Shotcrete mixes used in the tank construction shall conform to the following:

Mix	Compressive Strength (psi)	Maximum W/C Ratio	Air Content (%)	Slump (in)	Fiber Reinforcement (lbs/cyd)
Core Wall	4000	0.42		4"+/-1"	-
Covercoat	4000	0.42		4"+/-1"	

2.05 PRESTRESSED REINFORCEMENT

A. The prestressing wire shall conform to the requirements of ASTM A821/A821M, Type B.

B. The prestressing wire size shall be 0.162" (8 gauge), 0.192" (6 gauge) or larger, but no larger than 0.250".

C. The ultimate tensile strength, fu shall be, 231,000 psi or greater for 8 gauge wire, 222,000 psi or greater for 6 gauge.

D. Splices for horizontal prestressed reinforcement shall be ferrous material compatible with the prestressing reinforcement and shall develop the full strength of the wire.

2.06 NON-PRESTRESSED REINFORCEMENT

A. Non-prestressed mild reinforcing steel shall be new billet steel meeting the requirements of ASTM A615/A615M with a minimum yield strength, f_y, of 60,000 psi.

B. Welded wire reinforcing shall be plain wire conforming to the requirements of ASTM A1064/A1064M with a minimum yield strength, f_y, of 65,000 psi.

2.07 GALVANIZED STEEL DIAPHRAGM

A. The galvanized steel diaphragm used in the construction of the core wall shall be 26 gauge with a minimum thickness of 0.017 in. conforming to the requirements of ASTM A653/A653M. Weight of zinc coating shall be not less than G90 of Table 1 of ASTM A653/A653M.

B. The diaphragm shall be formed with re-entrant angles and erected so that a mechanical key is created between the shotcrete and diaphragm.

C. The diaphragm shall be continuous to within 3 in. of the top and bottom of the wall. Horizontal joints or splices will not be permitted.

D. All vertical joints in the diaphragm shall be rolled seamed, crimped and sealed watertight using epoxy injection.

E. In all tanks designed to use a waterstop at the floor/wall joint, the steel shell diaphragm shall be epoxy bonded to the waterstop.

2.08 PVC WATERSTOPS, BEARING PADS AND SPONGE FILLER

A. Plastic waterstops shall be extruded from an elastomeric plastic material of which the base resin is virgin polyvinyl chloride.

B. The profile and size of the waterstop shall be suitable for the hydrostatic pressure and movements to which it is exposed.

C. Bearing pads used in floor/wall joints shall consist of neoprene, natural rubber or polyvinyl chloride.

D. Sponge filler at the floor/wall joint shall be closed-cell neoprene.

2.09 EPOXY

A. Epoxy Sealants:

1. Epoxy shall conform to the requirements of ASTM C881/C881M.

2. Epoxy used for sealing the diaphragm shall be Type III, Grade 1, and shall be 100% solids, moisture insensitive, low modulus epoxy.

3. Epoxy used for placing the waterstop shall be Type II, Grade 2, and shall be 100% solids, moisture insensitive, low exotherm epoxy.

4. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77°F.

5. The epoxy sealants used in the tank construction shall be suitable for bonding to concrete, shotcrete, PVC and steel.

B. Bonding Epoxy:

1. Epoxy resins used for enhancing the bond between fresh concrete and hardened concrete shall conform to the requirements of ASTM C881/C881M.

2. Epoxy resins shall be a two-component, 100% solids, moisture-insensitive epoxy and shall be Type II, Grade 2.

2.10 SEISMIC RESTRAINT CABLES

A. When required by design, seismic restraint cables shall be seven-wire strand conforming to ASTM A416/A416M.

B. The strand shall be protected with a fusion-bonded, grit-impregnated epoxy coating conforming to ASTM A882/A882M.

C. The minimum yield strength of the seven-wire strand shall be 270,000 psi.

2.11 TANK ACCESSORIES

A. Minimum of one, 1' 5" x 4' 4" rectangular Type 316 stainless steel wall manhole for access to the interior of the tank. The cover shall also be of Type 316 stainless steel. The wall manhole shall be designed to resist hydraulic loading without excessive deflection.

B. Aluminum accessories

1. Exterior ladder shall be fabricated from 6061-T6 and 6063-T6 aluminum and shall conform to all applicable OSHA standards. The ladder shall have an aluminum safety cage and lockable security gate and/or a safety climbing device in accordance with all applicable OSHA standards.

2. Aluminum handrail shall be fabricated in 20 ft typical sections from 6061-T6 aluminum and shall conform to all applicable OSHA standards.

3. Aluminum accessories shall be shop fabricated and fully welded. All welding shall be in accordance with American Welding Society (AWS) standards using gas tungsten arc welding (GTAW) to fuse materials without distortion of the material. Mechanical splices shall only be used at field splice locations.

4. Aluminum accessories shall have a "mill" finish.

5. Aluminum surfaces in contact with concrete shall be protected with a coat of bituminous paint.

C. Interior ladder shall be fabricated from fiberglass shall conform to all applicable OSHA standards. The ladder shall have a safety climbing device manufactured from Type 316 stainless steel as required to meet applicable OSHA standards.

D. Roof hatch cover, roof ventilator, and liquid level indicator shall be fabricated from fiberglass.

E. Through-wall pipe sleeves shall be Type 316 stainless steel sleeves with neoprene modular seal units.

F. Accessory hardware, unless otherwise noted, shall be Type 316 stainless steel conforming to ASTM F593.

G. Cast-in-place concrete dome parapet wall (12" high x 5" thick)

2.12 COATINGS

A. Exterior coating system shall consist of one of the following:

1. Two coats Tnemec Series 156 Enviro-Crete Modified Waterborne Acrylate.
2. Two coats Thoroseal Waterproof Cement-Based Coating.

PART 3 EXECUTION

3.01 EXAMINATION

All subgrade elevations shall be verified prior to starting tank construction.

3.02 INSTALLATION

A. Floor:

1. The subgrade shall be prepared by fine grading to ensure proper placement of reinforcing steel with proper bottom cover.

2. A 6-mil polyethylene vapor-barrier shall be placed after subgrade preparation has been completed.

3. Form and screed boards shall be of proper thickness and sufficiently braced to ensure that the floor is constructed within proper thickness tolerances.

4. Plate bolsters shall be used to support reinforcing steel supported directly on the subgrade to ensure positive control of placement of reinforcing steel.

5. The floor shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.

6. The floor shall be water cured for a minimum of 7 days after casting.

7. The floor shall receive a light broom finish.

B. Core Wall:

1. The wall shall be constructed utilizing diaphragm and shotcrete with each conforming to the following:

a. Diaphragm Erection:
   i. The diaphragm shall be protected against damage before, during, and after erection. Nail or other holes shall not be made in the diaphragm for erection except in the top 3 inches. Holes shall not be made in the diaphragm except for inserting wall pipes or sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetrations shall be sealed with an epoxy sealant which complies with Section 2.8 Epoxy.

b. Shotcrete:
   i. All shotcrete shall be applied by or under direct supervision of experienced nozzlemen certified by the American Concrete Institute (ACI) as outlined in ACI certification publication CP-60.
   ii. Each shotcrete layer shall be broomed prior to final set to effect satisfactory bonding of the following layer.
   iii. No shotcrete shall be applied to reinforcing steel or diaphragm that is encrusted with overspray.
   iv. No less than ⅛" thick shotcrete shall separate reinforcing steel and prestressing wire.
   v. The diaphragm shall be encased and protected with no less than 1" of shotcrete in all locations.
   vi. The interior shotcrete shall receive a light broom finish.

c. Curing:
   i. Interior and exterior portions of the shotcrete wall shall be water cured for a minimum of 7 days or until prestressing is completed.

C. Epoxy Injection:

1. Epoxy injection shall be carried out from bottom to top of wall using a pressure pumping procedure.

2. Epoxy injection shall proceed only after the diaphragm has been fully encased, inside and outside, with shotcrete.

D. Dome:

1. All concrete shall be consolidated by means of a vibrator for proper encasement of reinforcing steel and welded wire fabric.

2. All surfaces at the joint between the wall and the dome shall be coated with bonding epoxy which complies with Section 2.8 Epoxy.

3. Plastic bolsters shall be used to support reinforcing steel and welded wire reinforcement to ensure positive control on placement of steel.

4. The exterior surface of the dome shall receive a light broom finish.

5. The dome shall be water cured for a minimum 7 days after casting or until dome band prestressing is completed.

E. Prestressing:

1. The initial tension in each wire shall be read and recorded to verify that the total aggregate force is no less than that required by the design. Averaging or estimating the force of the wire on the wall shall not be considered satisfactory evidence of correct placement of prestressing wires.

2. Placement of the prestressing steel wire shall be in a continuous and uniform helix of such pitch as to provide in each lineal foot of core wall height an initial force and unit compressive force equal to that shown on the design drawings. Splicing of the wire shall be permitted only when completing the application of a full coil of wire or when removing a defective section of wire.

3. Shotcrete shall be used to completely encase each individual wire and to protect it from corrosion. To facilitate this encasement, the clear space between adjacent wires is to be no less than one wire diameter.

4. Prestressing shall be accomplished by a machine capable of continuously inducing a uniform initial tension in the wire before it is positioned on the tank wall. Tension in the wire shall be generated by methods not dependent on cold working or re-drawing of the wire. In determining compliance with design requirements, the aggregate force of all tensioned wires per foot of wall shall be considered rather than the force per individual wire, and such aggregate force shall be no less than that required by the design and as shown on approved drawings.

5. The tank construction company shall supply equipment at the construction site to measure tension in the wire after it is positioned on the tank wall. The stress measuring equipment shall include: electronic direct reading stressometer accurate to within 2%, calibrated dynamometers and a test stand to verify the accuracy of the equipment.

6. After circumferential prestressing wires have been placed, they shall be protected by encasement in shotcrete. This encasement shall completely encapsulate each wire and permanently bond the wire to the tank wall.

7. When multiple layers of wire are required, shotcrete cover between layers shall be no less than ⅛" thick.

F. Covercoat:

1. After all circumferential prestressing wires have been placed, a shotcrete cover having a thickness of no less than 1" shall be placed over the prestressing wires.

2. Horizontal sections of the wall shall form true circles without flat areas, excessive bumps or hollows.

3. The covercoat shall receive a sliced trowel finish.

G. Wall Openings:

1. All wall pipes, sleeves and manholes passing through the wall shall be sealed to the diaphragm by epoxy injection.

H. Coatings:

1. All coatings shall be applied a minimum of 28 days after final application of concrete or shotcrete.

2. All application procedures for coatings shall be in accordance with manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

A. Inspection and Testing:

1. Concrete and Shotcrete Testing:
   a. Compression Tests:
      i. Compression test specimens shall be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as selected by the Engineer to insure continued compliance with these Specifications. At least one set of test specimens shall be made for each 50 yards of concrete/shotcrete placed. Each set of test specimens shall be a minimum of 5 cylinders.
      ii. Compression test specimens for concrete/shotcrete shall conform to ASTM C172/C172M for sampling and ASTM C31/C31M for making and curing test cylinders. Test specimens shall be 6-inch diameter by 12-inch high or 4-inch diameter by 8-inch high cylinders.
      iii. Compression test shall be performed in accordance with ASTM C39/C39M. Two test cylinders will be tested at 7 days and two at 28 days. The remaining cylinder will be held to verify test results, if needed.
   b. Air Content Tests (concrete only):
      i. Air content tests shall conform to ASTM C231/C231M (Pressure Method for Air Content).
      ii. Tests for air content shall be made prior to concrete placement and whenever compression test specimens are made.
   c. Slump Tests (concrete only):
      i. Slump tests shall be made in accordance with ASTM C143/C143M.
      ii. Slump tests shall be made whenever compression test specimens are made.

2. Hydrostatic Testing:
   a. The tank shall be tested for watertightness upon completion.
   b. The testing for watertightness shall be completed as follows:
      i. Fill the tank with water to the maximum water level and let it stand for a minimum of 24 hours.
      ii. Inspect the exterior of the tank wall and footing for damp spots. Damp spots shall be defined as spots where moisture can be picked up on a dry hand, the source of which is from inside the tank.
      iii. Leakage through the wall or wall-base joint shall be repaired and the tank shall be retested using the above procedure.

3.04 CLEANING AND DISINFECTION

A. The interior of the tank shall be cleaned to remove debris, construction items, and equipment prior to testing and disinfection.

B. The following disinfection procedure shall be used to disinfect storage tanks used for potable water:

1. Method 2 or 3 will be used for disinfection of the tank in accordance with ANSI/AWWA C652.

2. When Method 3 is used, the disinfection plan required by Section 1.4 H. shall address any compatibility issues with the form of chlorine used for disinfecting the storage tank with the type of disinfectant used in the normal production of the water used to fill the tank.

END OF SECTION

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SECTION 13450
PROCESS INSTRUMENTATION, CONTROLS AND MONITORING EQUIPMENT GENERAL REQUIREMENTS

PART I – GENERAL

1.01 WORK INCLUDED

A. This Section encompasses all general provisions relating to instrumentation work. The Work included in this Section pertains to all instrumentation work contained in Division 11, Division 33, Division 15, or Division 16, unless modified therein, as though this Section was repeated in its entirety in each Section.

B. Furnish all labor, materials, equipment and accessories required to provide complete operating instrumentation at the facility as described in the specifications, listed on the schedules and shown on the Drawings.

C. Install and/or connect all furnished equipment, including equipment furnished by others, as detailed herein and as shown on the Drawings.

D. It is the intent of these Contract Documents that the instrumentation shall be suitable in every way for the service required. All material and all work that may be reasonably implied as being required for a complete fully functioning, automated and manually controlled facility shall be furnished at no extra cost.

E. Make all field connections to all process instruments and other equipment furnished under this Contract; to equipment furnished by OWNER under separate contract, if any; and to reworked or relocated existing equipment as in the Contract Documents.

F. Provide mounting, mount, and wire process instruments furnished under Contract. Furnish all wire, and interconnections between process instrumentation primary elements, transmitters, local indicators, and receivers. Mount and wire surge protection equipment where indicated on the Drawings.

G. Provide mounting, mount, and make field connections to "packaged" instruments furnished under this Contract. Electrically or pneumatically connect "package" control systems to other related panels or instrumentation defined by the Contract Documents.

H. All Process Instrumentation equipment and materials furnished under this Contract, shall be installed under Division 13. This installation Work shall include mounting, and making of process and signal connections to the equipment. This Work, with the exception of factory-mounting of certain instruments, shall be performed under the supervision of a qualified representative of the vendor of the system or equipment. This installation Work and the completed installation shall be in compliance with instructions of the above mentioned vendor's representative and in accordance with the Drawings and documentation prepared by the vendor of the system or equipment and approved by the ENGINEER.

1.02 RELATED WORK

1. Section 13451: Instrumentation
2. Section 16050: Basic Materials and Methods

1.03 RESPONSIBILITIES

A. The CONTRACTOR shall assume all responsibility to take all field measurements of related and connecting work, and to determine the entire scope of the work required for a finished and completed project, in accordance with the Contract Documents and as approved by the ENGINEER.

B. The Drawings upon which this Contract is based show the arrangement, general design and extent of the systems and components. The systems are suitably outlined on the Drawings with regard to size, locations, general arrangements and installation details. Connections are shown in diagram form, except where in certain cases the drawings may include details giving the exact locations and arrangements. Drawings shall not be scaled to determine location. Work shall be installed in such a manner to avoid all interferences.

C. Where any parts of the systems or piece of equipment are located by dimensions on the Drawings, said dimensions shall be checked and verified in the field. Should any discrepancies or interferences occur which will necessitate major revisions in the work, the ENGINEER shall be notified immediately and his authority secured in writing for such revisions before proceeding with the Work.

D. The drawings are intended to convey the desired method of control and operation of the instrumentation and control system. The CONTRACTOR shall retain the services of the Control System Supplier to be responsible for the system analysis, design and functional adequacy of equipment necessary to achieve required systems performance and to satisfy the intent of these Contract Documents.

E. All instrumentation and controls shall be installed under the supervision of the Control System Supplier. Insofar as possible, all instrumentation and control equipment shall be furnished from a single supplier. The CONTRACTOR shall retain the services of the Control System Supplier to supply the complete control and instrumentation system and prepare all wiring diagrams, installation drawings and changes for all existing equipment.

F. Any modifications or additions to the electrical conduit and wiring installation for the instrumentation and control system required by the instrumentation and control system and not shown on the Contract Drawings shall be furnished and installed by the CONTRACTOR as approved by the equipment manufacturers. Any other devices or wiring including energy sources and/or converters necessary to obtain proper operation of the instrumentation and control system, shall be provided and installed by the CONTRACTOR. Any special interface equipment required shall be provided and installed by the CONTRACTOR at no additional cost to the OWNER.

1.04 REFERENCE STANDARDS

A. All equipment, materials, and systems provided shall be designed, manufactured, finished, painted, tested, inspected, packaged, shipped, stored, installed, connected, and tested in accordance with the General Industry Standards of OSHA, MIOSHA, and all local, county, state, and federal laws; and in accordance with the published codes, standards, and specifications of the following organizations:

1. ANSI - American National Standards Institute
2. ASTM - American Society for Testing and Materials
3. AWWA - American Water Works Association
4. IEEE - Institute of Electrical and Electronics Engineers
5. ISA - Instrument Society of America
6. NEC - National Electric Code

7. NEMA - National Electrical Manufacturers Association
8. NFPA - National Fire Protection Association
9. OSHA - Occupational Safety and Health Administration of the U.S. Department of Labor
10. OSHA (FL) - Occupational Safety and Health Administration, Florida

All Equipment, materials, and systems shall be U.L. labeled or listed except for classes of materials and equipment not available with such listing.

1.05 GUARANTEE AND WARRANTIES

Guarantee all work in accordance with the requirements of the Conditions of the Contract. With respect to instruments and equipment, guarantee shall cover:

A. Faulty or inadequate design

B. Improper assembly or erection

C. Defective workmanship or materials

D. Leakage, breakage, or other failure not caused by OWNER misuse.

For equipment bearing a manufacturer's warranty in excess of one year, furnish a copy of the warranty with OWNER named as beneficiary.

1.06 IMPROVEMENTS

Manufacturer's improvements involving specified systems or equipment needed to fulfill the intent of these specifications, and required to fulfill functionally the operational requirements, shall be provided at no additional cost to the OWNER.

1.07 DRAWINGS FOR APPROVAL

A. Certified drawings and diagrams for all instrumentation and control work shall be furnished by the CONTRACTOR and delivered to the ENGINEER. Information to be submitted for approval shall include:

1. Schematic Wiring Diagrams

The CONTRACTOR shall submit wiring diagrams of each piece of equipment, termination cabinet, starter, switch, relay, indicator, controller, recorder, annunciator, telemetering equipment, etc.

All drawings shall be 24" x 36" with border, title block, symbols, etc., as used on the Contract Drawings and approved by the ENGINEER. Ladder diagrams and wiring diagrams shall conform to JIC format and include line numbers, item numbers, source of power, terminal numbers, wire numbers, etc. Wire numbers and item numbers shall be assigned using the line numbers on the ladder diagrams.

2. Manufacturer's specifications complete with descriptive information indicating design data underscored to assist in verification that equipment proposed is equal to or exceeds the technical requirements and intent of these specifications. Design data shall cover exact equipment furnished.

3. Dimensional outline drawings of all control and instrument enclosures including designated conduit or wireway entrances, internal equipment layouts and structural details.

4. Internal wiring diagrams of control enclosures identifying all terminals and showing external and interconnecting terminals and field mounted devices.

5. Details necessary for fabrication of equipment specific to these control systems.

6. Working and/or construction drawings, showing conduit layout, locations, details, size, wire size and type and cables therein.

7. Technical information for all devices furnished.

8. Cable schedule detailing each cable, routing and all connections, as described in a format approved by the ENGINEER.

9. A riser diagram shall be provided showing all cables, wires and conduits.

10. A complete list of all recommended spare parts and test equipment required for the upkeep of all instruments and controls devices installed under this Contract.

11. Complete parts lists of all materials and components incorporated in the system.

12. Individual manufacturer's instruction manuals for all devices.

B. The CONTRACTOR shall submit as-built drawings, instruction manual material and assistance as required by Section 01700, Contract Closeout.

1.08 SHIPPING PRECAUTIONS

A. After completion of shop assembly and tests, all control cabinets, panels and consoles, etc., shall be enclosed in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from dust and moisture. Dehumidifiers or desiccant materials shall be placed inside the polyethylene coverings prior to sealing. The equipment shall then be skid mounted and braced for final transport. Lifting rings shall be provided for moving without removing protective coverings on all sections weighing more than 150 lbs. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling. Equipment provided under this Contract shall not be delivered to the job site until scheduled for installation. Special instructions for proper field handling and installation required by the manufacturer for proper protection shall be securely attached to each piece of equipment prior to shipment. Each package shall be tagged to identify its location, tag number and function in the system. Identification shall be prominently displayed on outside of package.

B. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, shall be provided on each piece of equipment supplied under the Contract.

1.09 STORAGE

Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters and shall be adequately protected against mechanical injury or damages by water.

1.10 INSTRUMENT IDENTIFICATION

Major instrumentation and equipment items or system specified shall be identified by system and tag numbers. This same number appears in the tag number designations on the drawings and on the schedule. Instrumentation and equipment shall be identified by nameplates or tags. Nameplates for panels and panel mounted equipment shall be as specified in the respective Section. Field equipment shall be tagged with assigned instrumentation tag number and function. Tags shall be white lamacoid with engraved black characters of 3/16 inch minimum height. Tags shall be attached to equipment with a commercial tag holder using a stainless steel band with a worm screw clamping device or by a holder fabricated with standard hose clamps and meeting the same description. In cases where this would be impractical, use 20 gage stainless steel screws installed in an unobtrusive manner. In addition to tags, field mounted control stations, recorders or indicators shall have a nameplates indicating their function and the variable controlled or displayed. Nameplate shall be attached by one of the above methods.

1.11 SIGNAL ISOLATORS, CONVERTERS, AND CONDITIONERS

Insure that input-output signals of all instruments and control devices are compatible. Unless otherwise specified, signals between field and panels shall be 4 to 20 mA DC unless specifically approved otherwise. Granting such approval does not relieve the compatibility requirement above. Provide signal isolators and converters as necessary to obtain the required system performance. Mount the devices inside or behind control panels, or in the field at point of application.

1.12 PROCESS CONNECTIONS

Provide instrument piping, tubing, and capillary tubing to meet the intended process service and ambient environmental condition for corrosion resistance. Slope lines according to service to promote a self draining or venting back to the process. Terminate connection to process lines or vessels in a service rated block valve, that will permit closing off the sense line or removal of the element without requiring shutdown of the process. Include drip legs and blow-down valves for terminations of sensing lines at the instruments when mounted in such a way that condensation can accumulate. Process vessels, line penetrations, connecting fittings, and block valves shall be furnished by the CONTRACTOR.

1.13 MANUFACTURER'S SERVICE

The CONTRACTOR shall furnish the services of a factory representative of the instrumentation equipment manufacturer to provide field supervision during installation, to direct the installation of the equipment, and to conduct initial equipment checkout and system start-up.

The CONTRACTOR shall furnish the services of a factory trained and qualified serviceman of the manufacturers of the instrumentation equipment and accessories supplied under this Contract to perform the following:

A. Supervision

The supervisory service of a trained serviceman, specifically trained on the type of equipment herein specified, shall be provided during construction to assist in, location of sleeves, methods of installing conduit and special cable, mounting piping and wiring for each type of device, and the methods of protecting all of the equipment prior to placing it in service.

B. Power Check-Out

Checking the installation of all components before power is applied. No form of energy shall

be applied to any part of the instrumentation system prior to receipt by the ENGINEER of a certified statement of approval of the installation from the CONTRACTOR, containing his Control System Supplier's authorization for turning on energy to the system.

C. Check-Out

Placing the equipment into operation and making necessary adjustments including tests and loop checks.

The CONTRACTOR shall provide the Control System Supplier's services to maintain all control system equipment in good operating condition and furnish-on-call maintenance as required to minimize equipment down time, until the project has attained Substantial Completion. The Control System Supplier shall provide scheduled preventative maintenance based on an ENGINEER approved listing specifying the time required for preventative maintenance on the various types of equipment and shall provide remedial maintenance services as required. Additional service time shall be provided during the two-year warranty period for at least three 8-hour day service visits to the site to check and readjust the equipment supplied under this Section.

1.14 TOOLS AND SPARE PARTS

A. Tools

One complete sets of any specialty instrument required to adjust and calibrate the instrumentation equipment shall be furnished with the equipment. They shall include hand tools for maintenance and calibration such as: unique screwdrivers and wrenches plus other tools as required. They shall be supplied in a durable case. Calibration tools for instrumentation equipment such as magmeters, flowmeters, and pneumatic instruments shall also be provided.

B. Spare Parts

All spares consumed during installation and testing shall be replaced by the CONTRACTOR prior to final acceptance of the system. The Control System Supplier shall supply a complete list of all suggested spare parts and supplies he considers required for the continuous operation of the system. The list shall include catalog and serial numbers of the hardware devices, spare parts part numbers, commercial part numbers and price in effect when the list is prepared. The spare parts shall be 100% of the manufacturer's recommended spare parts for each device.

Spare parts for specific equipment, if necessary to be furnished by the CONTRACTOR, shall be specified in the Sections for the specific equipment.

1.15 SOURCE QUALITY CONTROL

A. All instruments and controls shall be installed under the supervision of the Control System Supplier. In order to insure a coordinated instrumentation and control system, the CONTRACTOR shall require the Control System Supplier to certify coordination of the overall control and instrumentation system so that all devices provided under this Contract are compatible and provide a complete and operable system.

B. The Control System Supplier shall inspect each component piece of equipment supplied for each system to assure that it is new, in good working order and complies with the intent of Contract Documents. Components not fulfilling these criteria shall be rejected.

PART 2 – PRODUCTS

2.01 INSTRUMENTATION GENERAL

A. All electronic instrumentation shall be of the solid-state type, of manufacturer's latest design; preferably designed and packaged for miniature, high density mounting configuration. Where available, the instruments will be supplied with self-supporting, draw-out feature when in extended position. All transmitted analog signals shall be 4-20 mAdc; however, signals between instruments within the same panel/cabinet may be 1-5V. Zero base transmission signals will not be allowed, only "live zero" signals. An exception would include outputs of sensing devices specified hereafter, however, converted to compatible high level signals for remote transmission.

B. Field mounted equipment shall be in NEMA 4X enclosures and, if required, shall include suitable strip heaters to prevent accumulation of moisture.

C. Equipment installed in hazardous areas, shall meet Class I, Group D, Division I to comply with the National Electrical Code.

D. All indicators and recorder readouts will be linear in process units.

E. All transmitters shall be provided with either integral indicators or separately mounted indicators reading in process units. Special features listed in the individual instrument specifications are required and all information listed therein shall be considered as minimum requirements.

F. All equipment furnished shall be approved for specific application by Underwriter's Laboratories, Inc., or Factory Mutual if applicable.

2.02 ELECTRICAL

A. Refer to Division 16.

B. All equipment shall be designed to operate on a 60 Hertz alternating current power source at 105 to 135 volts, except as noted. All regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

C. All switches shall have single-pole double-throw contacts rated at 600 VA.

D. Contacts for low voltage signals shall be gold flashed.

2.03 POWER FAILURE

All equipment shall be designed and constructed so that in the event of a power interruption the equipment shall resume normal operation without manual resetting when power is restored.

2.04 CONTROL SYSTEM SUPPLIERS

A. Control System Suppliers: The Control System Integration will be performed by the MBR supplier.

B. Control System Supplier. Equipment specified and shown on Drawings shall be designed as a system, fabricated or purchased, shipped to job site, and started up by a qualified and approved Control System Supplier listed under this heading. Intent is for unit responsibility.

Control System Supplier shall not assign any of his rights or delegate any of his obligations.

Direct purchase of any items by CONTRACTOR is not in compliance with this Specification and will not be permitted.

The Control System Supplier shall assign a qualified representative to act as Project Engineer for the work efforts specified. The Project Engineer shall, at a minimum, have the following qualifications:

1. Successfully completed vendor factory training for the digital equipment supplied.
2. Successfully completed projects of similar size and complexity.

The Project Engineer shall be the focal point for all design, fabrication, contract communications, and construction and shall be responsible for start-up and acceptance. The Project Engineer shall be at the factory test, at the job site during the entire construction process start-up, and at the job site during the entire acceptance procedure. Only qualified and approved Control System Suppliers will be accepted as meeting this Specification. The Control System Supplier shall also assign a full-time service technician during the construction process effort to assist in verifying and making minor corrections to wiring which may be necessary as determined by the ENGINEER. The start-up/acceptance procedure shall not begin until all installation has been completed and any punch list items are minor in nature.

C. Installation and Start-up. The Control System Supplier shall have an established service facility from which qualified technical service personnel and parts may be dispatched upon call. Such a service facility shall be no more than six (6) hours travel time by ground from the jobsite.

2.05 TRAINING

A. General. The Control System Supplier shall provide two 8-hour days of training of the OWNER's personnel in all aspects of operation and maintenance such as direction on calibration of field instruments, fuse locations, instruction manuals, etc. All at-the-plant training and instructions shall be given by the Project Engineer assigned to the project by the Control System Supplier or other personnel as approved by the ENGINEER.

B. Digital Equipment. The Control System Supplier shall provide comprehensive instruction for the programmable controllers and software packages supplied. This instruction shall be performed by the manufacturer of the products at the OWNER'S facility. The Control System Supplier shall submit to ENGINEER, an outline of the proposed training courses to meet the requirements set forth below. The Control System Supplier shall also provide to ENGINEER a list of additional courses available from the manufacturer. Upon review, ENGINEER may request that a substitution be made of a course content that better fits the needs of OWNER. Such substitution shall only be requested for courses of equal length cost and availability. The content of these courses and proposed lengths shall be as follows:

1. Hardware training (3 individuals)
   a. 1 day, Maintenance and Troubleshooting

2. Software training (3 individuals)
   a. 1 day, Software Concepts

OWNER shall determine actual division of attendance. Written course materials shall be included along with hands-on exercises with instructional equipment. Factory training shall be conducted on a schedule acceptable to OWNER and shall commence prior to system factory testing.

CONTRACTOR shall arrange for all training for OWNER with a minimum of 6 week notification of training schedule prior to actual course being provided. Scheduling of courses and their contents shall be approved by ENGINEER and provided at a time and location agreeable to OWNER. Course shall be conducted at locations normally established for such courses by manufacturers of software and computer products.

PART 3 – EXECUTION

3.01 INSPECTION

Inspect each instrument and piece of equipment for damage, defects, completeness, and correct operation before installing. Inspect previously installed related work and verify that it is ready for installation of instruments and equipment.

3.02 CONTRACTOR'S CERTIFIED REPORTS

The CONTRACTOR shall submit a certified report for control panel and associated field instruments certifying that the equipment:

1. Has been properly installed under Control System Supplier's supervision.

2. Is in accurate calibration.

3. Was placed in operation in under Control System Supplier's presence.

4. Has been checked, inspected, calibrated, and adjusted as necessary.

5. Has been operated under maximum power variation conditions and has operated satisfactorily.

6. Is fully covered under the terms of the guarantee.

3.03 DEMONSTRATION AND FINAL OPERATING TEST PLANS AND RESULTS

Submit for approval, a written plan for demonstrating that each system of equipment provided meets the specified operational requirements. The plan shall include procedures to be used in final operational testing of entire system including description for each system of test methods and materials, testing instruments and recorders, a list of the equipment involved with the functional parameters to be recorded on each item, and shop drawings of required temporary bypasses and like facilities.

3.04 PREPARATION

Ensure that installation areas are clean and that concrete or masonry operations are completed prior to installing instruments and equipment. Maintain the areas in a broom-clean condition during installation operations.

3.05 INSTALLATION

A. Instrumentation and accessory equipment shall be installed in accordance with the Control System Supplier's instructions. The locations of equipment, transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the ENGINEER during construction. Field verify all information relevant to the placing of process control equipment and in case of any interference, proceed as determined by the ENGINEER. Furnish all labor and materials necessary to complete the work in an approved manner.

B. The instrumentation loop diagrams on the Drawings indicate the intent of the interconnection for the instruments specified. All work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, the CONTRACTOR shall bear full responsibility for such violations and assume all costs arising there from. Field instruments requiring power supplies shall be provided with local electrical shut-offs.

C. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment. The CONTRACTOR shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship this material in sections sized to permit passing through such restrictive areas in the building.

D. The shield on each process instrumentation cable shall be grounded as directed by the manufacturer of the instrumentation equipment but in no case shall more than one ground be employed for each shield. Cable shields will be continuously maintained by termination to "shield" terminals which are not grounded except at the Main Control Panel. The sole exception is if the manufacturer requires ground of the shield at the field device.

E. Each pair of wires of every instrumentation shall be tagged within four inches of each termination with the assigned cable, pair and terminal numbers. Low energy signal (4-20 mAdc) shall be run in instrumentation cables in conduits separated from AC power, control and annunciator wiring. Lifting eyes shall be removed from cabinets/assemblies. All holes in cabinet or boxes shall be plugged. The plug will be of the same color as the cabinet or box and shall be gasketed.

3.06 INSTRUMENT CALIBRATION

A. Provide the services of factory trained instrumentation technicians, tools and equipment to field calibrate each instrument to its specified accuracy in accordance with the manufacturer's specifications and instructions for calibration. Each instrument shall be calibrated at 10%, 50%, and 90% of span using test instruments to simulate inputs and read outputs that are rated to an accuracy of at least 5 times greater than the specified accuracy

of the instrument being calibrated. Such test instruments shall have accuracies traceable to the National Bureau of Standards, as applicable. Provide a list and basic specifications for instruments used. Provide a written report to the ENGINEER on each instrument certifying that it has been calibrated to its published specified accuracy. This report shall include applicable data as listed below plus any defects noted, correction action required and correction made. Data shall be recorded on prepared forms and shall include not less than the following items.

1. Facility identification (name, location).

2. Loop identification (name or function).

3. Equipment tag and serial numbers.

4. Scale ranges and units.

5. Test mode or type of test.

6. Input values or settings.

7. Expected outputs and tolerances.

8. Date of actual calibration.

9. Actual readings.

10. Explanations or special notes as applicable.

11. Tester's certification with name and signature.

3.07 SYSTEM VALIDATION

A. Provide the services of factory trained and field experienced instrumentation engineer(s) to validate each system to verify that each system is operational and performing its intended function within system tolerance. System tolerance is defined as the root-mean-square sum of the system component published specified accuracies from input to output. Validate each system by simulating inputs at the first element in loop (i.e., sensor) of 10%, 50%, and 90% of span, or on/off and verifying loop output devices (i.e., recorder, indicator, alarm, etc., except controllers). During system validation, make provisional settings on levels, and alarms. Verify controllers by observing that the final control element moves in the proper direction to correct the process variable as compared to the set point. Verify that alarms and logic sequences operate in accordance with the specifications.

B. Cause malfunctions to sound alarms or switch to standby to check system operation. Check all systems thoroughly for correct operation.

C. Immediately correct defects and malfunctions disclosed by tests. Use new parts and materials as required and approved and retest. Provide a report certifying completion of validation of each instrument system. This report shall indicate calculated system tolerances, data verifying that the system meets these tolerances, and any provisional settings made to devices. Data sheets shall be similar to those used for calibration.

3.08 FINAL OPERATIONAL TESTING AND ACCEPTANCE

A. Upon completion of instrument calibration and system validation, test system under process conditions. The intent of this test is to demonstrate and verify the operational interrelationship of the instrumentation systems. This testing shall include, but not be limited to, specified operational modes, taking process variables to their limits (simulated or process) to verify all alarms, failure interlocks, and operational interlocks between systems and mechanical equipment.

B. Immediately correct defects and malfunctions with approved methods and materials in each case and repeat and testing. Upon completion of final operational testing, submit certified report, with substantiating data sheets, indicating that total instrumentation and control system meets the functional requirements specified herein.

C. Testing shall be observed by the ENGINEER and OWNER. Notify the ENGINEER in writing a minimum of 48 hours prior to the proposed date for commencing the testing. Upon completion of this test the CONTRACTOR shall begin or have begun system start-up. OWNER reserves the right to set the schedule.

3.09 START-UP ASSISTANCE

A. Provide the services of a factory trained and field experienced instrumentation engineer for a minimum of 1 day at the project site to assist the ENGINEER in field checkout and start-up of software. This period shall be scheduled by the ENGINEER.

B. Provide the services of a factory trained and field experienced instrumentation engineer for a minimum of two (2) working days to assist OWNER's personnel during startup of the system. Purpose of this assistance is to support in making final adjustments of settings on the instrument systems.

3.10 COORDINATION

Work shall be coordination with other trades involved in the construction project. Work shall be carefully laid out in advance so that architectural, structural, mechanical, electrical, and instrumentation features of construction will be coordinated.

3.11 DIGITAL EQUIPMENT

Digital equipment supplier shall provide an authorized, service representative for a minimum of three times at jobsite, including once during installation and start-up and once during acceptance to inspect and check out the control system. Service representative shall revisit jobsite for 8 hours per day as often as necessary after installation until trouble is corrected and equipment has passed acceptance test and is operating satisfactorily to ENGINEER.

END OF SECTION

SECTION 13451
INSTRUMENTATION

PART I – GENERAL

1.01 WORK INCLUDED

A. The CONTRACTOR shall furnish and install all equipment, instrumentation, and hardware necessary to provide for a working and functional control system. At a minimum the CONTRACTOR shall be responsible for:

1. Purchasing of all instrumentation tagged on the P&ID drawings, equipment schedule, or others listed in these specifications.
2. Installation of all instruments and equipment required for a complete and operable system.
3. Installation and termination of all instrument and power wiring.
4. Installation and connection of all instrument pneumatic tubing and related controls.
5. Pressure and signal testing of all pneumatic control lines and related equipment.
6. Instrument calibration and loop checks.
7. Providing as-built drawings to OWNER or ENGINEER upon final acceptance of the system.

B. The CONTRACTOR shall furnish and install all necessary items and appurtenances in addition to those shown on the drawings and specified for the proper operation of the instrumentation.

C. All instrument devices where applicable shall be connected to clean dry air and electrical supply systems. The system shall be continuity checked, leak tested, ground tested, calibrated, control valves stroked, all in-line devices bolted or mounted in the proper orientation and place in the process system as a complete operable system when released by the CONTRACTOR to the OWNER.

D. Calibration standards shall be traceable to the National Institute of Standards and Technology. All instruments used to verify calibration shall have superior measurement capability and be of the highest quality and accuracy.

E. All work, shall be constructed true to lines and surfaces indicated in a neat, substantial, and workmanlike manner and in such a way as to properly serve the purpose intended. Equipment shall be plumb and level. All members and parts, upon installation, shall be properly supported from the building structure, existing supports or independent support framing, secured together, and anchored in place.

F. In cases where detailed wiring or tubing information is not included within the drawings or the accompanying specifications, the CONTRACTOR shall be responsible for installation and connecting and placing the instrument devices into proper and satisfactory service. The manufacturers' technical publications shall serve as the guidelines to incorporate these devices into the design of the system.

1.02 RELATED WORK

A. This Specification shall be used in conjunction with the following other specifications and related Contract Documents to form the complete requirements for valves:

1. Process and Instrumentation Drawings (P&IDs)

2. Section 16050: Basic Materials and Methods

B. CAUTION: Use of this Section without including all of the above-listed items will result in omission of basic requirements.

C. In the event of conflict regarding requirements for the valves between this Section and any other section, the provisions of this Section shall govern.

1.03 SUBMITTALS

A. In addition to any other requirements contained within the Contract Documents, the following information, at a minimum, shall be submitted for approval prior to purchase of any valves:

1. Detailed instrumentation information in the form of an Excel spreadsheet. Include: tag number, drawing number, manufacturer, model, process fluid, process connection, line size

B. Complete catalog information, descriptive literature, specifications, and identification of materials of construction in Adobe Acrobat format for all instrumentation, using the strikeout tool to clearly identify non-applicable model numbers and/or options.

PART 2 – PRODUCTS

2.01 GENERAL

A. The SUPPLIER shall provide all instrumentation indicated on the P&IDS and listed in the Bill of Materials.

B. Instrumentation is identified on the P&IDs by instrument tag number (e.g. LE/LIT-1042).

2.02 SCHEDULE

The requirements of each instrumentation call-out are described in tables at the end of this Section.

PART 3 – EXECUTION

3.01 GENERAL

A. All material and equipment shall be installed in accordance with manufacturer's technical instructions, engineering drawings and as may be required by the applicable codes of the state and city. Drawings do not attempt to show exact details of all routing, and no extra payment will be allowed for obstruction by work of other trades or local obstructions to the work under this Contract that require offsets. Piping drawings shall be used as dimensioned and indicated for proper process taps to all instruments.

B. The CONTRACTOR shall be responsible for identifying interferences and submitting in writing to the ENGINEER changes required to resolve interferences.

C. The CONTRACTOR shall be thoroughly familiar with industry standard practices and operating qualifications.

3.02 IDENTIFICATION PLATES AND CODING

A. The CONTRACTOR shall attach nametags to control devices with screws, bolts, or wire leader to create a permanent bond. All field tags shall be embossed stainless steel or as required in other sections of these specifications.

B. All components provided under this section, both field and rack mounted, shall be provided with permanently mounted name tags bearing the entire ISA tag number of the component. Rack mounted tags shall be plastic; field mounted tags shall be stamped stainless steel.

3.03 WIRING INSTALLATION

A. Wiring shall be installed in a neat manner and exhibit no skinned insulation. Bends in cables and wiring shall not be less than manufacturers' recommended radius.

B. Connections at the instrument and terminal strips shall adhere to the strictest standards of quality terminations. Splices shall not be allowed except where instruments have pigtails. There the wire shall be scotch locked and taped to prevent moisture entering under the cap. High grade electrical tape shall be used. In all practical installation, terminations in junction boxes at terminal strips shall be provided.

3.04 INSTRUMENT INSTALLATION REQUIREMENTS

A. The CONTRACTOR shall install instrument devices in accordance with appropriate installation procedures to insure the manufactures' published accuracy of the devices.

B. Extreme caution should be observed to install in-line measuring devices in the proper orientation. Manufacturer's installation procedures for placing the instrument in service shall be adhered to. Body ends and seats shall be installed facing the proper directions to insure no leakage occurs past the seat.

C. Gasket material as defined by the piping specifications shall be installed with the appropriate valves. Proper tightening of flange bolts to prevent uneven gasket loading shall be checked by the CONTRACTOR.

D. All instruments and control valves shall be installed in accordance with the location drawings and technical specifications guidelines. All instruments shall be accessible from grade, platforms, ladders or catwalks. All locally mounted indicating transmitters and gages shall be faced toward the normal operating aisle. They shall be within reading capability from normal line of site.

E. Brackets shown for attachment to walls columns, masonry or structural steel shall be installed so as not to obstruct any access or regress from any approach.

F. Instruments shall be grouped where practical and be mounted in locations so as not to block motors or equipment required to be pulled for maintenance or check out.

G. Instruments shall be mounted level and plumb, rigidly supported in a manner disallowing transmission of vibration to adjoining structures, components, walls or cabinets. Freedom from interference of piping and electrical conduit shall be required. Services brought to the instruments shall not prevent the installation or removal for maintenance purposes. Process

tubing routed to the instrument shall not block access to the instrument.

H. All instrument devices shall be calibrated, bench tested and verified ranges shall be recorded and checked against the specification sheet prior to installation in the field.

3.05 INSTRUMENT PROCESS CONNECTIONS

A. The CONTRACTOR shall complete all necessary connections to process equipment, control panels, and instruments as required to meet the intent of the drawings. All vents and drains from instrument process piping shall be routed to the proper vent headers or sewers as required for environmental reasons or as provided for in the job specifications and drawings.

B. Over range limit, maximum working pressure and static pressure limits shall not be exceeded to prevent damage to the transmitter. The Manufacturer shall specify all transmitters and measuring elements to be compatible with the pressure and temperature ranges of process parameters.

C. Process temperature limit, ambient temperature limit and storage temperature limit shall not be exceeded in any installation. The Manufacturer shall ensure the installation provides affordable protection to the instrument devices.

3.06 INSTRUMENT SETUP/PROGRAMMING

A. The CONTRACTOR shall setup and program all instrumentation. As necessary, the CONTRACTOR shall have the Manufacturer's Representative on-site to program or setup any instrumentation, and ensure that no warranties are voided.

B. Copies of all software, programs, or equipment setup logs shall be given to the OWNER prior to completion of the project. This information shall be made available to the OWNER or ENGINEER upon request at any time during construction or check-out of equipment.

3.07 INSTRUMENT CALIBRATION

A. The CONTRACTOR shall calibrate all instrumentation in a suitable environment to quality testing procedures. High accuracy comparative instruments or mechanisms shall be the standard against which instrument calibration is tested.

B. Simulated operating conditions for individual instruments and operating as a complete loop or system shall be calibrated to ensure control accuracy.

C. Instruments shall have a calibration sticker placed on the instrument. It shall be placed on the inside of the cover or door of the certified instrument. It shall bear the date and initials of the instrument tech certifying calibration.

D. Calibration records shall be kept in files available to the OWNER or ENGINEER. They shall contain the instrument tag number, all necessary calibration data, and be kept in an orderly system.

E. Manufacturer's installation and calibration literature shall be kept in the same file and turned over to the OWNER at the end of commissioning the instruments.

F. Record keeping shall include all original calibration curves supplied and certified by the

factory. Any additional maintenance literature shipped with the instrument shall be kept on record.

G. The CONTRACTOR shall furnish all apparatus assemblies required for testing standards to implement simulated process conditions.

H. The CONTRACTOR shall not energize nor pressurize systems until the installations have been approved by the OWNER.

Instrumentation Specifications

Instrument	**DO/Temp Sensor and Transmitter**
Service (s)	Mixed Liquor
Measuring Range	Sensor: 0 to 20 ppm Transmitter: two-analog 4-20 mA DC, max impedance 500 ohms
Accuracy	± 0.2% of span
Repeatability	± 0.5% of span
Response Time	To 90% in less than 40 seconds To 95% in less than 60 seconds
Pressure Range	150 psi max
Operating Temperature	0 to 50°C (32° – 122°F)
Sensor Immersion Depth	107m (350 ft)
Sensor Materials Wetted Parts	Probe: Foam Noryl and 316 Stainless Steel Sensor: Polybutyl methacrolate
Sensor Cable	10m (33ft)
Output Signal	4-20 mA
Relays	Three SPDT, user-configurable contacts rated 100 to 230 Vac, 5 Amp resistive maximum
Enclosure Rating	NEMA 4X/IP66
Electrical Rating	100 to 230 Vac, 50/60Hz; Power: 11W with 7W sensor load; 35W with 25W sensor load
Compliance/Approval	ETL to UL 61010A-1 and CSA C22.2 No. 1010.1
Display	Graphic dot matrix LCD, 128 x 64 pixels with LED backlighting
Calibration	0 – 20 ppm
Weights	Sensor: 3 lbs (1.4 kg) Transmitter: 3.5 lbs (1.6 kg)
Acceptable Manufacturers	HACH LDO Dissolved Oxygen Probe HACH SC100 Controller Or Equal

Instrument	**Turbidimeter**
Service (s)	MBR permeate system
Measuring Range	0.001 to 100 NTU
Accuracy	± 0.015 NTU
Repeatability	± 0.002 NTU
Response Time	To 90% in less than 40 seconds To 95% in less than 60 seconds
Pressure Range	150 psi max
Operating Temperature	0 to 50°C (32° – 122°F)
Output Signal	4-20 mA
Relays	Three SPDT, user-configurable contacts rated 100 to 230 Vac, 5 Amp resistive maximum
Enclosure Rating	NEMA 4X (mount in a 316 stainless steel enclosure)
Electrical Rating	100 to 230 Vac, 50/60Hz; Power: 11W with 7W sensor load; 35W with 25W sensor load
Compliance/Approval	ETL to UL 61010A-1 and CSA C22.2 No. 1010.1
Display	Graphic dot matrix LCD, 128 x 64 pixels with LED backlighting
Calibration	0 – 20 ppm
Weights	Sensor: 3 lbs (1.4 kg) Transmitter: 3.5 lbs (1.6 kg)
Acceptable Manufacturers	HACH Turbidimeter Model 1720 HACH SC100 Controller

Instrument	**Chlorine Analyzer**
Service (s)	Chlorinated MBR permeate
Measuring Range	0 to 5 mg/L
Accuracy	± 0.035 mg/L
Repeatability	± 0.005 mg/L
Response Time	One complete sample analysis in 2.5 minutes
Pressure Range	150 psi max
Operating Temperature	0 to 50°C (32° – 122°F)
Output Signal	4-20 mA
Relays	Tw0 SPDT, user-configurable relays rated 100 to 230 Vac, 5 Amp resistive maximum
Enclosure Rating	NEMA 4X (Mount is a 316 stainless steel enclosure)
Electrical Rating	100 to 230 Vac, 50/60Hz; Power: 90 VA maximum
Compliance/Approval	ETL to UL 1262 and CSA C22.2 No. 142
Display	Graphic dot matrix LCD, 128 x 64 pixels with LED backlighting
Weights	Transmitter: 25 lbs (11.3 kg)
Acceptable Manufacturers	HACH Model CL17

Instrument	**Submersible Pressure Level Transmitter**
Service (s)	Mixed Liquor
Measuring Range	3ft to 600ft of Water
Accuracy	± 0.2% full scale
Repeatability	± 0.1% full scale per year
Response Time	150 ms
Pressure Range	N/A
Temperature Range	Operating: 14° to 158°F (-10°C to 70°C) Storage: -40° to 176°F (-40°C to 80°C)
Transmitter Type	Hydrostatic Level
Output Signal	4-20 mA
Enclosure Rating	NEMA 6P (IP68)
Process Connections	316 SS Mounting clamp or 1 ½" NPT
Power Supply	10 – 30 VDC, 2 wire loop powered
Compliance/Approval	FM and CSA Intrinsically safe, Class I, Division I and Groups A-D
Display	N/A
Materials	Sensor Housing: 316L SS Sensor diaphragm: Aluminum oxide ceramic Al203 Internal Seal: EPDM or Viton Protective cap: PE-HD (high density polyethylene) Extension cable insulation: PE (Polyethylene) Mounting clamp: 316L SS and glass fiber reinforced PA (Polyamide) Cable mounting screw: G 1-1/2 A and 1-1/2" NPT, 304 SS Terminal Housing: PC (Polycarbonate)
Weights	N/A
Acceptable Manufacturers	"Bird Cage" model, manufactured by Blue Ribbon Corporation

Instrument	**Insertion Thermal Gas Mass Flow Meter**
Service (s)	Process Air
Measuring Range	Per process specifications and drawings
Accuracy	Accuracy of Point Velocity: ± 1% reading + 0.5% full scale Temperature Coefficient: ± 0.02% of reading per °F within ± 50°F of customer specified conditions ± 0.03 % of reading per °F within ± 50°F to 100°F of customer specified conditions ± 0.04 % of reading per °C within ± 25°C to 100°F of customer specified conditions ± 0.06 % of reading per °C within ± 25°C to 50°C of customer specified conditions
Repeatability	± 0.2 % full scale
Response Time	One second to 63% of final velocity value
Pressure Range	Pressure Coefficient: 0.02% per psi for air Pressure Drop: negligible for pipes three inches in diameter or larger
Temperature Range	Gas: 15°F to 350°F (-10°C to 177°C) Ambient: -5°F to 120°F (-20°C to 50°C)
Transmitter Type	Indication
Output Signal	4-20 mA proportional to mass flow rate, 700 ohms maximum resistance power supply dependent
Relay Outputs/Alarms	Hard contact user-adjustable high and low Dead band adjustable with Smart Interface software Relay ratings……Maximum 400 VDC or VAC (peak), 140 mA
Enclosure Rating	NEMA 4X (IP65)
Electrical Connections	Two ¾ inch NPT…..Hazardous area location enclosure (IP67) One ½ in NPT……NEMA 4X enclosure (IP65)
Power Requirements	18-30 VDC (regulated), 625 mA maximum
Compliance/Approval	CE (All Enclosures) FM & CSA (Explosion Proof Class I, Division I, Groups B, C, D)
Display	Alphanumeric 2x12 digit backlit LCD
Sensor Materials	316L Stainless Steel
Weights	N/A
Acceptable Manufacturers	Sierra Instruments or Equal

Instrument	**Pressure Gauge**
Service (s)	Permeate, CDS
Accuracy	0.5% full scale to ASME B40.1 standard (Grade 2A)
Dial Case and Type	Compound gauge
Case Material	304 SS
Pressure Range	30" Hg + 15 PSIG (as needed)
Dial Material	Aluminum Alloy
Lens Ring	Laminated safety glass (4mm/ 0.16” thick)
Ring Material	PBTP
Process Connections	Standard bottom connection, ½” NPT
Mounting Type	½” NPT
Materials	Bourbon Tube: 316 SS Socket: 316 SS Movement: precision stainless steel Case: Molded fiberglass reinforced thermoplastic
Weights	Dry: 1.88 lbs (0.86 kg) Filled: 2.76 lbs (1.25 kg)
Acceptable Manufacturers	McDaniel Controls, Inc, Rosemount or Equal

Instrument	**Pressure Sensor/Transmitter**
Service (s)	Permeate
Measuring Range	0 – 15 psig unless otherwise stated in specifications and drawings
Accuracy	To DIN IEC 770
Repeatability	0.5% full scale
Response Time	20 ms
Pressure Range	N/A
Temperature Range	Process: -40°F to +275°F Ambient: -4° to 185°F (-20°C to 85°C) Storage: -58° to 212°F (-50°C to 100°C) Sensor: Max Temperature 212°F (100°C)
Transmitter Type	Process Pressure
Output Signal	4-20 mA
Enclosure Rating	NEMA 4X (IP65)
Electrical Connections	1/2” NPT plug, ISO NEMA 4X
Process Connections	304 SS: G ½” (DIN 12 288) or ½” MNPT with ¼” FMPT, or PT ½” male thread
Power Supply	11 to 30 VDC, 5% ripple
Compliance/Approval	SIL-2
Display	N/A
Wetted Parts Material	304 SS process connection and housing FPM (Viton) internal gasket AL203 (Aluminum Oxide-Ceramic) Sensor
Weights	N/A
Acceptable Manufacturers	Endress & Hauser

Instrument	**Magnetic Flowmeter**
Service (s)	Mixed Liquor, Permeate, Effluent
Measuring Range	As stated in specifications and drawings
Accuracy	± 0.5% full scale
Repeatability	± 0.1% o.r. 0.005% of max full scale (o.r = of reading)
Sensor Temperature Range	Ambient: -5° to + 140°F (-20°C to 60°C) Storage:15° to 120°F (-10°C to 50°C)
Output Signal	Active/passive selectable galvanize isolated, time constant selectable (0.01 to 100s), full scale value selectable, temperature coefficient: type 0.003% o.r./°F (0.005% o.r./°C), resolution: 0.5µA (o.r. = of reading) Active: 0/4 to 20 mA, R_L < 700 ohms (HART: R_L > 250 Ω) Passive: 4 to 20 mA, operating voltage Vs 18 to 30 V DC, R_i ≤ 150 Ω)
Enclosure Rating	NEMA 4X (IP67)
Electrical Connections	9 – 32 VDC
Fluid conductivity	≥ 5µS/cm
Process Connections	Flanged Connections: ANSI, AWWA
Compliance/Approval	FM non-incendive Class I, Division 2 CSA non-incendive Class I, Division 2
Display	LCD, backlit, two lines with 16 characters per line custom configurations for presenting different measured value and status variables. Outdoor installations shall include sunshields.
Materials	Transmitter Housing: powder coated die-cast aluminum Sensor Housing: power coated die-cast aluminum Flanges: ANSI 105CS Electrodes: 316L SS Seal: Seals to DIN 2690 Fitted electrodes: Measuring, reference and Empty Pipe Detection electrodes: 316L SS Liner: Polyurethane
Acceptable Manufacturers	Endress & Hauser Pro Mag

Instrument	**Rotameter**
Service (s)	CDS
Measuring Range	Water: 0.01 to 0.1 through 265 to 2645 GPH Air: 0.025 to 0.25 through 670 to 6700 SCFH
Accuracy	± 1% full scale accuracy
Repeatability	n/a
Process Temperature Range	SS, hastelloy or Teflon float: -40°F to 212°F Hard Rubber: 14°F to 140°F
Body Size	½" through 2"
Maximum Pressure	½" through 1-1/2" : 130 psig 2": 100 psig
Body Materials (Non-Wetted)	Tube Housing: 316L SS Union Nut: Painted Aluminum or 316 SS
Wetted Materials	Measuring Tube: Borosilicate Glass Float: 316 SS, hastelloy, aluminum, Teflon or rubber Seals: Buna-N, Viton, EPDM or PTFE Fittings: 316 SS Float Stops: PVDF
Electrical Connections	Terminal box
Enclosure	N/A
Display	N/A
Acceptable Manufacturers	Kobold or Equal

Instrument	**Float Switches**
Service (s)	MBR and process basins
Switch	Mechanical switch. Mercury switch is not acceptable.
Float	Solid Polyurethane
Electrical Rating	10 amp, 120V
Power Cord	18 AWG 2 Conductor

Instrument	**Ultrasonic Level Transmitter**
Service (s)	Chemical storage
Measuring Range	0ft to 25ft of liquid
Accuracy	± 0.2% full scale
Repeatability	± 0.1% full scale per year
Response Time	150 ms
Pressure Range	N/A
Temperature Range	Operating: 14° to 158°F (-10°C to 70°C) Storage: -40° to 176°F (-40°C to 80°C)
Transmitter Type	Ultrasonic
Output Signal	4-20 mA
Enclosure Rating	NEMA 6P (IP68)
Process Connections	Process flange on tank
Power Supply	120 VAC
Compliance/Approval	FM and CSA Intrinsically safe, Class I, Division I and Groups A-D
Display	N/A
Materials	Sensor Housing: Kynar
Weights	N/A
Acceptable Manufacturers	HydroRanger 200, manufactured by Siemens

END OF SECTION

SECTION 13452
INSTRUMENTATION & CONTROL SYSTEM SCADA

PART I – GENERAL

1.01 WORK INCLUDED

A. The CONTRACTOR shall furnish and install all hardware and software necessary to provide for a working and functional SCADA system. At a minimum the Contractor shall be responsible for:

1. Purchasing of all hardware and software listed in these specifications.

2. Configure, Program, and Develop the SCADA System with reference to the HMI and PLC standards specification.

3. Provide all original vendor software CD's with version numbers and software licenses to OWNER or ENGINEER upon final acceptance of the system.

1.02 REFERENCED SECTIONS

The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the CONTRACTOR'S responsibility to perform all the work required by the Contract Documents.

Section 16010: Electrical General Requirements
Section 13451: Instrumentation
Section 13453: MBR Control System

1.03 SUBMITTALS

A. In addition to any other requirements contained within the Contract Documents, the following information, at a minimum, shall be submitted for approval prior to purchase of any SCADA system components:

1. Hardware and Software information to include: Version Numbers and Vendor Information.

B. Complete catalog information, descriptive literature, specifications, and identification of materials of construction for all SCADA system hardware and software.

PART 2 – PRODUCTS

2.01 SCADA HARDWARE

A. The SUPPLIER shall provide below Hardware specification for the SCADA system HMI.

1. Standard Hardware for SCADA System: Desktop PC (**Latest version with the following minimum requirements**)

Hardware	Description
Hardware Type	Dell Precision Workstation
Processor	Intel® Xeon™ Processor 2.80GHz, 2MB L2 Cache
Operation System	Genuine Windows® 10
File System	NTFS File System
Memory	512MB, DDR2 SDRAM Memory, 400MHz, ECC (2DIMMS)
Keyboard	Entry Level, USB, No Hot Keys
Mouse	Dell USB 2-Button Optical Mouse with Scroll
Boot Drive	80GB SATA, 7200 RPM Hard Drive
CD-Rom/RW Devices	48X/32X CD-RW CDRW
Monitor	Dell 15 inch UltraSharp™ 1504FPT Flat Panel, adjustable stand, VGA/DVI 1504FPH
Graphics Card	64MB PCIe x16 nVidia Quadro NVS 280, Dual VGA Capable
Modem	Dell™ 56K v.92 Data/Fax PCI Modem
LAN	Onboard 10/100 Ethernet Socket
Serial	Single or Dual Comport

2.02 SCADA SYSTEM SOFTWARE

A. The SUPPLIER shall provide below Software specification for the SCADA system HMI.

1. Standard Software for SCADA System:

Software	Description
HMI	Proficy HMI/SCADA iFIX – Latest Version – 1000 Tag Runtime with IO
I/O Server	Proficy HMI/SCADAiFIX I/O Server
Alarm Notification	Proficy HMI/SCADA iFIX – Latest Version
Remote Access	FAMTECH Remote Administrator – Latest Version
Productivity	MSOffice Basic Edition – Latest Version

2.03 SCADA SYSTEM COMMUNICATIONS

A. The SUPPLIER shall follow the below Communications specification for the SCADA system.

1. Standard Communications for SCADA System will be Ethernet TCP/IP.

2. Media Type will be RJ45 Copper connections.

3. An Ethernet / Dial-up Modem will be used for networking the PLC and HMI together. Also, this unit will be used via either Option A or Option B to gain remote access to the PLC and HMI for diagnostics and program updates.
    a. Remote Access Communications Option A:
        i. The customer shall supply a DSL or Cable service and modem that will be connected to the Ethernet / Dial-up modem for Remote Access Hardware via the Internet.
        ii. The customer shall sign-up for an annual subscription to www.Logmein.com for Remote Access Software Service via the Internet. This Service includes VPN and Firewall capabilities.

        (Note: Option A is the preferred method due to the high speed connection allowing for quick data transfers.)
    b. Remote Access Communications Option B:
        i. The customer shall supply a Telephone Connection that will be connected to the Ethernet / Dial-up modem for Remote Access Hardware via a Dial-Up connection.
        ii. Famtech Remote Administrator will be used to gain Remote Access Software via the Dial-Up connection.

B. The SUPPLIER shall follow the PLC Hardware specification for the SCADA system.

1. Standard PLC for SCADA System will be a Modicon M580 PAC.

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

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SECTION 13453
MBR CONTROL SYSTEM

PART I – GENERAL

1.01 WORK INCLUDED

The VENDOR shall provide PLC-based control system (PLCS) complete and operable, in accordance with the Contract Documents.

1.02 REFERENCED SECTIONS

The work of the following Sections is related to the work of this Section. Other Sections, not referenced below, may also be related to the proper performance of this work. It is the CONTRACTOR's responsibility to perform all the work required by the Contract Documents.

1, Section 16010: Electrical General Requirements
2. Section 13451: Instrumentation
3. Section 13452: SCADA

1.03 SUBMITTALS

A. Shop Drawings: Submittals shall be in accordance with the applicable requirements of Section 01300, 13450, and 16010.

B. Submittals: The PLC hardware submittal shall be a single submittal which includes at least the following:

1. A complete set of PLC diagrams which depict all cables required to support the communication requirements: A separate diagram shall be submitted for each component fully annotated with conduit size and number associated with the power source.

2. UPS and battery load calculations to show that that backup capacity and time meet the specified requirements.

3. Data sheets shall be included for each PLCS component together with a technical product brochure or bulletin. These data sheets shall show the component name as used within the Contract Documents, the manufacturer's model number or other identifying product designation, the project tag number, the project system of which it is a part, the input and output characteristics, the requirements for electric power, the ambient operating condition requirements, and details on materials of construction.

4. Complete and detailed bills of materials: A bill of material list, including quantity, description, manufacturer, and part number, shall be submitted for each component of the PLC system. Bills of material shall include all items within an enclosure.

5. Calibration, adjustment, and test details for all PLC components.

C. Technical Manuals**:** General requirements for Technical Manuals are as described in Section 01300. The following items shall also be included in the PLCS manual:

1. A documented PLC program listing including the I/O list and housing configuration for each PLC, a memory usage report for each PLC, and a register layout list for each PLC.

2. Operation and maintenance manuals for all hardware furnished under this section.

1.04 QUALITY ASSURANCE

A. The CONTRACTOR/Instrumentation Supplier shall arrange for visits by, and services of, technical field representatives of the manufacturer for installation certification, system testing, training, and start-up. These services shall be part of the WORK and provided at no additional cost to the OWNER.

B. Warranty Requirements: Special warranty requirements shall be in accordance with the applicable requirements of Section 01740.

1. Equipment, software, and materials which do not achieve design requirements after installation shall be replaced or modified by the Instrumentation Supplier to attain compliance. The cost for doing so shall be the Vendor's responsibility. Following replacement or modification, the Vendor shall retest the system and perform any additional procedures needed to place the complete PLC in satisfactory operation and attain design compliance approval from the Engineer.

2. The Vendor warrants the materials and workmanship used for the PLCS equipment and materials and further guarantees the materials and workmanship used for any equipment and materials produced and furnished hereunder as a part of the Work to be as required and agreed upon, fee from injurious defects, and in all respects satisfactory for the service required.

3. The Vendor warrants/guarantees the satisfactory performance of the equipment and materials under operating conditions for a period of two years after the date of final acceptance. In the event that tests and inspection disclose latent defects or failure to meet the specified requirements, the Instrumentation Supplier shall proceed at once to correct or repair any such defects or non-conformance. The delivery of new equipment or parts as may be necessary for conformity to the requirements shall be made at no additional compensation. In case of any required repair or other corrective or remedial work covered under warranty, the warranties on all such corrections, repairs, new equipment, or parts shall be extended for an additional 24 months from the date of final acceptance or 12 months from the date of completion of any such corrections, repairs, new equipments, or parts, whichever date is later. If the OWNER performs repair, the Vendor shall reimburse the OWNER for all costs incurred in the removal of the defective material and installation of the replacement.

PART 2 – PRODUCTS

2.01 GENERAL

A. All materials and all PLC equipment furnished under this Contract shall be new, free from defects, of first quality, and produced by manufacturers regularly engaged in the manufacture of these products.

B. Hardware Commonality: Where there is more than one item of similar equipment being furnished all such similar equipment shall be the product of a single manufacturer.

2.02 PROGRAMMABLE LOGIC CONTROLLER (PLC)

A. Manufacturer: The PLC shall be Modicon, model M340 PAC.

B. Each PLC shall be of solid-state design. All CPU operating logic shall be contained on plug-in modules for quick replacement. Chassis wired logic is not acceptable. The controller shall be capable of operating in a hostile industrial environment and designed to provide high reliability specifically in this process application. The internal wiring of the controller is to be fixed, with the logic functions it must perform in a given application to be programmed into its memory. The controller shall be supplied with the CPU, input/output scanner, inputs, outputs, memory, power supply, and all power and interface cables necessary to function as a complete and operable PLC system. Each PLC shall be furnished with multiple onboard communication ports including Modbus, Ethernet, remote I/O, and RS-232.

C. Spare PLC: A backup spare fully programmed PLC shall also be provided to replace the operating PLC should it fail. The backup PLC shall be capable of full operation when replacing the operating PLC.

D. Design: Each PLC shall have all of the facilities required to implement the control schemes and database indicated. PLC shall have the following functions and features:

1. Modular, field expandable design allowing the system to be tailored to this process control application. The capability shall exist to allow for expansion of the system by the addition of hardware and/or user software.

2. The processor plus input and output circuitry shall be of a modular design with interchangeability provided for all similar modules. Modules are defined herein as devices which plug into a chassis and are keyed to allow installation in only one direction. The design must prohibit upside down insertion of the modules as well as safeguard against the insertion of a module into the wrong slot.

3. The PLCS shall have downward compatibility whereby all new module designs can be interchanged with all similar modules in an effort to reduce obsolescence.

4. All hardware shall operate at an ambient temperature of 0 to 60 degrees C (32 to 140 degrees F), with an ambient temperature rating for storage of -40 to + 85 degrees C (-40 to + 185 degrees F), and shall function continuously in the relative humidity range of 5% to 95% with no condensation. The PLC system shall be designed and tested to operate in the high electrical noise environment of an industrial wastewater treatment plant.

5. The PLC shall provide a means for mounting the chassis in a standard cabinet.

6. The CPU shall have the capability of addressing up to 4096 input and 4096 output points. It shall also have the ability to communicate with up to 64 physical locations.

7. The PLC shall include feature the capability of addressing remote input and output modules up to 10,000 cable feet from the processor through the use of a Remote I/O Scanner Module.

8. It shall be possible to communicate with remote I/O racks or other PLC via fiber optic cable by inserting fiber optic modems into the twin axial links. The fiber link must support distances between modems of up to 6,500 cable feet.

9. The PLC shall have one dedicated serial port which supports RS-232-C, RS-422A, and RS-423 signals. It shall be accessible in control logic and provide support for Slave SCADA communication protocol systems.

E. Central Processors (CPU): Each CPU shall contain all the relays, timers, counters, number storage registers, shift registers, sequencer, arithmetic capability, and comparators necessary to perform the indicated control functions. It shall be capable of interfacing sufficient discrete inputs, analog inputs, discrete outputs, and analog outputs to meet requirements plus excess capacity as described above. Specifically, the PLC shall have the following features and capabilities:

1. Each PLC shall be provided to support and implement closed loop floating and PID control which is directly integrated into the PLC's control program.

2. The CPU shall be a self-contained unit, and shall provide control program execution and support remote or local programming. This device shall also supply I/O scanning and inter-processor and peripheral communication functions.

3. The operating system shall be contained in removable programmable devices which allow for easy field replacement.

4. The CPU within the system shall perform internal diagnostic checking and give visual indication to the user by illuminating a "green" indicator when no fault is detected and a "red" indicator when a fault is detected.

5. The main chassis front panel shall include two-color indicators showing the following status information:

   - Program or Run mode of the CPU.
   - The run/fault status of the CPU.
   - Forces Present/Active.
   - If a remote device is communicating via the inter processor communication link.

6. Non-volatile memory shall store the operating system information to protect against loss in the case of power loss or system shut-down. Only at the time of a hardware change shall this configuration status be altered or reentered.

F. Program Creation and Storage (Memory):

1. The program storage medium shall be of a static RAM type.

2. The PLC system shall be capable of addressing up to 32K words, where each word is comprised of 16 data bits.

3. Memory capacity shall be configurable to allow for the most efficient match to the intended application. It shall be possible to upgrade to a processor with a larger memory size simply by saving a program replacing the processor, and

downloading the program to the new system without having to make any program changes.

4. Memory shall contain battery back-up capable of retaining all stored program data through a continuous power outage for 4 months under worst case conditions. The capability shall exist to remove all batteries from the system without removing system power. A low battery condition must be detectable in ladder logic, but shall not automatically generate a major fault.

5. The PLC system shall provide the capability to use EEPROM as a backup for volatile memory up to the full capacity of the controller.

6. The operator shall be able to backup volatile memory, including data and program logic onto either CD-Rom or external hard disk, at their option.

7. All user memory in the processor not used for program storage shall be allocated from main memory for the purpose of data storage. The PLC system shall be capable of storing the following data types:

    - External Output Status
    - External/Internal Input Status – Timer Values
    - Counter Values
    - Signed Integer Numbers (16 bits) – Floating Point Numbers – Decimal Numbers
    - Binary Numbers
    - BCD Numbers
    - Direct and Indexed addressing
    - Internal Processor Status Information
    - ASCII Character Data – ASCII String Data
    - Block Transfer Control Structures
    - Floating Point PID Control Structures
    - File Instruction Control Structures
    - Message Control Structures

8. Control logic programs shall have immediate access to the sub-elements of control structures by address and sub-element mnemonic, such as timer accumulator value timer done bit, or PID Process Variable value.

9. Each unit shall be supplied with sufficient memory to implement the indicated control functions plus a reserve capacity as defined in Section 2.04 B above. This reserve capacity shall be totally free from any system use. The memory shall be programmed in a multi-mode configuration with multiple series or parallel contacts, counters, timers, and arithmetic functions.

G. Programming Techniques

1. The programming format cell shall be IEC 1131-3 compliant Ladder Diagram, Sequential Function Chart, or Structured Text.

2. The capability shall exist to change a contact from normally open to normally closed, add instructions, change addresses, etc. It shall not be necessary to delete or reprogram the entire rung.

3. It shall be possible to insert relay ladder diagram rungs anywhere in the program,

even between existing rungs, insofar as there is sufficient memory to accommodate these additions.

4. The PLC shall have the capability to remove an entire logic rung into an edit buffer where individual parameters may be easily altered.

5. A single program command or instructions shall suffice to delete an individual ladder diagram rung from memory. It shall not be necessary to dele the rung contact by contact.

6. It shall be necessary to issue a two-part command in order to delete all relay ladder rungs from memory. This will provide a safeguard wherein the operator must verify their intentions before erasing the entire program.

7. A clock/calendar feature shall be included within the CPU. Access to the time and date shall be from the programming terminal, user program, or message generation.

8. Latch functions shall be internal and programmable.

9. The system shall have the capability to address software timers and software counters in any combination and quantity up to the limit of available memory. All management of these instructions into memory shall be handled by the CPU. Instructions shall permit programming timers in the “ON” or “OFF” delay modes. Timer programming shall also include the capability to interrupt timing without resetting the timers. Counters shall be programmable using up-increment and down-increment. Timer instructions shall include selectable time bases in increments of 1.0 seconds and 10 milliseconds. The timing range of each timer shall be from 0 to 32,767 increments. It shall be possible to program and display separately the time’s preset and accumulated values.

10. The PLC shall use a signed integer format ranging from -32,768 to 32,767 for data storage of the counter preset and accumulated values.

11. The PLC shall store data in the following formats:

    - Signed Integer Numbers ranging from -32,768 to + 32,767.
    - Floating Point Numbers consisting of 6 digit mantissa. For numbers larger than six digits the CPU shall covert the number into exponential form with a range of plus/minus 1.175494 E-38 to plus/minus 3.402824 E+38.
    - Decimal Numbers ranging from 0 to 9,999.

12. The PLC shall have support for integer and floating point signed math functions consisting of addition, subtraction, multiplication, division, and square root.

13. When using modules such as analog where multiple channels are terminated on one module, it shall be possible to transfer the current status of all channels to the CPU upon execution of one program instruction. This instruction shall be bi-directional to include data transfer from the CPU to the module or from the module to the CPU.

14. Instructions shall be provided for grouping contiguous 16 bit data words into a file.

The system shall address up to 1000 files with up to 1000 words per file. File manipulation instructions such as high speed “file copy” and “file fill”, “file to file” move, “element to file”, file to element” move, “first in first out” shall bed supported by the system. The four function math instructions and instructions for performing “logical OR”, “logical AND”, “exclusive OR”, and comparison instructions such as “less than”, “greater than”, and “equal to” shall be included within the system. All instructions shall execute on either single words or files.

15. The system shall contain instructions which will construct asynchronous and synchronous 16 bit word shift registers. Additional instructions shall be provided to construct synchronous bit shift registers.

16. The PLC shall have a jump instruction which will allow the programmer to jump over portions of the user program to a portion marked by a matching label instruction.

17. It shall be a function of the CPU to automatically manage all data types. For example, if a word stored in the integer section of memory is transferred into the Floating Point section, the CPU shall convert the integer value into floating point prior to executing the transfer.

18. In applications requiring repeatable logic rungs it shall be possible to place such rungs in a subroutine section. Instructions which call the subroutine and return to the main program shall be included within the system. It shall be possible to program several routines and define each subroutine by a unique program file designator. The processor will support nesting of subroutines up to seven levels deep. The program format as displayed on the CRT shall clearly define the main program and all subroutines. It shall be possible to pass selected values (parameters) to a subroutine before it execution. This allows the subroutine to perform mathematical “or logical operations on the data and return the results to the main program upon completion. These subroutines will be accessed by jump-to subroutine instructions.

19. The program format shall display all instructions on a CRT programming panel with appropriate mnemonics to define all data entered by the programmer. The system shall be capable of providing a “HELP” instruction which when called by the programmer will display on the CRT a list of instructions and all data and keystrokes required to enter an Instruction Into the memory system.

20. At the request of the programmer, data contained in system memory shall be displayed on the CRT programming panel. This monitoring feature shall be provided for input/output status, timer/counter data, files, and system status. Ladder logic rungs shall be displayed on the CRT with rung numbers in sequential order. However, the programmer shall have the option of selecting and displaying logic t. rungs non-contiguously. Sequential Function Charts shall be displayed on the CRT. Structured text shall be displayed on the CRT.

21. The system shall have the capability to enter rung comments above ladder logic rungs. These comments may be entered at the same time the ladder logic is entered.

22. The system shall have the capability to enter address comments and symbols. These entities may be entered at the same time the ladder logic is entered.

23. The capability shall exist for adding, removing, or modifying ladder logic rungs

during program execution. When changes to ladder logic are mare or new logic rungs are added, it shall be possible to test the edits of such rungs before removal of prior logic rung is executed.

24. It shall be possible to manually set (force) either on or off all hardwired input or output points from the CRT programming panel or the main chassis front panel. Removal of these forced I/O points shall be either individually or totally through selected keystrokes. The programming terminal shall be able to display forced I/O points.

25. A means to program a fault recovery routine shall exist. When a major system fault occurs in the system, the fault recovery routine shall be executed and then the system shall determine if the fault has been eliminated. If the fault is eliminated, program execution shall resumes. If the fault still exists, the system will shut down. A user shall have the option to either resume operation or to shut down upon fault detection.

26. An interrupt routine shall be programmable such that the routine shall be executed regularly. The interval at which the routine is executed shall be user-specified in the range of 1 to 65,535 milliseconds.

27. The ability to program control logic via symbols from the global database of the PLC shall exist.

28. An instruction shall be available to give the control program diagnostic information, state control, and sequencing of a process simultaneously, while allowing the capability of user-friendly state programming techniques.

29. An instruction shall be supported to incorporate closed loop control systems. The “proportional”, “integral” and “derivative” elements shall be accessible to the user in order to tune a closed loop system. This instruction must fully support floating point math.

30. The CPU shall support indexed and indirect addressing of inputs and outputs, along with data table words (integer, binary, floating point, timers, and counters) for the software instruction set.

31. The system shall support both bit and word level diagnostic instructions.

32. The processor shall be able to edit, build, and execute logically constructed function blocks (steps). These function blocks shall be executed either selectively, based upon application logic (transitions), or simultaneously. The ability to “zoom” in on a given step file shall be inherent to allow the user to quickly diagnose their application program. The overall effect of the function chart programming shall to be to provide a more efficient flow of the user’s application program.

33. To facilitate conditional event detection programming, output instructions shall include “one shot” instructions which may be triggered on either low-to-high (rising) or high-to-low (falling) rung conditions.

34. To facilitate debugging, an “always-false” instructions shall exist which may be

utilized to temporarily inhibit the execution of control logic.

35. The processor shall support Master Control Reset (Relay) type functionality to selectively disable sections of logic.

36. Trigonometric instructions supported must include Sine, Cosine, Tangent, Inverse Sine, Inverse Cosine, and Inverse Tangent. These instructions must fully support floating point math.

37. Additional floating point instructions supported must include Log 10, Natural Log, and Exponential.

38. It shall be possible to complete complex, combined calculations in a single instruction, such as flow totalizing or equations of the format ((A+((B-C)*D))IE).

39. File function instructions supported shall also include Sort, Average, Square Root, and Standard deviation.

40. The processor instruction set shall provide support for a variety of ASCII string manipulation instructions such as research, concatenation, extraction, compare, and to/from integer conversion.

41. The processor shall support control logic functions providing ASCII port control such as read, write, handshake line control, buffer examination, etc.

42. An interrupt routine shall be programmable such that the routines shall be executed based upon the input condition of one of sixteen discrete hardware inputs in the 1 processor chassis. The routine will be executed within two milliseconds of the detection of the input signal.

H. PLC Power Supply: The PLC shall operate in compliance with an electrical service of either 120 VAC, single phase; in the frequency range from 47 to 63 Hz, or 24 VDC. The power supply shall be mounted in the PLC housing and be sized to power all modules mounted in that housing and an “average module load” for any empty housing slots plus 25 percent above that total. Power supply shall be by the same manufacturer as the PLC and shall be of the same product line. A single main power supply shall have the capability of supplying power to the CPU and local input/output modules. Auxiliary power supplies shall provide to power remotely located racks.

1. The power supply shall automatically shut down the PLC system whenever its output current is detected as exceeding 125% of its rated current. The power supply shall monitor the incoming AC line voltage for proper levels. When the power supply is wired to utilize 120 VAC power, the system shall function properly within the range of 90 to 132 VAC. If the voltage level is detected as being out of range for more than one-half line cycle, the power supply shall automatically shut down the system and remain disabled until the proper voltage level returns. In addition, the power supply shall provide surge protection, isolation, and outage carry-over up to 2 cycles of the AC line. In cases the AC line is especially unstable or subject to unusual variations it shall be possible to install a constant voltage transformer having a sinusoidal output waveform.

2. Design features of the PLC power supply shall include diagnostic indicators mounted in a position to be easily viewed by the user.

3. At the time of power-up, the power supply shall inhibit operation of the processor

and I/O module until the DC voltages are within specifications.

4. The power supply shall offer fuse protection.

5. Power Supply shall have a minimum current capacity of 5 amps at 5 VDC and 0.96 amps at VDC.

I. PLC Input/Output (I/O) Modules: All I/O housings and modules shall be suitable for hostile industrial environments as described above. All I/O modules shall be isolated and conform to IEEE Surge Withstand Standards and NEMA Noise Immunity Standards. The I/Os shall be 4-20 mA DC for all analog inputs and outputs and shall be 120 VAC for discrete inputs and dry relay contacts for safe discrete outputs. Modules shall be removable without having to disconnect wiring from the module's terminals by means of a swing-arm or plug-in wiring connector. Each PLC I/O location shall contain the I/O modules required to provide all of the I/O points contain the I/O modules required to provide all of the I/O points contained in the I/O Lists. As a minimum, each PLC I/O location shall contain an installed spare capacity of 20%. During normal operation, a malfunction in any remote input/output channel shall affect the operation of only that channel and not the operation of the CPU or any other channel. Any remove input/output chancel shall be field selectable to shut down the CPU upon failure of that channel. Upon remote channel shutdown the CPU shall see all inputs on the malfunctioning chancel as they were when the components for both remote input and output shall be mounted on plug-in modules and keyed to prevent modules insertion in to the wrong slot isolation shall be used between all internal logic and external power circuits. This isolation shall meet the minimum specification of 1500 VRMS.

1. **Discrete Input Modules**: Defined as contact closure inputs from devices external to the programmable controller module. Individual inputs shall be optically isolated from low energy common mode transients to 1500 volts peak from users wiring or other I/O Modules. The modules shall have LED's to indicate status of each discrete input. Input signal level shall be 120 VAC. Input modules shall have 16 points each. Discrete Input Modules shall be Modicon BMX DAI 1604.

2. **Discrete Modules Output**: Defined as solid state outputs for ON/OFF operation of devices external to the programmable controller module. The output modules shall be wired to interposing relays. All output modules shall have LED's to indicate status of each output point. Interposing relay contact rating shall be 10 A minimum, 120VAC. The output module shall have 16 points. Discrete Output Modules shall be Modicon BMX DRA 1605.

3. **Analog Input Modules**: Defined as 4 to 20 mA DC signals, where an analog digital conversion is performed with 12-bit precision and the digital result is entered into the processor. The analog to digital conversion shall be updated with each scan of the processor. Input modules shall be source or sink to handle 2-wire or 4-wire transmitters respectively. Analog input modules shall have 4 input channels. Analog Input Modules shall be Modicon BMX AMI 0410.

4. **Analog Output Modules**: Defined as 4 to 20 mA DC output signals where each output circuit performs a digital to analog conversion minimum of 12-bit precision with each scan of the processor. Each analog output module shall have two isolated output points which shall be rated for loads of up to 1200 ohms. The CONTRACTOR shall provide current loop isolators as required to break ground loops. Analog Output Modules shall have 2 current outputs. Analog Output Modules shall be Modicon AMO 0210.

5. **Remote I/O**: One remote I/O Scanner module shall be provided for communication with Remote I/O racks.

2.03 PLC ENCLOSURE

Each PLC and its corresponding I/O modules, power supply module(s), communication interface device(s), peripheral, and UPS shall be mounted inside suitable enclosures. All I/O wiring from the field to the I/O modules shall be terminated on terminal blocks in the enclosure. Control panel enclosure shall be NEMA 12 rated for indoor service.

2.04 SOFTWARE

All PLC programming, workstations, communication, and data gathering software shall be compatible with latest versions of Modicon Unity and GE Fanuc Proficy HMI/SCADA iFIX Software.

2.05 SPARE PARTS

PLC System spare parts shall be furnished in accordance with Section 01750.

PART 3 – EXECUTION

3.01 STORAGE AND HANDLING

All equipment and materials delivered to the Site shall be stored in a location which shall not interfere with the operations of the OWNER's personnel or interfere with construction. Storage and handling shall be performed in a manner which shall afford maximum protection to the equipment and materials. It is the CONTRACTOR's responsibility to assure proper handling and on-site storage.

3.02 INSTALLATION

The CONTRACTOR shall utilize personnel to accomplish, or supervise the physical installation of all elements, components, accessories, or assemblies which it provides. The CONTRACTOR shall employ installers who are skilled and experienced in the installation and connection of all elements, components, accessories and assemblies it provides.

3.03 CALIBRATION, TESTING, AND INSTALLATION

A. Calibration: All analog inputs and outputs of the PLC shall have their calibration checked at a minimum of 4 points to verify the consistency with the balance of the analog loop. This calibration check shall be done in conjunction with the analog loop tests in Section 13450 Workstation displays and PLC registers shall both be verified for correctness.

B. Testing: After the PLC installation has been certified and the analog points have been calibrated, the PLC shall be tested to verify that all discrete inputs and outputs of both the PLC system and the workstation system are correct. All points shall be checked "end to end". For example, valve status inputs shall be checked by stroking the valve and a pump start output shall be checked by using it to start the pump. Simulated testing shall be allowed only when no practical alternative exists. Workstation displays shall be verified for correctness at the same time. An I/O checklist shall be used to record test results and a copy provided to the Engineer upon completion.

3.04 LADDER LOGIC DOCUMENTATION

The CONTRACTOR shall annotate the PLC ladder logic by providing a descriptive label for all relays and function blocks and functional description of each rung.

END OF SECTION

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SECTION 15050
MECHANICAL GENERAL REQUIREMENTS

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes general provisions for all mechanical Work, including Work specified in Division 15, Equipment, and inclusive of whatever miscellaneous material and/or equipment required for operation of mechanical systems as indicated on the Plans. This Section also includes requirements of electrical equipment, such as motor starters, controls, and instruments when furnished as components of the mechanical equipment or system.

B. Related Work Specified Elsewhere

1. Section 03300: Cast-In-Place Concrete
2. Section 09900: Painting and Special Coatings
3. Section 11005: Process Equipment General Requirements
4. Section 16010: Electrical General Requirements

1.02 QUALITY ASSURANCE

A. Reference Standards

These standard specifications have been prepared by authorities which are recognized by the mechanical trades. The names of these authorities are listed below together with the abbreviations of their names as they appear in the following Specifications:

1. ASA - American Standards Association
2. ASTM - American Society for Testing Materials
3. AMCA - Air Moving and Conditioning Association
4. AFBMA - Antifriction Bearing Manufacturing Association
5. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
6. ASME - American Society of Mechanical Engineers
7. NEMA - National Electrical Manufacturers' Association
8. AWWA - American Water Work Association
9. UL - Underwriters Laboratories, Inc.
10. FM - Factory Mutual
11. NFPA - National Fire Protection Association
12. ANSI - American Standards Association

The particular reference is identified by appropriate prefix with the latest revision being applicable.

B. Workmanship

All Work shall be performed in accordance with latest accepted standards and practices for the trades involved. The workmanship shall be subject to the approval of the ENGINEER at all times.

Only craftsmen experienced in the Work to be performed will be allowed to do the Work. This applies particularly to skilled trades such as welding, pipe fitting, plumbing, and sheet metal work.

C. Codes, Ordinances, Permits, and Inspections

All materials and equipment required for the Work and their installation shall conform to the laws of the State of Florida and to all the codes, rules, regulations, and ordinances of the locality where the Work is to be performed. The CONTRACTOR shall secure all permits, licenses, inspections and tests required in connection with his Work. Upon completion of the Work, the CONTRACTOR shall secure and present to the OWNER a certificate of inspection and approval from the department having jurisdiction over his Work, if such be issued. All fees in connection with the above requirements shall be paid by the CONTRACTOR.

Any changes in the drawings and/or Specifications required to conform to the above codes, laws, rules and/or regulations shall be taken up with the ENGINEERS' office by the CONTRACTOR before submitting his proposal.

After entering into the Contract, the CONTRACTOR shall be held to make all changes required to conform to the above ordinances, laws, rules, and/or regulations without extra expense to the OWNER, except in the instance of ordinances, laws, rules, and/or regulations which are revised or enacted subsequent to the time of signing the Contract.

D. Design Drawings

The general arrangements, design, and extent of the mechanical Work prescribed in these Specifications are indicated and/or detailed on the accompanying drawings. Any discrepancies which may occur on the drawings and/or in the Specifications shall be called to the attention of the ENGINEER. No changes or alterations in the Work shall be made because of said discrepancies until approval of such changes or alterations has been secured from the ENGINEER.

In the event of disputes arising because of discrepancies between drawings of the Architectural, Mechanical, and/or Electrical Trades, such disputes shall be taken up with the ENGINEER whose decisions will be final.

All dimensions which tie mechanical and/or electrical installations to the building structure shall be thoroughly field checked for accuracy and possibility of interferences due to field conditions. Ignorance of such field conditions because of the CONTRACTOR's failure to field check the dimensions in question will be no excuse for additional compensation.

E. CONTRACTORS' Interface

The CONTRACTOR shall be responsible to coordinate the furnishing and installation of all materials and labor required for a complete and operable facility.

The CONTRACTOR shall be responsible to include adequate appurtenances to complete installation of equipment furnished by him including motor starters when furnished as an integral part of a packaged piece of equipment or integral mechanical equipment system.

The CONTRACTOR shall be responsible for furnishing and installing the necessary piping to provide a complete and operable installation of all equipment and fixtures whether or not furnished by the CONTRACTOR.

F. Apportionment of the Work

The CONTRACTOR shall classify and apportion all materials and performance of all labor to the several trades involved in accordance with all local customs, rules, regulations, jurisdictional awards, decisions, etc., insofar as they may apply and as required to efficiently execute the Work involved in this Contract regardless of the classification indicated in these Specifications.

G. Surveys

The CONTRACTOR shall layout and establish the lines and grades of all pipes in accordance with the drawings and he shall employ a competent surveyor registered in the State of Florida for this Work. In the event of unforeseen obstructions, the CONTRACTOR shall confer with the ENGINEER and obtain his written approval before proceeding with any Work deviating from the governing drawings. The CONTRACTOR shall assume full responsibility for locations and grades throughout the Work.

H. Locations

All process equipment, plumbing fixtures, and mechanical equipment shall be in the exact locations as determined by the ENGINEER. It shall be the duty of the CONTRACTOR to request such exact locations from the ENGINEER sufficiently in advance of the time when such information will be required at the buildings so as not to interfere with progress of his Work.

I. Points of Termination

The points of connection and termination of the Work under these sections of the Specifications are shown on the drawings or stated in the Specifications, but in case of doubt as to such points of connection or termination, the decision of the ENGINEER shall be final.

J. Local Utilities

The CONTRACTOR shall be responsible for coordinating, obtaining service, including costs and advising the ENGINEER and utility company(s) as to installation schedules.

1.03 SUBMITTALS

A. Shop Drawings and Manufacturer's Data

Submit shop drawings and/or manufacturer's data as required in Section 01300, Submittals. Shop drawings used during construction as temporary record documents shall comply as specified within these Contract Documents.

B. Balance Report

Submit a balance report upon completion of checking, adjusting, and balancing of mechanical systems as specified herein. This report shall be in a tabulated form with each piece of equipment and/or outlet identified by an equipment or other number, location, and include the following:

1. Air Handling Systems

Fans - design rpm - operating rpm

Fan Motors - full load amps - operating amps
Fan Capacities - design CFM - actual CFM
Fan Static Pressures - suction and discharge
AC and H&V Unit Capacities - design CFM - actual CFM
AC and H&V Unit - minimum OA Setting and CFM
Grills, Registers and Diffusers - size, design CFM - actual CFM
All CFM readings shall be adjusted to within +5%, of the specified value

2. Temperature Control Systems

Report shall identify and list the operational setting and limit ranges of all temperature controllers within each building on a building by building basis.

3. Pumped Fluid Systems

Pumps - design rpm - actual rpm
Pump Motors - full load amps - operating amps
Pump Capacities - design gpm - actual gpm
Pump Pressures - design head - actual head
Balancing valves and flow fittings - required gpm - actual gpm
Heating Coils - design gpm - actual gpm - water pressure drop thru coils

C. Operation and Maintenance Data

The CONTRACTOR shall submit operating instructions, repair parts lists, equipment manuals, and automatic control diagrams. The submittals shall be as required in Section 01300, Submittals. In addition, one copy of each automatic temperature control diagram shall be framed and glazed and wall mounted in an area designated by the OWNER, showing all temperature controls relating to equipment.

The CONTRACTOR shall also provide the ENGINEER with additional copies of the above material, each copy to be bound in book or pamphlet form with approved fastenings and covers. Each bound copy shall include a set of the finally approved shop drawings of all equipment, fixtures, and accessories used on this Project.

D. Record Drawings

Submit record drawings as required in Section 01700, Contract Closeout. Drawings shall be 24" x 36" of the Plans obtained from the ENGINEER and paid for by the CONTRACTOR, clearly marked by the CONTRACTOR with accurate field dimensions locating mechanical systems, equipment, piping, component parts, etc.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Storage

Erect and maintain a weatherproof storage shed or weatherproof storage trailer on the premises of sufficient size to adequately receive and house the miscellaneous equipment and materials subject to damage by exposure to the weather. The storage facility shall be located after consultation with the ENGINEER and CONTRACTOR. The OWNER reserves the right to deny the CONTRACTOR the privileges of storing material in the buildings.

1.05 JOB CONDITIONS

A. Protection

All pipe ends, and parts of equipment left unconnected shall be capped, plugged or properly covered to prevent the intrusion of foreign matter.
The use of tarpaulins or plastic sheets for temporary enclosures, protection of materials, etc., will not be permitted in areas where burning and/or welding operations are going on or in any location where there may be the slightest hazard of their use contributing to a fire.

B. Sequencing

The CONTRACTOR shall be responsible for sequencing the Work of Subcontractors to avoid interferences and delays. Additional costs incurred as a result of changes in the Work to avoid interferences or delays shall be at the expense of the CONTRACTOR.

C. Cutting and Patching

All minor cutting that may be necessary for the installation of the Work and any minor patching as a consequence thereof shall be done by the CONTRACTOR after review by the ENGINEER.

All major cutting of the structure necessary for the installation of the mechanical Work and major repairs required as consequence thereof shall be done by the CONTRACTOR, after review by the ENGINEER.

PART 2 – PRODUCTS

2.01 MATERIALS

When specific manufacturers or trade names are mentioned in these Specifications, and/or on the drawings, they are used as the design criteria and to establish a minimum of quality standard.

Any substitution made that may affect building size or process function shall be deemed to be made for the convenience of the CONTRACTOR, and all shall be brought to the attention of the ENGINEER at an early date for consideration. Any additional costs resulting therefrom shall be borne by the CONTRACTOR.

The CONTRACTOR shall accept full responsibility that said substitution shall function as required by the process and shall not require additional building space or additional structural requirements. The CONTRACTOR shall also be responsible for all redesign expenses incurred because of the substitution.

Any items required to complete the Work and not specifically mentioned herein, shall conform fully to the quality pattern established by these Specifications.

All materials shall be new and be the standard products of the manufacturer. Seconds, rejects, or damaged materials will be rejected by the CONTRACTOR. The ENGINEER reserves the right to disapprove and reject any materials, proposed or installed which fail to meet these quality standards. The CONTRACTOR shall, at his own expense, remove and replace with approved materials, any materials which do not comply with these standards.

Electrical equipment furnished under Division 15 of these Specifications shall be in full compliance with Division 16 of these Specifications.

2.02 FABRICATION

Provide for possible adjustments in the field of mechanical work fabrications. Adjustments shall allow for adjustment to avoid interferences, installation of equipment or connecting to other Work.

2.03 EQUIPMENT

A. General

Unless furnished as integral parts of mechanical equipment, appurtenances such as remote operation switches or push buttons, pilot lights, starter relays, overloads or other items shall conform to and be installed as specified herein and any related Sections.

B. Electrical Service

Unless specified elsewhere, electrical service for equipment shall be either 480/277 volt, 3-phase, 60 HZ with 4 wire or 208/120 volt, 3-phase, 60 HZ with 4 wire. Lighting shall be 120 volt, single phase.

C. Motors

1. General

Refer to Section 11005, Process Equipment General Requirements, for detail requirements of electric motors.

2. Belt Drives

Motors with belt drives shall provide adjustment by means of sliding bases, rails, and adjusting screws for proper belt tension. All belt drives shall be static-proof safety type.

D. Starters

Manual and magnetic starters furnished as a part of the mechanical equipment shall conform to the detailed provisions in the electrical specifications.

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

Verify location for installation of mechanical Work by field checking proper placement, possible interferences, and points of connection or termination.

Verify opening clearances required for unobstructed passage of equipment or fabricated Work. Large equipment or fabrications shall be installed before buildings or structures are installed or completed.

Additional cost for extra Work and/or delay in the Work because of failure by the CONTRACTOR or a Subcontractor to verify locations, field conditions, or obstructions shall not be the responsibility of the OWNER or ENGINEER.

3.02 INSTALLATION

A. Structural Cutting

Cutting of walls, floors, etc., for the installation of mechanical Work shall be done only when approved by the ENGINEER. The CONTRACTOR may allow Subcontractors to do minor cutting and patching, however, major cutting and repair shall be made by the CONTRACTOR.

B. Equipment

1. General

The CONTRACTOR's attention is directed to the fact that certain equipment, (fans, drives, and other machinery), must be installed before housing and/or enclosures are installed or completed. Doors and other access openings in some cases are not large enough to permit passage of the equipment completely assembled. The CONTRACTOR shall thoroughly investigate these conditions prior to fabrication or shipment.

Component parts furnished as part of a packaged equipment system shall be installed with the mechanical Work, ready for connection as specified in Section 16010, Electrical General Requirements. Electrical connection between component mechanical parts shall be inclusive to mechanical Work.

Components such as remote operation controls, pilot lights, overloads or others not furnished as integral packaged pieces of equipment shall conform to and be installed as specified in the appropriate Sections in Division 13, Instrumentation and Control System Sections.

2. Supports and Anchors

Provide bases, pads, platforms, hangers, clamps, or embedded inserts necessary for proper support and/or anchoring of mechanical Work. Inserts to be embedded in concrete shall conform to and be installed as specified in Sections 03300, Cast-in-Place Concrete and 03200, Concrete Reinforcement. Detailed specifications for anchoring are included in other Sections of these Specifications.

The CONTRACTOR will provide and install concrete foundations, bases and/or pads under each piece of mechanical equipment and machinery. The CONTRACTOR will also install all anchor bolts and anchor bolt sleeves for said mechanical equipment and machinery.

The CONTRACTOR shall be responsible for the proper sizes, locations, and quantities of these bases and pads where same are to be on concrete floor slabs, and shall provide all anchor bolts, sleeves, and setting templates for the mechanical equipment and machinery. Bases and/or pads are to be provided for each piece of mechanical equipment and machinery whether shown or not shown on the drawings.

Mechanical equipment resting on concrete foundations, bases or pads shall rest on a level and uniform bearing surface with grout when vibration isolation is not required or specified. Grout shall be nonshrink, nonstaining Type V as specified in Section

03600, Mortar and Grout.

3. Electrical Service

The CONTRACTOR shall furnish all motors required in connection with his Work and he shall mount or install all his motors in their finished locations.

Electrical components required and furnished for mechanical equipment systems provided as complete system by the manufacturer or Mechanical Subcontractor, and automatic temperature control systems together with any power and control interface wiring shall be the responsibility of the CONTRACTOR. He shall perform this Work in accordance with all requirements of the electrical Specifications. The CONTRACTOR shall be responsible for the proper operation of his equipment and shall furnish all wiring and control diagrams to ensure proper operation of same.

C. Painting

Painting of installed piping, ducts, or equipment shall be in accordance with Section 09900, Painting and Special Coatings.

D. Sleeves

Provide sleeves where pipes or ducts pass through walls or floors necessary for installation and as specified elsewhere for mechanical Work. Sleeves for covered pipe or ducts shall be of proper size to allow the covering to pass through unless otherwise directed or specified elsewhere.

E. Plates

Ceiling, floor or wall plates shall be installed at all points where exposed pipes pass through walls, ceiling, or floors. Plates shall be nickel-plated sectional, pressed steel plates with positive catches.

F. Lubrication of Equipment

After installation of any equipment is complete such as motors, pumps, compressors, etc., which depends on lubrication for efficient operation, they shall be lubricated in accordance with the manufacturer's recommendations. Lubrication shall be done before any test runs will be permitted or equipment placed in final operation.

G. Identification

All mechanical equipment including pumps, air handling units and each and every valve and regulator shall be identified in accordance with other Sections of these Specifications.

H. Welding

Blower air supply lines shall be welded.

All natural gas lines 1-1/2 inches and larger shall be welded. If desired, piping less than 1-1/2 inches may be welded; however, sample welds shall be submitted for ENGINEER'S approval.

Material shall be clean either by wire brushing or by sandblasting, if needed, prior to welding, depending upon the condition of the material. If grease, or other foreign materials of the same nature are present, cleaning shall be done by a suitable solvent.

Black steel pipe and fittings may be welded by either oxyacetylene or electric arc method.

All welding shall be done by first class pipe welders meeting qualifications covered by the American Standard Code for Pressure Piping (ASA B31.1). Welding shall conform to the standards and requirements of this code and all applicable state and local codes. The OWNER reserves the right to require qualifying demonstrations of any welder assigned to the job by this CONTRACTOR.

Branch connections shall be made with welding tees. Welding ells shall be used for changing pipe directions. Scarf welding of branch pipe connections and use of mitered joints shall not be permitted.

All slag, dirt, and loose pieces of metal shall be removed from the interior of the vessels, jackets, nozzles and piping. All welds are to be thoroughly cleaned and wire brushed and weld spatter removed. Grinding of finished welds is not desired except where specified.

3.03 FIELD QUALITY CONTROL

A. Testing

During and after installation, those tests required by the local, county and state inspection bureaus, the OWNER or the ENGINEER, shall be performed in strict accordance with the department concerned and at the full expense of the CONTRACTOR.

The CONTRACTOR shall furnish all equipment, water, compressed air, apparatus, and labor necessary for the test. All defects disclosed by the tests shall be rectified by the CONTRACTOR without cost to the OWNER. Test shall be made under the direction of and subject to the approval of the OWNER or the ENGINEER. Tests required after installation are outlined herein and shall endure for not less than 48 hours.

All equipment shall be tested as in normal operating service unless specific rating tests are required as results of questionable performance.

Gages and equipment, etc., which may be damaged by the tests shall be valved off or removed before testing.

Special tests required for certain apparatus are specified under the specific headings for that apparatus.

In general, all visible or audible leaks shall be fixed regardless of previous testing results.

B. Final Inspection

Upon completion of the Work, the CONTRACTOR shall conduct a complete inspection of all items of Work instituted by the Contract obligations; and make whatever corrections and adjustments deemed necessary to a well functioning system, same to meet the satisfaction of the ENGINEER and the OWNER.

The CONTRACTOR shall signify his readiness for final inspection in writing to the ENGINEER. The time of inspection may occur at the time of "Operating and Instructions." The inspection shall be made in the presence of the OWNER and ENGINEER.

C. Equipment Start-Up

After completion of the installation, all systems and equipment shall be tested by the CONTRACTOR in the presence of the ENGINEER under actual operating conditions. Tests shall be performed according to manufacturer's recommendations.

The CONTRACTOR shall include with his bid the services of all required equipment manufacturer's field service technician for a period necessary to complete the work to the satisfaction of the ENGINEER and OWNER.

This service shall be for the purposes of check-out, initial start-up, certification, and instruction of plant personnel.

A written report covering the technician's findings and installation approval shall be submitted to the ENGINEER covering all inspections and outlining in detail any deficiencies noted.

Specific requirements, if any, for a particular system or piece of equipment are contained in the particular specification sections. The CONTRACTOR'S responsibility relative to coordinating these services are contained in Section 01600, 01650, 01700 and 01800.

3.04 CLEANING AND ADJUSTMENT

Before turning the buildings over to the OWNER, clean all fixtures, piping, covering, exposed metal surfaces and leave all in clean condition at the end of the Work and remove from the premises all refuse, dirt and rubbish which are a result of the mechanical Work or workmen. Also, remove from the premises all cartons, scrap, and major debris at least once a week during progress of the Work.

Upon completion of the plumbing systems, the CONTRACTOR shall adjust all regulating valves for fixtures and equipment, etc., to provide proper and adequate flow.

All instruments used in the checking, adjusting, and balancing shall be accurately calibrated and maintained. Accuracy tests on instruments shall be performed in the presence of and whenever requested by the OWNER or the ENGINEER.

After the cleaning and decorating of the buildings has been completed, the CONTRACTOR shall thoroughly clean all heating units, unit heaters, including coils and filters, elements, and inside of all enclosures to completely remove the construction dust and dirt from same.

Flush and clean the heating apparatus and systems for not less than four hours, using a standard accepted cleaning compound.

Upon completion of the heating, ventilation and air conditioning systems of the buildings, the CONTRACTOR shall check, adjust and balance the air moving and air distribution systems, and all mechanical equipment.

Air and water balance and checking shall not begin until systems have been completed and are in full

working order. The CONTRACTOR shall put all heating, ventilating, and air conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing.

Two weeks after turning the systems over to the OWNER, the CONTRACTOR shall return to the building and clean and check all strainers, controls, and accessories.

END OF SECTION

SECTION 15080
MECHANICAL INSULATION

PART I – GENERAL

1.01 SUMMARY

A. Section Includes: Labor, materials, tools, equipment, accessories, and services necessary for providing and installing mechanical insulation of all items as shown on Drawings and/or specified herein. All sizing required for preparation of painting shall be performed under this Section.

B. Related Documents: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, including Section 01600, apply to Work of this Section.

1.02 SUBMITTALS

A. Shop Drawings: Submit in accordance with requirements of Section 01300, Submittals covering the items included under this Section. Shop Drawing submittals shall include:

1. Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.

B. CONTRACTOR shall furnish ENGINEER for approval a list of insulating materials and thickness for items listed on Schedule. The list shall be complete including all types and thicknesses of insulation used for the various services as well as the limits of Work.

1.03 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics, and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.

2. Exception: Industrial mechanical insulation that will not affect life safety egress of building may have flame spread index of 75 and smoke developed index of 150.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from Site.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:

1. Type I Insulation:
   a. CSG.
   b. Manville - Micro-lok 650.
   c. Owens/Corning Fiberglass.
   d. UpJohn Company.

2. Type III Indoor Exposed Insulation:
   a. CSG.
   b. Keene Corp., Fibrous Glass Board.
   c. Owens/Corning Fiberglass, Type 705.

3. Type V Insulation:
   a. Armstrong, L-K.
   b. Keene Corp., Termasil.
   c. Manville, Thermo-12.
   d. Owens/Corning Fiberglass, Kaylo 10.

4. Paint for Exposed Pipe Insulation:
   a. Arabol.
   b. Fosters.
   c. Lagfas.

2.02 MATERIALS

A. Insulation for each of the applications listed on Schedule shall be one of the following types:

1. Type I insulation shall be a precision molded pipe covering composed of bonded fiberglass wool resin, minimum density 7.25 pounds per cubic foot (pcf), or polyurethane or phenolic foam minimum density 1.8 pcf formed in 2 half cylinders.
   a. Indoor insulation cover shall be the all service jacket ASJ type with integral vapor barrier unless otherwise noted on Schedule, and outdoor insulation cover shall be 0.016-inch aluminum jacket.
   b. All ASJ jacket laps and butt joint strips shall be of the adhesive contact type. Aluminum jackets shall have mastic laps and butt joints and banded using soft aluminum bands on 12-inch centers.
   c. Fittings and valve insulation shall be fabricated from mitered segments of pipe insulation or molded fitting covers. Fitting and valve insulation shall be coated with insulating cement, dried, coated with a vapor barrier mastic and, on indoor applications, wrapped with fiberglass reinforcing cloth and a second coat of mastic applied or, on outdoor applications, coated with a method recommended by the manufacturer and approved by ENGINEER.

2. Type III indoor, exposed insulation shall be inorganic glass fibers pre-formed into rigid boards with a minimum density of 3.0 pcf with an all service jacket facing. Insulation shall be impaled on pins, on flat surfaces, and cut in segments and bonded in place on irregular surfaces.
   a. Joints and holes shall be sealed to form a completely vapor tight system.

b. All exposed ductwork within 6 feet of floor or walkway shall be protected with a 0.016-inch aluminum jacket with aluminum bands.

3. Type V insulation shall be rigid hydrous calcium silicate, asbestos-free, minimum density 11 pcf. Insulation shall be held in place with 1/2 inch by 0.020-inch galvanized steel bands, or No. 16 galvanized annealed wire on 12-inch maximum centers. Joints shall be pointed with insulating cement. Apply suitable metal mesh with edges laced, and coat with 1/2-inch thick powerhouse cement.
   a. Finish indoors with coat of finishing cement; apply 8-ounce canvas between 2 coats of lagging adhesive, and size. Blocks also may be held in place by clips or bolt studs on 12-inch centers.
   b. Outdoor finish shall be as recommended by the insulation manufacturer and approved by ENGINEER. Roofing felt shall not be used on exposed areas.

2.03 INSULATING CEMENT

A. Insulating cement shall be mineral fiber ASTM Standard and designed for use on hot or cold surfaces from temperature ranges of 0 to 1,200 degrees F.

B. Insulating cement for temperatures above 1,200 degrees F shall be a dry mix composed of spun mineral wool granules, benitonite clay, and glass fiber, ASTM standard.

C. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics, and protective finishes as recommended by insulation manufacturer for applications indicated.

D. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors, and stud pins as recommended by insulation manufacturer for applications indicated.

PART 3 – EXECUTION

3.01 ACCEPTABLE INSTALLERS

Installer's Qualifications: Firm with at least three (3) years successful installation experience on projects with mechanical insulations similar to that required for this Project.

3.02 INSPECTION

Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.03 INSTALLATION

A. The Mechanical Insulation Schedule gives the application, type, temperature, and thickness of insulation required. This Schedule should be used with the following interpretations.

1. Insulation thickness selection not shown on Schedule shall be based on the ASHRAE Standard for the conditions of 80 degrees F ambient air temperature with 80 percent relative humidity indoor, and –20 degrees F ambient air temperature with 90 percent relative humidity outdoor, with operating temperatures as listed on Schedule.

2. Type I insulation thickness shown on Schedule is based on fiberglass with a k-factor of 0.255 at 40 degrees F. Insulation thickness may be increased or decreased in direct proportion to the k-factor of the insulation material furnished.

3. Heating equipment items shall have an insulation thickness to limit surface temperature to 120 degrees F.

3.04 DUCTWORK SYSTEM INSULATION

A. Do not insulate fibrous glass ductwork or lined ductwork.

B. Cold Ductwork (Below Ambient Temperature):

1. Application Requirements: Insulate the following cold ductwork:
   a. HVAC supply ductwork between HVAC unit discharge and room terminal outlet.

3.05 EQUIPMENT INSULATION

A. Hot Equipment (above ambient temperature):

1. Application Requirements: Insulate the following hot equipment:
   a. Generator exhaust system
   b. Low pressure air discharge piping system

3.06 INSTALLATION OF DUCTWORK INSULATION

A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces.

C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.

E. Extend ductwork insulation without interruption through walls, floors, and similar ductwork penetrations, except where otherwise indicated.

F. Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound-absorbing linings have been installed.

G. Protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by manufacturer.

H. Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

3.07 INSTALLATION OF EQUIPMENT INSULATION

A. Install equipment thermal insulation products in accordance with manufacturer's written instructions and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor barrier on equipment insulation and protect it to prevent puncture and other damage.

D. Do not apply insulation to equipment, breechings, or stacks while hot.

E. Apply insulation using staggered joint method for both single- and double-layer construction where feasible. Apply each layer of insulation separately.

F. Coat insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges, and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

G. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2 inches. Apply over vapor barrier where applicable.

H. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

I. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance, including metal vessel covers, fasteners, flanges, frames, and accessories.

J. Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by manufacturer.

3.08 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Insulation Installer shall advise CONTRACTOR of required protection for insulation work during remainder of construction period to avoid damage and deterioration.

SECTION 15080
MECHANICAL INSULATION SCHEDULE

Application	Type	Temp. (°F)	Duct/Pipe Size Minimum Insulation Thickness Interior < 2"	Interior 2"-4"	Interior > 4"	Exterior < 2"	Exterior 2"-4"	Exterior > 4"
HEATING EQUIPMENT								
Generator Exhaust System	V	1000	Design to limit surface temperatures to 120°F for personal protection.					
Low Pressure Air Discharge	I or V	350						
HVAC								
Cooling Air Ducts	III	50	-	-	1	-	-	1

END OF SECTION

SECTION 15200
PROCESS PIPING AND VALVES

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes process piping systems complete with pipe, fittings, valves, connections, and accessories such as hangers, supports and operators as indicated on the Schedule or shown on the drawings, for a complete and functioning installation.

B. Related Work Specified Elsewhere

1. Section 02226: Trenching and Backfilling
2. Section 03300: Cast-in-Place Concrete
3. Section 05500: Metal Fabrications
4. Section 13451: Instrumentation
5. Section 15050: Mechanical General Requirements
6. Section 16010: Electrical General Requirements
7. Section 16050: Basic Materials and Methods

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

1. ANSI - American National Standards Institute
2. ASME - American Society of Mechanical Engineers
3. ASTM - American Society for Testing and Materials
4. AWWA - American Water Works Association
5. NCPWB - National Certified Pipe Welding Bureau
6. NEMA - National Electrical Manufacturers' Association
7. UL - Underwriters Laboratories

B. Welder Qualifications

Welders and/or welding processes shall be qualified by the NCPWB or similar ASME Boiler and Pressure Vessel Code.

1.03 SYSTEM DESCRIPTION

A. General

Drawings show general arrangement, direction, and sizes of pipes. Drawings are not intended to show every offset and fitting or every structural difficulty that may be encountered.

Install the piping and appurtenances to suit, and to avoid interference with installation, operation, and maintenance of fixtures, equipment, or other piping. Verify all measurements at job site.

Provide all piping with necessary hangers, anchors, and supports as specified herein and

as indicated. Piping supported by equipment to which it is connected is not acceptable.

1.04 SUBMITTALS

A. Shop Drawings

Submit shop drawings as required in Sections 01300, Submittals and 11005, Process Equipment General Requirements, showing the layout of the piping systems complete with piping, supports, and structural dimensions. The shop drawings shall identify all joints, valves, fittings, component parts, pipe material, insulation where required, and valve identification codes. Supports and anchors shall be shown in the layout and detailed.

The CONTRACTOR shall verify in the field, the location, position, and size of all existing piping (including buried pipes), as indicated on the Contract Drawings and Specification to be reused, forming a part of the new process piping layout.

Process piping Shop Drawings submitted to the ENGINEER for review shall clearly indicate the location, position (elevation), and size of all existing piping to be reused.

B. Product Data

Submit product data as required in Section 01300, Submittals. Include manufacturer's recommendations for installation, connection to automatic operators, and instructions for proper operation and maintenance. Valve operator data shall also include information necessary for any external controls, wiring or hydraulics to be furnished, installed or connected by other Work.

C. Welders Certification

Submit certification of welders and/or welding process for fabrication and/or field assembly.

D. Operation and Maintenance Data

Submit operation and maintenance data as required in Sections 01300 Submittals, and 15050, Mechanical General Requirements.

E. Record Drawings

Submit record drawings as required in Section 11005, Process Equipment General Requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handling

All pipe and special castings shall at all times be handled in such a manner as to avoid any damage to pipe or specials. In the event pipe coating is damaged, especially on the inside of the pipe, the damaged area shall be cleaned by wire brushing and then recoated with an approved coating similar to that specified for the pipe.

B. Storage

Store materials in enclosures or under protective coverings. Keep inside of pipe fittings and valves free of dirt and debris. Store in a manner for easy identification of all materials.

1.06 JOB CONDITIONS

Supply sleeves, supports, anchors or other items that are to be installed by other trades. Information for positioning the above items shall also be provided.

PART 2 – PRODUCTS

2.01 PIPE SYSTEM

A. General

Pipe systems shall conform to the materials or component performance as specified herein and the pipe schedule as shown on the drawings. Color coding for pipes shall be based on service in accordance with 10 States Standards convention for all pipes.

SERVICE	COLOR
Potable Water	Blue
Reclaimed/Non Potable Water	Purple
Force Main	Green
Process Pipe	Brown

B. Ductile Iron Pipe Systems

1. Pipe

Pipe shall be AWWA C151, Class 350. Provide 1-mil AWWA C203, Type I coal tar enamel coating for buried pipe, epoxy-polyamide for above ground pipe. Lining shall be as indicated on the pipe schedule. Lining shall be AWWA C104 double cement mortar for reclaimed, non-potable water, and potable water services. Lining shall be Protecto 401 or equivalent epoxy for all other services. Pipe sizes indicated are inside diameter (I.D.). Ductile iron pipe shall be manufactured by American Ductile Iron Pipe Company or United States Pipe and Foundry Company.

2. Connections

Flanges shall be Class 125 per ANSI B-169.1. Flanges shall be long-hub type screwed tightly on pipe by machine at the foundry prior to facing and drilling. Flange faces shall be coated with a rust inhibitor immediately after facing and drilling. Field assembled screwed on flanges are prohibited.

Gaskets to be furnished in SBR (Styrene Butadiene) or an approved equal suitable for sanitary sewage, water, and reuse service.

All nuts and bolts for flanges shall be Type 316 stainless steel conforming to ASTM A-193, Grade B&M for bolts, and ASTM A-194, Grade M for nuts.

Provide washers for each nut. Washer shall be of the same material as the nuts.

3. Fittings

AWWA C110 and C111 with lining, coating, and pressure rating same as pipe.

a. Flanged Joint

i. Flanges shall be Class 125 per ANSI B-16.1. Flanges shall be long-hub type screwed tightly on pipe by machine at the foundry prior to facing and drilling. Flange faces shall be coated with a rust inhibitor immediately after facing and drilling. Field assembled screwed on flanges are prohibited.

ii. Gaskets to be furnished in SBR (Styrene Butadiene) or an approved equal suitable for sanitary sewage, water, and reuse service.

iii. All nuts and bolts for flanges shall be Type 316 stainless steel conforming to ASTM A-193, Grade B&M for bolts, and ASTM A-194, Grade M for nuts.

- Provide washers for each nut. Washer shall be of the same material as the nuts.

b. Mechanical Joint Restraints

i. All piping shall be restrained. Pipe joints shall be restrained on each side of a fitting with a mechanical joint restraint. Mechanical joint restraints shall be accomplished using a mechanism consisting of plurality of individually activated gripping surfaces incorporated into the design of the follower gland with a compression gasket, conforming to ANSI A21.11. Glands shall be manufactured of ductile iron conforming to ASTM A 536. Restraining devices shall be of ductile iron, heat treated to a minimum hardness of 370 BHN. Twist off nuts shall be used to insure proper actuating of the restraining devices. Bolts and nuts shall be corten, low alloy, high strength steel conforming with AWWA standards. Bolts shall be tee-head conforming to ANSI A21.1, A21.53 and AWWA C 153 and C111.

C. Steel Pipe Systems

1. Pipe

ASTM A53, Schedule 40, Type S, Grade B. Pipe 16-inch, 12-inch, 10-inch, and 8-inch shall be interior coated with NSF approved, modified polyamine epoxy after fabrications in accordance with AWWA C200. All flanges shall be class D per AWWA C207.

2. Connections

Flanged joints in accordance with AWWA 207 or by mechanical coupling for grooved pipe as specified in Article 2.01.B.2.

3. Fittings

Fittings shall be steel or cast iron conforming to C110, C111, or C208. Fittings shall conform to Article 2.01.B.3. Steel fittings interior coated per Article 2.01.C.1.

D. Copper Pipe Systems

1. Pipe: Conform to ASTM B88. Type as specified in Schedules.

2. Connections: Copper Sweat, lead free solder.

3. Fittings: Conform to ASA B16.18.

E. Stainless Steel Pipe Systems

1. Pipe: Stainless steel pipe greater than 3-inch diameter shall be ASTM A778, Type 316L, Schedule 5S, unless otherwise indicated on the plans. After all shop operations have been completed, all stainless steel material shall be full immersion pickled, rinsed with water, and passivated.

2. Fittings: Shall be ASTM A774, Type 316L. After all shop operations have been completed, all stainless steel material shall be full immersion pickled, rinsed with water, and passivated. Wall thickness shall equal that of pipe. Fittings shall be smooth standard fittings with dimensions conforming to ANSI B16.9

3. Joints: Butt-weld per American Welding Society Standards except where valves or equipment requires flanged connections. Flanged joints shall be fabricated from SS 316L per dimensions of AWWA C207 Class B ring flanges. Provide gaskets and bolts/nuts per pipe manufacturer recommendations for intended service.

F. Polyvinyl Chloride Pipe (PVC) Systems

Polyvinyl Chloride Pipe (PVC) and fittings shall be in accordance with ASTM D-1784, D-1785, D-2464, and D-2467, Schedule 80 as indicated in the pipe schedules with socket welded or flanged joints. Provide unions or flanges at all valves and equipment. All pipe connections shall be made in conformance with the manufacturer's recommendations including supply of gaskets, where necessary.

Polyvinyl Chloride pipe and fittings shall be "Chemtrol" as manufactured by Celanese Piping Systems, Xirtecl 140 as manufacturer by IPEX, Inc , Plastiline, Inc., R & G Sloane; or equal.

G. Stainless Steel Tubing

General working pressure 150 psi tubing shall be 304 or 316 stainless steel, seamless, ASTM A269, 18 gauge wall thickness. Connections shall be compression type 304 or 316 stainless steel fittings.

Fittings shall be as manufactured by Swagelok or equal.

H. Flexible Pipe

Flexible pipe connections shall be factory painted steel flanged with convoluted neoprene molded to absorb piping shock and offsets up to 1/8-inch. The flanges shall conform to ANSI B16.1 with built in the cables to prevent the joint from expanding past its limit. The flexible control unit shall have a rated working pressure of 175 psig. The flexible piping shall be suitable to the intended service as recommended by the manufacturer. The flexible pipe shall be as manufactured by Metraflex, Proco Products or equal.

2.02 WALL PIPE AND SLEEVES

A. General

Pipes and sleeves shall be as specified herein.

B. Wall Pipe

AWWA C110 with lining, inside diameter and connections compatible to pipe system, shall be flanged, tapped bolt holes, with integral water stop.

C. Sleeves

Sleeves shall be schedule 40 pipe and be galvanized. Sleeves through new concrete walls shall have continuous water stop.

2.03 LINK-TYPE SEALS

Shall be interlocking expandable type of molded synthetic rubber segments with 316L stainless steel bolts and nuts and pressure plate.

Seals shall be as manufactured by Thunderline or equal.

2.04 SLEEVE-TYPE COUPLINGS

1. Pressure rating at least equal to that of related pipeline.

2. Manufactured by Dresser Mfg. Div., Bradford, PA; Rockwell International, Municipal & Utility Div., Pittsburgh, PA; R.H. Baker & Co., Inc., Los Angeles, CA; or equal.

3. Couplings for Buried Pipe: Cast iron sleeve or steel sleeve and retainer with fusion bonded epoxy coating, Dresser Style 53 or 153, Rockwell Style 431, Baker Series 228, or equal. Couplings provided with type 304 or 316 stainless steel bolts and nuts.

4. Couplings for Exposed Pipe: Steel; Dresser Style 38, 127 or 128 Rockwell Style 411, Baker Series 200, or equal. Couplings provided with type 304 or 316 stainless steel bolts and nuts. Provide tie rods across couplings as shown.

5. Furnished with pipe stop removed.

6. Provided with gaskets of composition suitable for exposure to liquid within pipe.

2.05 FLANGE ADAPTERS

Cast iron adapters for transitioning from plain end ductile iron to flanged fittings, 125 # bolt pattern. (ANSI B16.1). Flange adapters shall have ductile iron set screws to securely grip the pipe end. Flange adapters shall be as manufactured by EBAA Iron, inc. or equal.

2.06 VALVES

A. General

Valves, operation, accessories, and specific notes are specified on the drawings and/or shown in the schedule. Valves associated with the MBR system are noted on the drawings and are not included on the valve schedule, as these valves are subject to change dependent upon the selected MBR equipment vendor. Small bore valves for non-potable service water are not included in the valve schedule.

Valve materials and workmanship shall conform to applicable ANSI, ASTM, and AWWA

standards. Valve bodies shall have an arrow to indicate direction of turning to open.

B. Swing Check Valve

Swing check valves 2-1/2 inch and larger shall be the rubber flapper type with a heavily constructed cast iron body and cover. The body shall be long pattern design (not wafer), with integrally cast-on end flanges. The flapper shall be Buna-N having an "O" ring seating edge and be internally reinforced with steel.

Flapper to be captured between the body and the body cover in a manner to permit the flapper to flex from closed to full open position during flow through the valve. Flapper shall be easily removed without need to remove valve from line. Check valves to have full pipe size flow area. Seating surface to be on a 45° angle requiring the flapper to travel only 35° from closed to full open position, for minimum head loss and non-slam closure.

Buna-N flapper to have an elastic spring, molded internally, to assist the flapper to close against a slight head to prevent slamming.

Materials of construction shall be certified in writing to conform to A.S.T.M. specifications as follows:

Body and Cover	Ductile Iron	ASTM A296
Flapper	Buna-N	
Exterior Paint	Phenolic Primer Red Oxide	NSF Approved

Valve shall be Val-Matic, Clow, or equal.

C. PVC Swing Check Valve

Provide flanged Swing Check Valve constructed from PVC conforming to ASTM D1783 cell classification 12454 with Viton O-rings, seat, and gaskets. Valves shall be of top entry bonnet design and O-ring sealed drain plug for maintenance servicing without the need to remove valve body from pipeline. Valves shall be rated for 150 psi at 73°F. Provide external level and weight to assist disc in faster closing. Bolts, nuts and washers shall be resistant to sodium hypochlorite.

Manufacturer: Spears Manufacturing or approved equal.

D. Ball Check Valves

Provide PVC Ball Check Valve with socket union connections, true union design, ball check type, Viton O-rings and seat, rated for 150 psi at 73°F.

Manufacturer: NIBCO, Inc., Hayward Industrial Products, Inc, or approved equal.

E. Wafer Style Check Valves

1. Size as shown on Drawings.

2. Working Pressure: 150 psi

3. Silent or double door check valves shall be compact wafer style, designed to fit between ANSI flanges.

4. Check valve shall be spring loaded, normally closed by means of one or more heavy duty stainless steel torsion springs. Flow from the pumps shall cause the

valve to open and upon pump shut down, the torsion spring will shut the valve before reverse flow starts and at a point of zero velocity of non-slam closure.

5. Seating shall be resilient and watertight. The sealing element shall be BUNA-N molded to body.

6. Valve body shall be fabricated of cast iron.

7. Torsion spring, hinge shaft and stop pin shall be constructed of stainless steel.

8. Silent plug or doors shall be bronze, ASTM B584.

9. Manufacturer: Val-Matic, Apco, Mission or equal.

F. Gate Valves

Gate valves two inches and smaller shall have a bronze body and union bonnet. Seats shall be integral with the body and provide leakproof shut off with the disc. The disc shall be a solid bronze wedge. The stem shall be bronze and packed with corrosion resistant packing. Pressure class shall be 125 psi, unless as otherwise indicated in the valve schedule.

Gate valves 3" and larger shall have a cast or ductile iron body and bonnet, resilient wedge, non-rising stem type with O-ring stem seals. The valve stem, stem nut, glands and bushings shall be bronze. The resilient seal of the valve shall be formed by styrene butadiene elastomer which is permanently bonded to and completely encapsulates a cast iron valve disc. Gate valves shall open left or counter-clockwise when viewed from the stem. Pressure class shall be 125 psi, unless as otherwise indicated in the valve schedule. The inside and outside of each valve shall be coated, minimum 3-5 mils, with epoxy meeting AWWA C-550 latest revision. Valves 12” and larger shall be equipped with a geared operator. Valves 3” through 36” shall comply with AWWA C509.

Gate valves shall be Clow, U.S. Pipe Metroseal, Mueller or equal

G. Globe Valves

Globe valves two inches and smaller shall have a bronze body and union bonnet. Seats shall be integral with the valve body and provide leakproof shut off with the disc. The disc shall be a composition type mounted in a bronze retainer. The stem shall be bronze and packed with corrosion resistant packing.

Globe valves shall be DeZurik or equal.

H. Air Release & Vacuum Break Valves

The air release valves shall consist of a compact tubular all stainless steel fabricated body, hollow direct acting float and solid large orifice float in H D.P.E., stainless steel nozzle and woven dirt inhibitor screen, nitrile/E.P.D.M. rubber seat.

The valve shall have an integral Anti-Surge Orifice mechanism which shall operate automatically to limit surge pressures induced by liquid oscillation and /or rapid air/gas discharge to less than1.5 x valve working pressure.

The intake orifice area shall be equal to the nominal size of the valve. Large Orifice sealing shall be affected by the flat face of the control float seating against a nitrile/

E.P.D.M. rubber O-ring.

The valve connections shall be NPT for the 2-inch size and ANSI B16.1 Class 125 flanged with threaded bolt holes and stainless steel studs.

The valve shall be by RF Valves, Dezurik APCO, or equal.

I. Mud Valves

The valve shall be of the heavy duty flanged type designed to provide a positive seal under both seating and unseating head conditions. The valves shall be rising stem type. The frame, plug, operating stem, and yoke shall be 316 stainless steel. The plug seat shall be Viton rubber and provide a positive seal.

The valve shall be guaranteed against stem galling for the life of the valve. Stems shall not be coated.

The manufacturer shall provide valve operating stems, floor stands and stem guides as required. Stem guides shall be provided such that the L/r ratio of the unsupported part of the stem shall not exceed 200.

Plug Drain valves shall be as manufactured by Waterman, Troy, or ENGINEER approved equal.

J. Ball Valves

Ball valves have a working pressure of 200 psig, drop tight shut off, full port material bronze body, hard chrome plated ball teflon or viton seats and/or 316 stainless steel body and ball, teflon seats with stops at full open and full closed.

Manufacturer: Apollo Conbroco, Jamesbury Series 500 Chemtrol, Hayward or equal.

K. PVC Body Diaphragm Valves

Provide flanged Diaphragm valves with PVC body and bonnet construction conforming to ASTM D1783 cell classification 12454. The valve shall be provided with position indicator, travel stop and bonnet O-ring sealing arrangement. The valve shall be weir type with a square sealing body sealing design and bayonet connected diaphragm (1/2 to 2 inch) or round bonnet body sealing design and threaded stud diaphragm connection (21/2 to 4 inch). Provide valve with PTFE diaphragm. The valve shall be rated to 150 psi at 70°F. The valve shall be suitable for service in sodium hypochlorite applications. Bolts, nuts and washers shall be resistant to sodium hypochlorite.

Provide electric motor actuators on the valves indicated on the Contract Drawings. The motor actuator shall provide declutching manual override, NEMA 4 plastic or epoxy coated corrosion resistant housing, permanently lubricated gear train, integral thermal overload protection with autoreset. Provide limit switches required for indication and control. Provide torque select to open or close valve against a 25 ft head differential.

Manufacturer: ASAHI/America or approved equal.

L. Plug Valve

Eccentric plug valves shall be of the tight closing, resilient faced non-lubricating variety and shall be of eccentric design such that the valve's pressure member (plug) rises off the body seat contact area immediately upon shaft rotation during the opening movement.

Valves shall be drop-tight at the rated pressure (175 psi through 12", 150 psi 14" and above) and shall be satisfactory for applications involving throttling service as well as frequent or infrequent on-off service. The valve closing member should rotate approximately 90 degrees from the full-open to full-closed position and vice-versa.

The valve body shall be constructed of cast iron (semi-steel) conforming to ASTM A 126, Class B. Body ends shall be as indicated on the plans and as follows:

1. Flanged with dimensions, facing, and drilling in full conformance with ANSI B 16.1, Class 125. This includes flange thickness.

2. Mechanical Joint to meet the requirements of AWWA C111/ANSI A21.11.

3. Grooved ends to meet the requirements of AWWA C606.

4. Valve body interior shall be epoxy coated.

Eccentric Plug Valves shall have a rectangular shaped port. Port areas for 3" - 20" valves shall be a minimum 80% full pipe area. Port area for 24" valve shall be a minimum 70% of full pipe area.

Valve seat surface shall be welded-in overlay, cylindrically shaped of not less than 90% pure nickel. Seat area shall be raised, with raised area completely covered with weld to insure proper seat contact. The machined seat area shall be a minimum of .125" thick and .500" wide.

The valve plug shall be constructed of cast iron (semi-steel) conforming to ASTM A126, Class B. The plug shall have a cylindrical seating surface that is offset from the center of the plug shafts. The plug shafts shall be integral. The entire plug shall be 100% encapsulated with EPDM in all valve sizes. The rubber compound shall be approximately 70 (Shore A) durometer hardness. The rubber to metal bond must withstand 75 lbs, pull under test procedure ASTM D- 429-73 Method B.

Shaft bearings, upper and lower, shall be sleeve type metal bearings, sintered, oil impregnated and permanently lubricated Type 316 stainless steel. Thrust bearings shall be Nylatron.

Plug valve shaft seals shall be on the multiple V-ring (Chevron) and shall be adjustable. All packing shall be replaceable without removing the bonnet or actuator and while the valve is in service. Shaft seals shall be made of Buna-N.

Each valve shall be given a test against the seat at the full rated working pressure and a hydrostatic shell test at twice the rated working pressure. Certified copies of individual tests shall be submitted when requested. Certified copies of proof-of-design tests shall be submitted upon request.

Manual valves shall have lever or worm gear type actuators with handwheels, 2" square nuts, chainwheels attached. Lever actuators shall be furnished on valves 8" and smaller where the maximum unseating pressure is 25 psig or less. Worm gear type actuators shall be furnished on all 4" or larger valves where the maximum unseating pressure is 25 psig or more.

All eccentric plug valves shall be DeZurik, Clow, Pratt, or equal.

M. PVC Body Ball Valves

Provide PVC construction socket connection for valves less than 1-inch or flange connection for valves greater than 1-inch, double, true union ball valves, 150 psi rated, full port, quarter turn to open with Viton O-rings seals, and Teflon seats for sodium hypochlorite service.

Provide vented ball for ball valves for sodium hypochlorite service.

Manufacturer: Plastomatic Valves, Inc., or equal.

N. Butterfly Valves

Butterfly valves (4" thru 48" size) shall conform to the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designated C504, except as hereinafter specified. Valves shall be Class 150A or B, and equal to those manufactured by Henry Pratt Company, DeZurik, Mueller, KOR-FLO or approved equal. All valves shall be factory leak tested at 200 psi.

The face-to-face dimensions of flanged end valves shall be in accordance with AWWA Standard Specification C504 for short-body valves. Adequate two-way thrust bearings shall be provided. Flange drilling shall be in accordance with ANSI B16.1. Mechanical Joint end valve dimensions shall be in accordance with AWWA Standard Specification C504.

All Butterfly valves shall have a factory applied fusion bonded epoxy coating inside and outside, in accordance with AWWA C550. The interior and exterior surfaces shall be shown to be holiday free using an electronic holiday test, in accordance with AWWA C550.

Valve seats shall be an EPDM elastomer. Valve seats 24 inches and larger shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material with stainless Nylock screws and be capable of a 1/8 inch adjustment. Valves 20 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C 504. Where rubber seat is mounted on the valve body, the mating edge of the valve disc shall be 18-8 stainless steel or Nickel-Chrome, 80-20%. Where the EPDM seat is mounted on the valve disc, the valve body shall be fitted with an 18-8 stainless steel seat offset from the shaft, mechanically restrained and covering 360 degrees of the peripheral opening or seating surface.

The valve body shall be constructed of ductile iron or close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housing of the through boss-type.

The valve shaft shall be turned, ground, and polished, constructed of 18-8, ASTM A-276, Type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design. Shaft bearings shall be teflon or nylon, self-lubricated type.

All valves shall be subject to hydrostatic and leakage tests at the point of manufacture. The Class 150 valves shall be tested in conformance with AWWA C504. During the hydrostatic test there shall be no leakage through the metal, the end joints or the valve shaft seal. No adjustment of the valve disc will be necessary after pressure test for normal operation of valve.

In general, the butterfly valve operators shall conform to the requirements of Section 11 of the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable and as herein specified.

Gearing for the operators shall be totally enclosed in a gear case in accordance with the above mentioned AWWA Standard Specification.

Operators shall be capable of seating and unseating the disc against the full design pressure or velocity, as specified for each class, into a dry system downstream, and shall transmit a minimum torque to the valve. Operators shall be rigidly attached to the valve body.

All valve operators shall conform to Section 11 of the AWWA Standard Specification and shall be manual unless otherwise shown or specified and shall have permanently lubricated, totally enclosed gearing with handwheel and gear ratio sized on the basis of actual line pressure and velocities. Operators shall be equipped with handwheel, position indicator, and mechanical stop-limiting locking devices to prevent over travel of the disc in the open and closed positions when valve is located above grade. They shall turn counterclockwise to open valves. Manual operators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Operators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 pounds on the handwheel or chainwheel when valve is located above grade. Operator components shall withstand an input of 450 foot pounds for 30” and smaller and 300 foot pounds for larger than 30” size valves at extreme operator position without damage. Valve operators shall be as shown on the valve schedule. Valve operators shall conform to AWWA C504, latest revision.

The manufacturer shall certify that the required tests on the various materials and on the completed valves have been satisfactory and that the valves conform to all requirements of the specifications and the AWWA standard.

Where indicated on the Drawings, extension stems, floor stands, couplings, stem guides, and floor boxes as required shall be furnished and installed.

2.07 VALVE LEVER/HANDWHEEL OPERATORS

On valves six inches and smaller, latch lock levers shall provide automatic, positive latching in the open, closed, or eight intermediate positions. These valves shall allow locking in any position with a standard padlock. Infinite position levers shall allow manual throttling and locking in any position from open to close.

All manually actuated valves eight inches and larger shall be operated using a cast iron housed handwheel actuator with crank or optional chainwheel. All units to have adjustable open and closed position stops with provision to prevent accidental adjustment changes. The operating shaft shall be supported axially and radically at input end by permanently lubricated bronze thrust and sleeve bearings.

Where required, the floorstand shall be mounted using a 1/2-inch thick stainless base plate designed to transfer the thrust generated by the valve to the adjacent structure. The plate shall be supplied with suitable anchor bolts provided the manufacturer.

2.08 PNEUMATIC VALVE ACTUATORS

Cylinder actuators shall have working mechanism fully enclosed and shall be sized for operation using 100 psig pneumatic supply. Cylinder actuators shall have pilot valves and positioners where

indicated on the drawings. Units shall have adjustable end position stops. Valves used for automatic throttling applications shall incorporate a position transmitter. Manual valves shall include limit switches as shown on drawings.

Valve operators shall be provided by the valve manufacturer factory mounted on valve.

2.09 VALVE BOXES FOR BURIED SERVICES VALVES

A. Valve boxes shall be two (2) piece sliding type cast iron with extension shafts. Extension pipe shall be C-900 PVC cut to fit finished grade. Coat buried cast iron pieces with epoxy.

B. Where the depth of the valve is such that its operating nut is more than 36 inches below grade, provide operating extension stems to bring the operating nut to a maximum of 36 inches below the surface of the ground or valve box cover. Extension stems shall be steel and shall be complete with a 2 inch operating nut.

2.10 TAPPING SLEEVES

A. Tapping sleeve shall be fabricated from 304 Stainless Steel or its equivalent, CF8 Cast Stainless Steel. Sleeve shall have a pass-through bolt design and provide full circumferential seal around the pipe. Sleeve shall be fully passivated to return the stainless steel to its highest corrosion resistance.

B. For proper strength, support and rigidity for the valve, drilling machine operation and load forces, the neck outlet construction shall be a minimum of Schedule 10 Stainless Steel pipe sized to accept full size cutter. Flange outlet shall be CF8 Cast Stainless Steel or equivalent 304 Stainless Steel. Flange outlets shall be indexed per MSS-SP60 to accept tapping valve.

C. The lugs shall have a pass-through bolt design, to avoid alignment problems and allow tightening from either side of the pipe. Bolts shall not be integrally welded to the sleeve. Bolting lug shall be triangular design with a maximum of 3" bolt center spacing. Bolting hardware shall be a minimum of 304 Stainless Steel. The bolts shall be track head type and furnished with permanently lubricated heavy-hex nuts
and stainless washers.

D. The full circumferential gasket shall be molded of synthetic rubber compounded for use with water salt solutions, mild acids, bases and sewage. The gasket shall have a gridded surface, be a full 1/4" thick with 304 stainless steel bridge plates molded flush into the gasket and have a raised hydromechanical outlet seal to seal against line surges and water hammer.

E. Sleeves shall be rated at 150 PSI working pressure with a hydrostatic test pressure of 200 PSI on pipe with a full circumferential break.

F. Tapping Sleeves shall be Mueller, JCM or ENGINEER approved equal.

2.11 ELECTRIC VALVE ACTUATOR

A. General

The actuators shall be suitable for use on a nominal power supply as shown on the drawings and are to incorporate motor, integral reversing starter, local control facilities, and terminals for remote control and indication connections.

The actuator shall include a phase discriminator: a device to ensure that the motor runs with the correct rotation for the required direction of valve travel with either phase sequence of the three-phase power supply connected to the actuator.

It shall be of a non-intrusive design, making it possible to set of the torque, limits, configuration of the indication contacts, and interrogate the data logger via IrDA without the need to remove any electrical compartment covers. The actuator shall come standard with an intrinsically safe infrared setting tool capable of: downloading data logger files (4 minimum), the ability upload and download configuration files (10 minimum), and upload language files and main PCB firmware upgrades.

The CONTRACTOR is responsible with ensuring that the valve actuators are compatible with their respective valves.

B. Actuator Sizing

The actuator shall be sized to guarantee valve closure at the specified differential pressure. The safety margin of motor power available for seating and unseating the valve shall be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10% below nominal. The operating speed shall be such as to give valve closing and opening at 12 inches per minute unless otherwise stated in the job specification.

C. Ambient Temperature

The actuator shall be capable of functioning in minus 20°F to + 118°F ambient temperatures.

D. Motor

The electric motor shall be Class F insulated with a time rating of at least 15 minutes at 104°F (40°C) or twice the valve stroking time, whichever is the longer, at an average load of at least 33% of maximum valve torque. Electrical and mechanical disconnection of the motor should be possible without draining the lubricant from the actuator gear case. Plugs and sockets are not acceptable as a means of electrical connection for the motor.

E. Motor Protection

Protection shall be provided for the motor as follows:

1. The motor shall be de-energized in the event of stall when attempting to unseat a jammed valve

2. Motor temperature shall be sensed by a thermostat to protect against overheating

3. Single phasing protection

F. Gearing

The actuator gearing shall be totally enclosed in an oil-filled gear-case suitable for operation at any angle. All main drive gearing must be of metal construction. Where the actuator operates gate valves or large diameter ball or plug valves, the drive shall incorporate a lost-motion hammer-blow feature. For rising spindle valves, the output shaft shall be hollow to accept a rising stem and incorporate thrust bearings of the ball or roller type at the base of the actuator, and the design should be such as to permit the gear-case to be opened for inspection or disassembled without releasing the stem thrust or taking the valve out of service. Note: For full Modulating applications, “hammer-blow” feature

should be removed to increase accuracy and reduce wear.

Standard SAE80EP gear oil shall be used to lubricate the gear-case. Special or exotic lubricants shall not be used, as they may be difficult to source in remote locations.

G. Hand Operation

A hand-wheel shall be provided for emergency operation engaged when the motor is declutched by a lever or similar means; the drive being restored to power automatically by starting the motor. The hand/auto selection lever should be pad-lockable in both "Hand" and "Auto" positions. It should be possible to select hand operation while the actuator is running or start the actuator motor while the hand/auto selection lever is locked in "Hand" without damage to the drive train.

The hand-wheel drive must be mechanically independent of the motor drive, and any gearing should be such as to permit emergency manual operation in a reasonable time. Clockwise operation of the hand-wheel shall give closing movement of the valve unless otherwise stated in the job specification.

H. Drive Bushing

The actuator shall be furnished with a drive bushing easily detachable for machining to suit the valve stem or gearbox input shaft. Normally the drive bush shall be positioned in a detachable base of the actuator. Thrust bearings, when housed in a separate thrust base, should be of the sealed-for-life type.

I. Torque and Turns Limitations

Torque and turns limitation to be adjustable as follows:

1. Position setting range: 2.5 to 100,000 turns, with resolution to 15° of actuator output.

2. Torque setting: 40% to 100% rated torque.

3. Torque sensing must be affected purely electrically or electronically. Extrapolating torque from mechanically measured motor speed is not acceptable due to response time.

4. “Latching" to be provided for the torque sensing system to inhibit torque off during unseating or during starting in mid-travel against high inertia loads.

The electric circuit diagram of the actuator should not vary with valve type remaining identical regardless of whether the valve is to open or close on torque or position limit. An inexpensive setting tool is required for non-intrusive calibration and interrogation of the actuator. This setting tool will provide speedy interrogation capabilities as well as security in a non-intrusive intrinsically safe watertight casing.

J. Remote Valve Position/Actuator Status Indication

The actuator must provide a local display of the position of the valve, even when the power supply is not present. In the event of a (main) power (supply) loss or failure, the position contacts must continue to be able to supply remote position feedback and maintain interlock capabilities.

A backup power source must be provided in the actuator to ensure correct remote indication should the actuator be moved manually when the power supply is interrupted.

The position of the actuator and valve must be updated contemporaneously, even when the power supply is not present.

Four latching volt free contacts shall be provided which can be selected to indicate any position of the valve with each contact selectable as normally open or normally closed. Each contact can be configured to either -normally open- or -normally closed- and rated at 5mA to 5A, 120V AC, 30V DC.

Any of the four above contacts shall be independently configurable to signal one of the following:

1. Valve Position - fully open, fully closed or intermediate positions (0-99% open).

2. Status - Valve opening, closing, moving (continuous or pulsing signal), local stop selected, local selected, remote selected, open or close interlock active, ESD active.

3. Valve Alarms - Motor tripped on torque in mid travel, motor tripped on torque going open, going closed, valve jammed, actuator being operated by hand-wheel.

4. Actuator alarms - Lost phase, customer 24V DC (120V AC) supply lost, battery low, internal failure detected, thermostat tripped.

An additional (4) configurable contacts, totaling (8) shall be optionally available, with these additional contacts also be configurable to the same possible settings listed above.

K. Local Position Indication

The actuator shall include a digital position indicator with a display from fully open to fully closed in 1% increments. Red, green, and yellow lights corresponding to Open, Closed, and Intermediate positions shall be included on the actuator. The digital display shall be maintained even when the power to the actuator is isolated. The local display should be large enough to be viewed from a distance of six feet (6') when the actuator is powered up. Provision shall be made in the design for the addition of a transmitter without contacts to give a 4-20mA analog signal corresponding to valve travel for remote indication when required.

L. Integral Starter and Transformer

The reversing starter, control transformer, and local controls shall be integral with the valve actuator, suitably housed to prevent breathing and condensation buildup. For ON/OFF service, this starter shall be an electromechanical type suitable for 60 starts per hour and of rating appropriate to motor size. For MODULATING duty, the starter shall be solid state and suitable for up to a maximum of 1,200 starts per hour. The controls supply transformer shall be fed from two of the incoming three phases. It shall have the necessary tapping and be adequately rated to provide power for the following functions:

1. 120V AC energizing of the contactor coils

2. 24V DC output where required for remote controls

3. Supply for all the internal electrical circuits

4. The primary and secondary windings shall be protected by easily replaceable fuses

M. Integral Push Button and Selector

Integral to the actuator shall be local controls for Open, Close, and Stop, and an local/remote selector switch pad-lockable in any one of the following three positions:

1. Local Control Only
2. Off (No Electrical Operation)
3. Remote Control plus Local Stop Only.

It shall be possible to select maintained or non-maintained local control.
The local controls shall be arranged so that the direction of valve travel can be reversed without the necessity of stopping the actuator.

M. Control Facilities

The necessary wiring and terminals shall be provided in the actuator for the following control functions:

1. Removable links for substitution by external interlocks to inhibit valve opening and/or closing

2. Connections for external remote controls fed from an internal 24V DC supply and/or from an external supply of (min. 12V, max. 120V) to be suitable for any one or more of the following methods of control:
   a. Open, Close, and Stop
   b. Open and Close
   c. Overriding Emergency, Shutdown to Close (or Open) Valve from a "Make" Contact.
   d. Two-Wire Control, Energize to Close (or Open), De-Energize to Open (or Close)

Selection of maintained or push-to-run control for modes (A) and (B) above shall be provided and it shall be possible to reverse valve travel without the necessity of stopping the actuator. The starter contactors shall be protected from excessive current surges during travel reversal by an automatic time delay upon energizing of approximately 300 ms.

The internal circuits associated with the remote control and monitoring functions are to be designed to withstand simulated lightning impulses of up to 1.1 kV.

N. Monitoring and Diagnostics Facilities

Facilities shall be provided for monitoring actuator operation and availability as follows:

Monitor (availability) relay, having one change-over contact, the relay being energized from the control transformer only when the Local/Off/Remote selector is in the "Remote" position to indicate that the actuator is available for remote (control room) operation.

Where required, it shall be possible to provide indication of thermostat trip and "Remote" selected as discreet signals.

Actuators shall include a diagnostic module, which will store and enable download of historical actuator data to permit analysis of changes in actuator or valve performance. A software tool shall be provided to allow configuration and diagnostic information to be reviewed and analyzed and reconfigured. Additionally, diagnostic data shall be available over an IrDA™ port, which can be relayed to a remote facility by an IrDA™ compatible

device (laptop PC, PDA, cell-phone, etc.). After remote analysis, changes to the actuator configuration can be relayed back to the actuator via the device.

Diagnostic status screens must be provided to show multiple functions simultaneously so troubleshooting can be affected rapidly and efficiently. All diagnostic information should be contained on no more than eight (8) screens so multiple functions can be checked simultaneously.

Provision shall be made to graphically display valve torque demand as a percent of rated actuator torque vs. position simultaneously in 1% increments so as to facilitate valve troubleshooting and diagnostics.

O. Wiring and Terminals

Internal wiring shall be of tropical grade PVC insulated stranded cable of appropriate size for the control and three- phase power. Each wire shall be clearly identified at each end. The terminals shall be embedded in a terminal block of high tracking resistance compound. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal. The terminal compartment of the actuator shall be provided with a minimum of three threaded cable entries. All wiring supplied as part of the actuator to be contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable. Control logic circuit boards and relay boards must be mounted on plastic mounts to comply with double insulated standards. No more than a single primary size fuse shall be provided to minimize the need to remove single covers for replacement.

A durable terminal identification card showing plan of terminals shall be provided attached to the inside of the terminal box cover indicating:

1. Serial Number
2. External Voltage Values
3. Wiring Diagram Number
4. Terminal Layout

This must be suitable for the contractor to inscribe cable core identification beside terminal numbers.

P. Enclosure

Actuators shall be 'O' ring sealed, watertight to NEMA 6, IP68 during operation and shall at the same time have an inner watertight and dustproof 'O' ring seal between the terminal compartment and the internal electrical elements of the actuator fully protecting the motor and all other internal electrical elements of the actuator from ingress of moisture and dust when the terminal cover is removed on site for cabling.

Enclosure must allow for temporary site storage without the need for electrical supply connection. A space shall not be required due to the enclosure design.

All external fasteners should be of stainless steel.

Actuators for explosion/hazardous applications shall in addition be certified flameproof for Zones 1 and 2 (Divisions 1 and 2) Group gases.

Q. Start-up Kit

Each actuator shall be supplied with a startup kit comprising installation instruction,

electrical wiring diagram, and sufficient spare cover screws and seals to make good any site losses during the commissioning period.

R. Performance Test Certificate

Each actuator must be performance tested and individual test certificates shall be supplied free-of-charge.
The test equipment should simulate a typical valve load and the following parameters should be recorded:

1. Current at maximum torque setting
2. Torque at maximum torque setting
3. Flash Test Voltage
4. Actuator Output Speed or Operating Time

In addition, the test certificate should record details of specification, such as gear ratios for both manual and automatic drive, closing direction, and wiring diagram code number.

S. Warranty

Each actuator shall be warranted for a minimum of 36 months from shipment up to a maximum of 24 months from commissioning (if commissioning is performed by a Certified Factory Technician).

T. Experience

All technologies and devices used in the actuator must have a minimum of five years commercial operating experience for that specific manufacturer. This is to include torque and position sensing, lubrication, and electrical compartment design.

U. Actuator Factory Mounting

Valve operators shall be provided by the valve manufacturer factory mounted on the valve.

W. Approved Manufacturer

- Rotork IQ Series or equal

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

The CONTRACTOR shall field measure all dimensions and check possible interferences for the pipe system and accessories.

3.02 PREPARATION

All pipe fittings and accessories shall be free of all foreign matter. Any accumulations of dirt, rust, scale, etc., shall be removed prior to installation. All pipe ends shall be reamed and deburred to prevent loose particles from getting into the pipe line.

3.03 INSTALLATION

A. General

Pipe systems shall be installed to line and grade indicated on the Plans. Valves shall be located as indicated on the Plans.

All piping connections to equipment shall be aligned and supported in such manner that no load or thrust will be exerted upon the equipment by the piping at installation or in operating conditions.

All cutting of the pipe shall be done in a neat workmanlike manner with the least amount of waste and without damage to existing or new lines. A fine tooth saw, tubing, or pipe cutter, or similar tool shall be used to cut the pipe. Cuts must be square and ragged edges removed with a burring tool and/or file.

After cutting bell and spigot or socket pipe a stop mark shall be made with a pencil or crayon using dimensions as shown by the manufacturer's instructions or by using another pipe in the field as a guideline.

Cutting of concrete walls, floors or ceilings shall be avoided and requires written approval from the ENGINEER. If approved, holes shall be core drilled and patched. Reinforcement steel shall not be cut or disturbed.

At the termination of pipe installation any open ends of pipelines shall be closed off by a suitable cover until installation operations are resumed.

Provide plugged wyes, tees, or crosses with threaded joints at all changes in direction to facilitate cleaning of chemical lines.

B. Pipe Supports

Pipe supports, pedestals, base elbows and tees and pipe hangers shall be provided and installed as required by the ENGINEER in accordance with the following:

PIPE SIZE INCHES	MAXIMUM DISTANCE IN FEET BETWEEN SUPPORTS	MINIMUM DIAMETER OF HANGER ROD
1/2 thru 2	6	3/8
2-1/4 thru 4	8	3/8
4-1/4 thru 12	9	7/8
14 thru 30	9	1

Polyvinyl chloride pipe, fiber glass reinforced pipe, rubber hose, tubing, etc., shall be supported along the entire length by means of a stainless steel channel or approved tray anchored to the floor, wall, or ceiling with supports per above. Where shown, chemical feed lines are installed in containment piping.

Piping systems shall be supported by hangers, guides, anchors, and sway bracing or by resting on structural brackets or racks. Piping 8-inch and larger located close to the floor shall be supported in concrete saddles. Welding to structural steel members shall not be permitted without written approval of the ENGINEER. Valves shall be supported to keep undue strain off piping and adjacent equipment. Equipment requiring periodic maintenance shall be supported to allow easy removal with a minimum of temporary supporting.

Hanger rods shall be connected to beam clamps or concrete inserts. Clamps or inserts shall be Underwriters' Laboratories approved. "C" clamps will not be permitted. Expansion anchors may be used upon written approval by the ENGINEER. Holes for expansion anchors shall be made by rotary drilling only, hammering devices will not be permitted. Explosive studs may be used provided they are driven under safe conditions.

Anchors, guides and sway braces shall be provided to allow for forces on the piping system. Sleeves shall be provided on all pipe subject to movement. Sleeves shall be no less than four inches wide or have a width equal to 1/3 the diameter of the pipe, whichever is larger.

Vertical piping shall be supported at each floor or grating level with approved riser clamps except where prohibited by piping flexibility requirements. Lateral movement of exposed vertical piping at building walls shall be restrained by anchor devices attached to walls except where prohibited by piping flexibility requirements. Provide retaining straps when clamps are used.

C. Pipe Connections

1. General

Joint connections shall be as indicated on the Drawings and specified herein. Excluding connections for valves, fittings, equipment, etc., joints in the pipe line shall be minimal yet provide easy access as required for maintenance.

2. Threaded

A joint compound of oil and graphite, Teflon tape or other ENGINEER approved material shall be applied to the male threaded end only. Care shall be used to prevent the joint compound from entering the pipe interior.

3. Electrical Conductivity

When indicated on the Plans or specified, ductile iron piping joints shall be bonded to provide electrical conductivity across the joints of both bell and mechanical joint pipe and fittings. The cable conductor shall be flexible to simplify assembly and to withstand ground and pipe movement after installation. The installation shall provide a positive lasting connection. Where required, bonds shall be made between cast and/or ductile iron pipe and steel pipe to ensure electrical conductivity across the joints.

D. Expansion Joints

Expansion joints shall be installed where indicated on the Plans and in accordance with the manufacturer's recommendations. Pipe systems shall be properly supported so expansion joints do not carry any loads. Piping on equipment adjacent to expansion joints shall be anchored to prevent excessive elongation of the pipe system when subject to pressure. Restrained expansion joints shall be used when adequate anchoring is not available.

Misalignment of installation shall not exceed 1/8" to allow full movement of expansion joints when necessary. Do not cover expansion joints with insulation. Straight, concentric or eccentric tapered joints shall be used as indicated on the Plans.

E. Miscellaneous System Connections

Connection to large size pipe or headers for gages, sampler lines or other small inlets or outlets shall be made as indicated on the Plans and specified herein. Connections to large steel pipe shall be by welding on the threaded saddle. The small line shall be socket or nipple type for either threaded or welded connection. Tapping saddles shall be used on large PVC or fiberglass pipe. The small line connection shall be threaded. All connections shall have gate valve installed adjacent to pipe.

3.04 FIELD QUALITY CONTROL

A. General

Installed pipe systems shall be tested by hydrostatic or pneumatic means as specified in Section 15050, Mechanical General Requirement, and herein. Hydrostatic testing shall be for any fluid type material to be handled with pneumatic testing for any gas or air pressurized lines. Testing shall be made with the temperatures of surrounding air and test water or air are approximately constant within operating temperature ranges. Pipe ends shall be valved or blanked off. Exterior surfaces of pipes, fittings, or valves shall show no cracks or other forms of leakage.

B. Hydrostatic Testing

Lines shall be pressure tested in accordance with Specification 02735 Force Mains, Section 3.04 A.

C. Pneumatic Testing

Lines shall be pressurized to test pressure and shall not have a drop exceeding 1% over a one-hour period after cutting off the source of pressure.

END OF SECTION

SECTION 15895
FIBERGLASS DUCTWORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Extent of fiberglass ductwork is indicated on Drawings and in schedules, and by requirements of this Section.

B. Types of non-metal ductwork required for project include the following:

1. Air exhaust systems for odor control at the headworks and anaerobic basins.

1.02 QUALITY ASSURANCE

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work are limited to, the following:

- Perry Fiberglass Products, Inc.
- Rigidon/Heil Process Equipment
- Or approved equal

B. Standards:

1. Materials, construction and workmanship, physical properties, and methods of testing reinforced polyester materials shall comply with Voluntary Product Standard PS 15-69, U.S. Department of Commerce National Bureau of Standards, (SD Catalogue No. C13.20 2:15-69, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402), and industry initiated development standards.

2. Base component products shall meet applicable established standards or manufacturer's published standards.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's specifications on manufactured products and fabricated ductwork, used for work on this Section.

1.04 DELIVERY, STORAGE AND HANDLING

A. Protect ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 FIBERGLASS REINFORCED PLASTIC (FRP) DUCT

A. Exhaust FRP Duct: Materials, construction and workmanship, physical properties, and methods of testing reinforced polyester materials shall comply with Standards listed in Part 1.

2.02 MATERIALS

A. Resin: Resin used shall be of a commercial grade and shall either be evaluated as a laminate by test or determined by previous service to be acceptable for the environment. Resin shall be Ashland Chemical Hetron 197 or Koppers Dion 6693 with 5% antimony trioxide added.

B. Fillers and Pigments: The resins shall not contain fillers except as required for viscosity control or fire retardance.

C. Reinforcing Material: The reinforcing material shall be commercial grade of glass fiber having a coupling agent which will provide a suitable bond between and glass reinforcement and the resin.

D. Surfacing materials: The material used as reinforcing on the surface exposed to chemical attack shall be commercial grade chemical-resistant glass having a coupling agent. A surfacing veil is required on the I.D. of the duct, and ultraviolet protection is required on the O.D. of the duct as an inhibitor to sunlight exposure.

E. Laminate: The laminate shall consist of an inner surface, an interior layer, and an exterior layer or laminate body. The composition specified for the inner surface and interior layer are intended to achieve optimum chemical resistance.

F. Cut Edges: All cut edges shall be coated with resin so that no glass fibers are exposed and all voids filled. Structural elements having edges exposed to the chemical environment shall be made with chopped-strand glass reinforcement.

G. Joints: Finished joints shall be built up in successive layers and be as strong as pieces being joined and as crevice free as is commercially practical. The width of the first layer shall be 2-inch minimum. Total minimum width of joint shall be 3-inches for 1/8-inch thickness, 4-inch for 3/16-inch thickness, and 6-inches for 1/4-inch thickness. Crevices between jointed pieces shall be filled with resin or thixotropic resin paste, leaving a smooth inner surface. The interior joints may also be sealed by covering with not less than 0.100-inch of reinforced resin-rich surface.

H. Ells: Standard ells shall have a centerline radius of one and one-half times the duct diameter.

I. Reducers, Concentric or Eccentric: Length of standard reducers shall be five times the difference in diameters (D1-D2). Minimum wall thickness shall be that required for the larger diameter duct.

J. Flanges:

1. Flange attachment - Duct wall at hub of flange shall be at least one and one-half times the normal thickness and tapered to normal thickness over a distance of at least one flange width. Fillet radius shall be at least 3/8-inch at point where the hub meets the back of the flange.

2. Face of flange - Face of flange shall have no projections or depressions greater than 1/32-inch and shall be perpendicular to the centerline of the duct within 1/2 degree. A camber of 1/8-inch with respect to the centerline, measured at the

O.D. of the flange shall be allowable. The face of the flange shall have a chemical-resistant surface.

3. Gasket material - Gasket material shall be fabricated from flexible plasticized PVC of suitable gauge to seal (minimum of 1/8-inch). Field installation gaskets shall be cemented to one of two mating flanges. The flexible PVC gasket shall be fabricated with unbroken circumference or perimeter.

4. Bolts, nuts and washers - Bolts, nuts and washers shall be of stainless steel material. Metal washers shall be used under all nut and bolt heads.

K. Pipe hangers and spacing: Pipe hangers shall be stainless steel band type hangers 6-inches in width and contacting a minimum of 180 degrees of the pipe surface. Maximum spacing for pipe hangers and supports shall be 8-ft. Hangers are to be securely fastened to avoid vibration, and care shall be taken to install hangers so as to avoid creating conditions of stress in the finished installation.

L. Expansion: Proper consideration should be given to accommodate overall linear expansion.

M. Flexible Connections: Flexible connections shall be fabricated from flexible plasticized PVC using material not less than 3/32-inches thick. Connections shall be fabricated with a longitudinal seam lapped not less than 1-1/2-inches and clamped with stainless steel bands to ducts or equipment collars. In cases where flexible connections are provided for connections to fans or equipment, a support or hanger shall be provided at the unsupported location. In general, ductwork shall be supported independently of fans or other equipment.

2.03 CONTROL DAMPERS

A. Provide manual type, opposed multiblade, butterfly type damper consisting of a singular circular blade as specified and indicated. Provide damper constructed of FRP suitable for hydrogen sulfide environment, with lever-type accessible locking-quadrant operator identified with OPEN and CLOSE positions. All metal parts shall be stainless steel. Damper shall include a firm closed cell neoprene seal sandwiched between two blades. Damper shall be manufactured by:

- Perry Fiberglass Products, Inc.
- Rigidon/Heil Process Equipment
- Or Equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Follow manufacturer's recommendations and Standards listed.

3.02 TESTING, ADJUSTING AND BALANCING:

A. Testing, adjusting and balancing for supply and exhaust ventilation systems of low pressure ductwork is specified in Section 01660 - Testing, Adjusting and Balancing. The ventilation contractor shall be responsible for the testing, adjusting and balancing with the work performed by a certified Test and Balance agency with the assistance of the ventilation contractor.

TABLE I - 15895
REINFORCED-POLYESTER ROUND DUCT DIMENSIONS

I.D. inches	Wall thickness (min.) inch	Allowable vacuum-2 inches of water	Allowable pressure-2 inches of water	Flange diameter (O.D.) inches	Flange thickness inch	Bolt circle diameter inches	Bolt hole diameter inch	No. of bolt holes
2	0.125	405	750	6-3/8	1/4	5	7/16	4
3	0.125	405	500	7-3/8	1/4	6	7/16	4
4	0.125	210	410	8-3/8	1/4	7	7/16	4
6	0.125	64	350	10-3/8	1/4	9	7/16	8
8	0.125	30	180	12-3/8	1/4	11	7/16	8
10	0.125	16	340	14-3/8	3/8	13	7/16	12
12	0.125	9	280	16-3/8	3/8	15	7/16	12
14	0.125	7	220	18-3/8	3/8	17	7/16	12
16	0.125	6	290	20-3/8	1/2	19	7/16	16
18	0.125	5	240	22-3/8	1/2	21	7/16	16
20	0.125	5	190	24-3/8	1/2	23	7/16	20
24	0.187	9	140	28-3/8	1/2	27	7/16	28
30	0.187	7	100	34-3/8	1/2	33	7/16	28
36	0.187	5	70	40-3/8	1/2	39	7/16	32
42	0.250	10	120	46-3/8	5/8	45	7/16	36
48	0.250	9	100	54-3/8	5/8	52	9/16	44
54	0.250	7	80	60-3/8	5/8	58	9/16	44
60	0.250	6	60	66-3/8	5/8	64	9/16	52

1. 5 to 1 design factor of safety based on data in Table 1. Also based on 10-foot lengths between stiffener rings for vacuum service.

2. These ratings are suitable for use up to 180 degrees F (82.2 degrees C) in pressure service and ambient atmosphere temperatures on vacuum service. For ratings at higher temperatures consult the manufacturer.

TABLE II - 15895
REQUIREMENTS FOR PROPERTIES OF REINFORCED-POLYESTER LAMINATES

Property at 73.4F degrees F	Fiberglass Thickness 1/8 to 3/16 Inch	Fiberglass Thickness 1/4 Inch
Min. ultimate tensile strength psi (1)	9,000	12,000
Min. flexural strength psi (2)	16,000	19,000
Min. flexural modulus of elasticity (tangent) psi (3)	700,000	800,000

(1) ASTM Designation D638-68

(2) ASTM Designation D790-66

(3) ASTM Method D790-66

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END OF SECTION

SECTION 16010
ELECTRICAL GENERAL REQUIREMENTS

PART I – GENERAL

1.01 DESCRIPTION

A. Scope of Work

These Specifications and the accompanying drawings contemplate the furnishing and installation of all materials, equipment, supplies, testing, adjustments, labor, and supervision required for the complete performance of all operations relating to the electrical and instrumentation.

The CONTRACTOR shall be held responsible for the complete and satisfactory accomplishment of all Work inclusive of whatever miscellaneous material and/or appurtenances are required to perfect the installation and demonstrate that all electrical systems will operate satisfactorily under normal operating conditions.

The CONTRACTOR shall be responsible for all electrical connections to equipment. Electrical connections in addition to making wire connections shall include, but not be limited to, furnishing, installing, and testing circuit protection devices, motor overload devices, conduits, and fittings needed to ensure a complete and operable electrical installation.

B. Related Work Specified Elsewhere

1. Section 03300: Cast-in-Place Concrete
2. Section 16050: Basic Materials and Methods

C. Responsibility

It shall be the responsibility of the CONTRACTOR to furnish a complete and fully operating system. The CONTRACTOR shall be responsible for all details which may be necessary to properly install, adjust, and place in operation the complete installation. The CONTRACTOR shall assume full responsibility for additional costs which may result from unauthorized deviations from the Plans and Specifications.

D. Apportionment of the Work

The CONTRACTOR shall classify and apportion all materials and performance of all labor to the several trades involved in accordance with all local customs, rules, regulations, jurisdiction awards, decisions, etc., insofar as they may apply and as required to efficiently execute the Work involved in this Contract.

E. Cooperation of the Contractor

The CONTRACTOR shall coordinate the work of Subcontractors of each trade to avoid interference in the Work and to avoid delays in the construction. He shall coordinate the Work of all Subcontractors to obtain a first-class workmanlike system.

Where interference occurs as a result of poor cooperation between Subcontractors and the coordination on the part of the CONTRACTOR, the OWNER reserves the right to change the Work in hand to resolve the interferences and such changes will not be considered as extras.

F. Damage to Other Work

The CONTRACTOR will be held responsible for all damage done by his workmen. All patching and repairing of damaged Work shall be done by the CONTRACTOR.

G. Maintenance Prior to Final Acceptance

The CONTRACTOR shall be responsible for the maintenance of equipment and systems installed until final acceptance by the OWNER and shall take such measures as necessary to ensure adequate protection of all equipment and materials during delivery, storage, installation, start up, temporary operation, and shut down.

H. Accessibility

All equipment shall be installed so as to be readily accessible for operation, maintenance, and repair, subject to the approval of the ENGINEER.

I. Physically Handicapped Accommodations

These buildings shall comply with all requirements for public building accommodations of the physically handicapped, for installation of electrical, telephone, and fire alarms stations, unless a variance has been approved.

1. Light switch, 48 inches from floor to centerline of switch.

2. Telephone, 48 inches from floor to centerline of dial and equipped with hearing aid (when applicable).

J. Local Utilities

The CONTRACTOR shall be responsible for coordinating, obtaining service, including costs and advising the ENGINEER, and utility company(s) as to electrical and telephone installation schedules.

K. Cutting and Patching

The CONTRACTOR shall perform all cutting and patching that may be necessary for the installation of the Work.

Major wall penetrations shall not be made without the written consent of the ENGINEER unless they are called for on the construction drawings.

Structural steel shall not be cut, welded, or altered in any way without the written consent of the ENGINEER.

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work of this Section shall conform to the applicable portions of the following Standard Specifications:

1. ANSI - The American National Standards Institute
2. ASA - Acoustical Society of America

3. ASTM - The American Society for Testing Materials
4. ETL - Electrical Testing Laboratories
5. IEEE - The Institute of Electrical and Electronic Engineers
6. ICEA - The Insulated Cable Engineers Association
7. ISA - The Instrument Society of America
8. ITL - Independent Testing Laboratories
9. JIC - Joint Industrial Conference
10. NACE - National Association of Corrosion Engineers
11. NEC - The National Electric Code
12. NEMA - The National Electrical Manufacturers Association
13. NESC - The National Electrical Safety Code
14. NFPI - The National Fire Protection Institute
15. OSHA - Federal Occupational Safety and Health Act
16. UL - Underwriters Laboratories, Inc.
17. FM - Factory Mutual Insurance Underwriters

B. Erector Qualifications

All Work shall be performed in accordance with latest accepted standards and practices for the trades involved. The workmanship shall be subject to the approval of the ENGINEER at all times.

Only experienced craftsmen will be allowed to perform the items of Work as required within this Project.

C. Requirements of Regulatory Agencies

All materials and equipment required for the Work and their installation shall conform to all national, state, county, and local codes, rules, regulations, and ordinances. Each contractor shall secure all permits, inspections, and tests required in connection with his Work.

Any changes in the drawings and/or Specifications required to conform to the above codes, laws, rules, and/or regulations shall be taken up with the ENGINEER by the CONTRACTOR before submitting his Proposal. After entering into the Contract, the CONTRACTOR shall be held responsible to make all changes required to conform to the above ordinances, laws, rules, and/or regulations without extra expense to the OWNER, except in the instance of ordinances, laws, rules, and/or regulations which are revised or enacted subsequent to the time of signing the Contract.

1.03 SUBMITTALS

A. Schedule

The CONTRACTOR shall submit a schedule in accordance with Section 01300, Submittals, for review to the ENGINEER outlining the steps to be taken to maintain electrical service and showing the coordination effort which will be taken to coordinate the work between the various trades.

B. Samples

When directed by the ENGINEER or required by the Specifications, the CONTRACTOR shall submit samples of materials and accessory equipment such as lighting fixtures, switches, receptacles, etc.

The CONTRACTOR shall not use these materials in the Work until the ENGINEER has had ample time to determine the products suitability and compliance with the Specifications. In general, two weeks shall be considered ample time to approve or reject the submitted sample.

C. Shop Drawings and Product Data

Submit shop drawings and product data. The CONTRACTOR shall submit the following types of information for approval by the ENGINEER before any equipment is installed.

1. Catalog Cuts and/or Product Data Sheets

Catalog cuts shall be provided for standard manufactured items such as conduit and conduit fittings, electric heaters, lighting fixtures, lighting panels, instruments, motors, switches, transformers, wire, etc. Each sheet shall identify the exact equipment for which it is intended. All pertinent information such as physical dimensions, current rating, horsepower, kilowatt rating, phase, power factor, voltage, NEMA classifications, and material type shall be indicated. Also shown shall be approved listings such as UL label or other testing agencies.

2. Vendors Standard Drawings

24" x 36" drawings are preferred, however, where a manufacturer's standard equipment is being used, his "full size" standard drawings may be submitted for approval provided the following information is included on the drawings:

a. Identity of equipment for which drawing is intended.
b. Optional features to be used for this Project identified.
c. Field connections clearly identified complete with necessary terminal and wire numbers.
d. Sequence of operation shall be written on the drawing unless the control diagram is easily understood without a sequence of operation.

Note: Sequence of operation will be required if determined necessary by the ENGINEER.

D. Process Control Drawings

The CONTRACTOR shall submit wiring diagrams of each piece of equipment, termination cabinet, starter, switch, relay, indicator, controller, recorder, annunciator, telemetering equipment, etc.

All drawings shall be 24" x 36", reproducible media, with border, title block, symbols, etc., as used on the Contract drawings and approved by the ENGINEER. Ladder diagrams and wiring diagrams shall conform to JIC format and include line numbers, item numbers, source of power, terminal numbers, wire numbers, etc. Wire numbers and item numbers shall be assigned using the line numbers on the ladder diagrams.

Where applicable, and if the CONTRACTOR desires, he may purchase reproducible media or electronic files (when approved by the ENGINEER) of the process control drawings from the ENGINEER, modify these drawings as required, and utilize them as shop drawings.

Note: bond copies will be acceptable for the approval issue only.

E. Test Reports

When directed, the CONTRACTOR shall submit the manufacturer's test reports on any

equipment proposed for this Project.

The CONTRACTOR will maintain a complete set of test records covering all tests required by this Specification. The records will include the date, equipment or system tested, testing conditions, test results, and CONTRACTOR verification. The records will be available for review during construction and will be submitted to the ENGINEER upon completion of the Project.

F. Certificates

The CONTRACTOR, upon completion of his portion of the Project, shall secure and present to the ENGINEER a certificate of inspection and approval from the department having jurisdiction over his work, if such be issued. The CONTRACTOR shall pay all fees in connection with the above requirements.

G. Operation and Maintenance Data

Provide maintenance manual for the main switchgear, motor control centers and reduced voltage starters, and the main control/instrumentation panels.

H. Record Drawings

It shall be the responsibility of the CONTRACTOR to provide all drawings pertaining to his Work. All drawings including both manufacturer's drawings and engineer design drawings shall be on reproducible media as approved by the ENGINEER. Electronic record drawings will be acceptable when approved by the ENGINEER.

The drawing set shall include site plan and floor plans of each elevation showing the location of all equipment, lighting fixtures, embedded conduit, grounding, conduit size, conduit routing, wire size, etc. Schematic ladder diagrams for each piece of equipment and system using JIC format. Wiring diagrams of each piece of equipment, termination cabinet, starter, switch, relay, indicator, controller, recorder, annunciator, telemetering equipment, etc. The CONTRACTOR shall accurately maintain the set of drawings and submit prints at various stages of the Work, upon request of the ENGINEER. The final revised record drawings shall be turned over to the ENGINEER upon completion or termination of CONTRACTOR's responsibility to this Contract. The CONTRACTOR shall purchase the design drawings from the ENGINEER.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Storage

All electrical equipment and materials shall be stored in a location and manner to protect against damage.

B. Delivery and Handling

Materials and equipment shall be delivered, unloaded, and handled in a manner to protect against damage. The CONTRACTOR shall repair or replace all damaged or defective material at the ENGINEER's option and at no cost to the OWNER or the ENGINEER.

1.05 JOB CONDITIONS

A. Existing Conditions

The CONTRACTOR shall be responsible for determining the existing conditions at the time the electrical work begins and arrange for surveys, trenching, concrete work, conduit sleeves, and any other work necessary to perform the electrical installation.

B. Environmental Requirements

The CONTRACTOR shall exercise caution during installation and afterward to assure all equipment is protected from adverse environmental conditions such as temperature, wind velocity, humidity, rain, ice, etc.

C. Protection of Work and Property

All materials and equipment both before and after erection shall be properly protected and kept in a clean condition.

All conduit ends and parts of equipment left unconnected shall be capped, plugged or properly covered to prevent the intrusion of foreign matter.

The use of tarpaulins or plastic sheets for temporary enclosures, protection of materials, etc., will not be permitted in areas where burning and/or welding operations are going on or in any location where there may be the slightest hazard of their use contributing to a fire.

Any equipment which has been installed and later becomes damaged shall be replaced or repaired at the ENGINEER's option at the CONTRACTOR's expense.

D. Sequencing

The CONTRACTOR shall so schedule his Work to assure that he does not delay the work of any other trades. He shall also supply sleeves, supports, anchors, hangers, and other items that are to be included in the work of other trades and provide information for positioning.

PART 2 – PRODUCTS

2.01 MATERIALS

All material and equipment furnished and installed by the CONTRACTOR for the permanent Work shall be new, unused, of the best quality of make specified, shall be free from defects of any character, and shall be listed as approved by the UL and/or FM.

Equipment with aluminum buses, aluminum conduits, fittings, supports and conductors are not acceptable.

Outdoor electrical equipment shall be weatherproof, NEMA 4X (stainless steel), unless otherwise indicated.

Unless otherwise specified in other Division 16 sections, the sheet metal surfaces of equipment enclosures shall be coated with a rust resisting primer.

Over the primer, a corrosion resistant baked enamel finish shall be applied. The color shall be ASA No. 49, medium light gray.

PART 3 – EXECUTION

3.01 GENERAL

The CONTRACTOR shall install electrical work in accordance with the codes and standards specified, except where more stringent requirements are indicated or specified, verify that materials and equipment properly fit the installation space with clearances conforming to the codes and standards specified except where greater clearance is indicated. Perform work as required to correct improper installations, at no additional cost to the OWNER.

3.02 ELECTRICAL SUPERVISION

In addition to supervision required under the General Conditions, the CONTRACTOR shall assign a competent representative to supervise the electrical construction work from beginning to completion and final acceptance.

3.03 INSPECTION

The CONTRACTOR shall inspect each item of material and equipment for damage, defects, completeness, and correct operation before installing. Inspect previously installed related work and verify that it is ready for installation of electrical work.

3.04 PREPARATION

Prior to installing electrical work, the CONTRACTOR shall ensure that installation areas are clean, shall maintain the areas in a broom-clean condition during installation operations, shall clean, condition, and service equipment in accordance with the manufacturer's instructions, approved submittals, and other requirements indicated or specified.

3.05 WORKMANSHIP

The CONTRACTOR shall employ skilled craftsmen experienced in installation of the types of electrical materials and equipment specified. The CONTRACTOR shall use specialized installation tools and equipment as applicable and produce installations free of defects.

3.06 FIELD QUALITY CONTROL

A. Equipment Start-Up

After completion of the installation, all systems and equipment shall be tested by the CONTRACTOR in the presence of the ENGINEER under actual operating conditions. Tests shall be performed according to manufacturer's recommendations.

The CONTRACTOR shall include with his bid the services of all required Equipment Manufacturer's field service technicians for a period necessary to complete the work to the satisfaction of the ENGINEER and OWNER.

This service shall be for the purposes of check-out, initial start-up, certification, and instruction of plant personnel.

A written report covering the technician's findings and installation approval shall be submitted to the ENGINEER covering all inspections and outlining in detail any deficiencies noted.

Specific requirements, if any, for a particular system or piece of equipment are contained in the particular specification sections. The CONTRACTOR's responsibility relative to coordinating these services is contained in Section 01700, Contract Closeout.

B. Manufacturer's Supervision and Field Installation Check

Where specified, electrical equipment manufacturer shall furnish the services of an authorized representative especially trained and experienced in the installation of his equipment to 1) supervise the equipment installation in accordance with the approved submittals and manufacturer's instructions; 2) be present when the equipment is first put into operation; 3) inspect, check, adjust as necessary, and approve the installation; 4) repeat the inspection, checking, and adjusting until all trouble or defects are corrected and the equipment installation and operation are acceptable; and, 5) prepare and submit the specified Manufacturers' Certified report. Include all costs for representative's services in the contract price.

C. Final Operation Tests

The CONTRACTOR shall test all electrical systems for not less than 168 hours, with no interruptions except for normal maintenance or corrective work. Conform to the approved test plan. Coordinate with final operation test required under Section 11005, Process Equipment General Requirements.

1. Testing Materials

The CONTRACTOR shall furnish labor, instruments, recorders, gages, materials, and power for tests as required.

2. Testing Methods

The CONTRACTOR shall operate systems continuously 24 hours a day under constant inspection of trained operators. Cause variable speed equipment to cycle through the applicable speed range at a steady rate or change. Induce simulated alarm and distressed operating conditions, and test controls and protective devices for correct operation.

3.07 SHORT CIRCUIT ANALYSIS, COORDINATION STUDY, AND ARC FLASH STUDY

The CONTRACTOR shall provide a complete short circuit study and a protective device coordination study for the electrical distribution system. The study shall include all portions of the electrical distribution system throughout the low voltage distribution system.

The study shall be submitted to the ENGINEER prior to granting final approval of the distribution equipment shop drawings.

A. Short Circuit Study

The study shall be performed in accordance with ANSI C37.5 and corresponding IEEE publications.

Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center and, distribution panelboard.

Based upon the calculated short circuit and interrupting duties, the CONTRACTOR shall determine the adequacy of the distribution equipment.

B. Protective Device Coordination Study

The CONTRACTOR shall perform a protective device coordination study to check the selection of circuit breakers and power fuses ratings, protective relays settings, low voltage

breaker trip characteristics and settings.

The coordination study shall include all voltage classes of equipment from the utility's incoming line protective device down each motor control center and panelboard.

The time-circuit characteristics of the protective devices shall be plotted on the appropriate log paper.

These plots shall indicate the types of protective devices selected, time delay and instantaneous trip settings.

C. Arc Flash Study

The CONTRACTOR shall perform an arc flash study to determine the potential arc flash hazard for each piece of electrical equipment and the level of personal protection equipment (PPE) required. Each panelboard, motor control center bucket, disconnect switch, etc. shall be labeled in the field using the data obtained from this study and in accordance with NFPA 70E, Standard for Electrical Safety in the Workplace.

D. Study Report

The results of the short circuit, protective device coordination, and arc flash studies shall be summarized in a final report. The report shall be submitted to the ENGINEER.

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END OF SECTION

SECTION 16050
ELECTRICAL BASIC MATERIALS AND METHODS

PART I – GENERAL

1.01 DESCRIPTION

Requirements specified in Section 16010: Electrical General Requirements, are part of this Section. This section forms a part of all other sections of Division 26, unless otherwise indicated.

A. Related Work Specified Elsewhere

1. Section 03300: Cast-in-Place Concrete
2. Section 16010: Electrical General Requirements

1.02 SUBMITTALS

The CONTRACTOR shall submit for the ENGINEER's, approval material lists, shop drawings, and factory test reports, to the extent required in this section and Section 16010, Electrical General Requirements.

PART 2 – PRODUCTS

2.01 BASIC EQUIPMENT AND MATERIALS

A. Primary Service Cable

Primary service cable where required shall be in accordance with Florida Power & Light Co. requirements.

B. Duct Bank

The CONTRACTOR shall install the incoming service duct banks from the Florida Power & Light Co utility pole to the service entrance equipment as indicated on the drawings. Another secondary service duct bank shall be installed from the diesel generator to the automatic transfer switch. Concrete for the duct bank shall have a red dye color added identifying it as electrical equipment.

C. Service

Secondary voltage from the transformer to the main switchboard breaker shall be 480Y/277 volt, 3 phase, 4 wire, with solid neutral grounded at transformer.

Power distribution is 480 volt, 3 phase, 3 wire plus ground wire.

Building facility power distribution is 208Y/120 volt, 3 phase, 4 wire grounded neutral.

Motors 1/2 HP and larger shall be 3 phase 3 wire plus grounding conductor: motors under 1/4 HP shall be 208 or 120 volt single phase (2 wire plus ground wire) either single pole or capacitor starting only.

D. Automatic Transfer Switch (ATS) and Control

Provide and install an automatic transfer switch (ATS) as indicated on the plans. The

ATS shall be provided with three poles for 480 volt, 3 phase, 4 wire, solid neutral 60 HZ. The ampere rating of each contactor shall be as indicated on the plans.

The ATS shall include the necessary relays and component parts, together with UL listed and tested electrically and mechanically interlocked contactor, and shall provide the following functions:

1. Upon power line outage, automatically switch over to the alternate source, diesel generator.

2. Upon power line return, transfer the load back to the normal source after a time delay of 20 to 30 minutes.

Each contact pole of the main transfer device shall be double break design, with solid silver cadmium contacts, capable of handling both non-inductive and inductive loads and allow for inrush currents of 20 times the continuous rating. Contact pressure shall be maintained by a coil spring, not a part of the current carrying path. The ampere rating of the transfer switch shall be sufficient to handle the loads being transferred. Switch shall conform to UL 1008 for transfer switches.

The transfer switch shall be double throw, actuated by two electrical operators. An adjustable time delay between the opening of the closed contacts and closing of the open contacts shall allow loads to be demagnetized before power is transferred.

The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing.

The transfer switch shall include an in-phase monitor. This device is to monitor the normal and emergency sources and will not permit transfer in either direction until the phase voltages are within 15% and have a frequency difference within two cycles. If the source supplying the load fails or drops below 70%, the monitor will override itself and permit immediate transfer. Transfer switch can be furnished by the Diesel Generator Manufacturer or Russell Electric and ASCO.

E. Control Panel

Panel shall be NEMA 12, totally enclosed one-piece design, pad-mounted and free-standing. Material shall be not less than 12 gage sheet steel reinforced and plug welded to angle iron frames. Construction incorporating a frame with light gage skin will not be acceptable. Panel shall have front access and be constructed by a UL listed panel manufacturer in strict compliance with NEMA and UL Standards.

The panel shall be factory assembled, wired, and tested. All wiring shall be neatly installed in horizontal and vertical runs. Terminals shall be so arranged to provide complete accessibility to all items.

Panel face openings for mounting equipment shall be smoothly finished cut with counter boring and trim strips provided as required to give a neat finished appearance.

All enclosure doors shall be hinged with removable hinge pins. Each door shall incorporate a vault type handle with three point latching mechanism for securing door in closed position, door locks shall be keyed alike. Only smooth rubber gasket material shall be used for providing door seal.

All joined edges, corners, and seams shall be of continuous bead weld (no filler or

dubbing) and ground to a finish so as not to be detectable after painting. Spot welds shall be used only to connect flat metal surfaces to structural support bracing to provide rigidity. Care shall be taken to prevent warping of metal.

Enclosures shall be spray painted with two coats of primer and two coats of finish high-gloss epoxy enamel (both inside and outside surfaces). Inside surfaces shall be painted with a high-gloss white and the outside surface shall be painted with a color selected by the OWNER.

Removal "eye" bolts shall be provided to facilitate slinging and handling of enclosures. "Eye" bolts shall be mounted directly to and be part of the enclosure structural members so as to distribute the stresses and enclosure weight while slinging.

Each floor standing-type panel shall be equipped with interior panel service lighting system and duplex receptacles as required.

Panel layout and equipment spacing shall be sufficient to allow for device removal and maintenance without disassembly of adjacent devices. Additionally, ample panel gutter space (sides, top, and bottom) shall be provided for training wires and cables.

Plastic wireway shall be used to route wires in all control panels and enclosures. Wireway fill shall not exceed 60% and shall be run in continuous lengths with snap-on type covers.

Each and every wire both internal and external to the panel shall be tagged at both ends with its respective wire number. Internal panel wiring will be No. 14 AWG, MTW 600 volts working, 1,500 volts test, Class C stranding with 2/64-inch minimum, 90° C insulation. All panel wiring not run in wire ducts shall be bundled and tied. Wire markers shall be provided at each wire termination point. All wires to internal components shall be connected to the "outside" of the terminal strip. No more than two wires shall be connected to any one terminal point.

Power wiring shall be black for hot and white for neutral. Control wiring shall be red for AC and blue for DC. Yellow wire shall be used on circuits which receive from two sources not controlled by the panel disconnect. Green wire shall be used for ground. Shielded cable shall be black and white No. 16 AWG with aluminum mylar with bleed ground wire and provided with an overall PVC jacket.

F. Circuit Breaker Distribution Panel Board

Panel board shall be equipped with thermal magnetic molded case circuit breakers of frame and trip ratings as indicated on the drawings.

Panel board bus structure and main breaker shall have current ratings as shown on the drawings.

Circuit breakers shall be equipped with individually insulated braced and protected connectors. Provisions for additional connectors shall be such that no additional connectors will be required to add breakers.

Panel board shall be rated for 600 volt AC maximum suitable for use on systems with up to 200,000 rms symmetrical amperes available on a short circuit at 480 volt when assembled with approximately rated branch circuit breakers.

The panel board shall be enclosed in steel cabinet as specified in UL standard 50 for cabinets. Fronts shall be of code gauge steel.

Panel board shall be UL listed and shall bear a UL label. Panel board shall be as manufactured by Square D.

G. Lighting Panels

Lighting panels shall be of code gauge steel, of the dead front safety type with single or multi-pole circuit breaker branches of the number and size as indicated on the drawings. Main bus shall be copper. Each panel shall have a main circuit breaker as indicated on the drawing and have a 10,000 RMS symmetrical interrupting capacity for 208/120 volt panels. Lighting panels shall be square D "NQOB", G.E. NLAB, or approved as equal by the ENGINEER.

H. Distribution Transformers (480-208/120 Volt, 4 Wire and 480-240/120 Volt, 3-wire)

The distribution transformers shall be 480 volt Delta primary and 208/120 volt or 240/120 volt secondary, as indicated on the Plans. The transformers shall be 115° C temperature rise above 40 C ambient. All insulating materials to be in accordance with NEMA ST20 standards. The transformers shall be in a heavy steel, ventilated enclosure. The transformers shall be designed to be either floor or wall mounted.

I. Wire Size and Insulation (low voltage)

Wire for all branch circuits, including power and lighting shall consist of No. 12 minimum size copper conductors, type THHN, THW, XHHW or THWN, insulated with Underwriters' approved 600 volt insulation, and in accordance with the following:

All rubber and rubber-like insulated wire and cable shall be manufactured and tested
in accordance with ICEA Publication No. S-19-81 (latest edition), NEMA Publication No. WC3.

All thermoplastic insulated wire and cable shall be manufactured and tested in accordance with ICEA Publication No. S-61-402 (latest edition), NEMA Publication WC5.

All cross-linked polyethylene insulated wire and cable shall be manufactured and tested in accordance with ICEA Publication No. S-66-524 (latest edition), NEMA Publication No. WC7.

Indoor lighting branch circuits and 120 volt receptacle circuits shall be single conductor solid copper, 600 volt insulation, Type "THW", "THWN", or "XHHW" moisture and heat resistant thermoplastic approved by N.E.C. for operating temperature of 75^{o}C and for installation in wet or dry locations.

Type "XHHW" heat resistant wire shall be used for wiring of recessed fixtures, and between fixtures and their adjacent outlets.

For 480 volt standard service, single conductor stranded copper cable shall have corona, ozone, heat and moisture resistant cross-linked polyethylene 600 volt insulation, or approved equal, rated to withstand a copper temperature of 90^{o} C. without deterioration. It shall meet applicable ICEA Standards, and be UL labeled XHHW.

All wire and cable, including feeders, main and branch circuits, shall be color coded as follows:

208/120 Volt		240/120 Volt		480/277 Volt	
Color	Phase	Color	Phase	Color	Phase
Black	A	Black	X1	Brown	A
Red	B	Red	X4	Orange	B
Blue	C			Yellow	C
White	Neutral	White	Neutral	Gray	Neutral
Green	Ground	Green	Ground	Green	Ground

Conductors No. 8 and smaller shall have color coded insulation, Conductors No. 6 and larger shall have terminations and conductors in pull boxes taped with colored tape, not less than two inches wide.

All wire and cable shall be continuous in the same color code and type to its extreme termination point. The use of different type of insulated wire to the same device or equipment will not be accepted. Manufacturers shall be Anaconda, General Cable, General Electric, Okonite, Triangle, or equal.

J. Control Wiring

Control circuit, single conductor field wire shall be No. 14 AWG, stranded copper with 30-mil thick wall of cross-linked polyethylene or polyvinyl chloride insulation rated to withstand a copper temperature of 90° C. at 600 volts without deterioration. It shall meet applicable ICEA Standards.

Multi-conductor control cable shall consist of individual conductors, No. 14 AWG, stranded copper with 30-mil thick wall of insulation rated to withstand a copper temperature of 75° C without deterioration. The insulation shall be a 20-mil wall of polyethylene with a 10-mil thick polyvinyl chloride jacket. The individual conductors shall be identified per Paragraph 5.6.3. of ICEA Publication No. S-61402 and shall be cabled together with suitable fillers and binder tape to give the completed cable a substantially circular cross section.

An overall sheath of black polyvinyl chloride shall be applied to the cable and shall not be less than the following thickness:

No. of Conductors	Jacket Thickness
2 - 5	0.045"
6 - 14	0.060"
15 and above	0.080"

The entire cable shall meet applicable ICEA Standards and tests for thermoplastic insulated cables.

All control wires to be identified with vinyl wire markers.

K. Panel Wiring

Panel wiring shall be a minimum 14 AWG-MTW, 60° C rated for AC connections.

Thermoplastic wire cover shall be rated at 600 volts and be colored red for AC wires; light blue shall be used for DC wires; canary yellow shall be used for wires interconnecting with other control panels or systems which may be energized from alternate power source; green shall be used on all ground wire connections; black wire shall be used for power source and white shall be used for power neutral.

All instrument shields shall be connected to a common ground termination in the control panel. Shields shall not be grounded in the field.

No splices of either control or instrument wiring shall be permitted outside of termination points.

All wires comprising the various control systems for this installation shall be identified at each termination with wire identification tags.

Numbered tags shall be of the type manufactured of laminated mylar and be capable of withstanding temperatures to 300° F. without deterioration and discoloration.

Each wire number shall be "solid" preprinted and not pieced from single and/or double-digit tags.

L. Shielded Single Pair Cable

For general shielded service, single-pair cables shall consist of two conductors, twisted together, served with a continuous aluminum mylar shield with grounding bleed wire and protected with an insulating jacket.

Individual conductors shall consist of a tinned, soft annealed copper conductor, stranded, insulated with a 24-mil thick wall of polyethylene. The twisted pair shall be color coded and sized as follows:

Runs under 400 feet	No. 16 AWG
Over 400 feet	No. 14 AWG

M. Multiple Conductor Shielded Cable

This cable construction shall be an assembly of twisted pairs cabled together and served with an overall aluminum mylar shield with grounding bleed wire, with an extruded jacket of polyvinyl chloride having a thickness as follows:

Cable Size	Jacket
3 and 7 pair	60 mils

Portable cords shall consist of flexible, bunch stranded, plain annealed copper conductors with a 600 volt heat and moisture resistant rubber insulation suitable for operation with a 60° C. copper temperature. Individual conductors shall be color coded for identification and cabled with suitable high strength fillers to give the completed cable a circular cross section.

N. Conduits and Fittings

Conduits shall be manufactured in conformance with the latest published standards of ANSI, ASTM, and UL and shall be as follows:

All exposed interior and exterior conduits shall be rigid aluminum. All conduits installed in explosion-proof rated locations shall be rigid aluminum. Couplings and connectors shall be threaded type. All buried conduits shall be Schedule 40 PVC.

Conduit terminations shall consist of double locknuts and insulated bushing, raintight connectors, or threaded hubs as applicable to maintain the rating of the enclosure to which it is being terminated.

All joints in conduits shall be made with standard couplings unless neither conduit can be turned; then, union shall be made with O.Z. Type "SP" split coupling or Erickson couplings. Running threads are not permitted.

Conduit expansion fittings shall be O.Z. Type "DX" with bonding jumper, as required.

PVC conduit material shall have tensile strength of 7,000 psi at 73.4^{o} F., flexural strength of 11,000 psi, and compressive strength of 8,600 psi.

PVC conduit fittings and covers shall be of the same manufacturer as the PVC conduit.

Flexible liquid tight conduit shall be provided for connections to vibrating or rotating equipment. Conduit shall be Anaconda Type "UA" for 3/4-inch to 1-1/4 inch and Type "EF" for 1-1/2-inch and larger, flexible conduit, with Appleton STN series fittings, as required.

Flexible steel conduit similar to "Greenfield" shall not be permitted. Electrical Metallic Tubing (EMT) shall not be permitted.

Conduits installed in "hazardous areas" shall be approved for the Hazardous Class Division and Group as required by NEC and identified on the drawings.

O. Pull Boxes

Pull boxes, junction boxes, and cable support boxes of proper size and design shall be provided in accordance with the N.E.C. and as required to facilitate installation of wires. All boxes shall be sized in accordance with the N.E.C. Covers shall be gasketed and held in place with corrosion resistant machine screws. Cable supports for vertical runs shall be provided at code required locations, within pull or junction boxes. Boxes shall be NEMA 12 for inside and NEMA 4X for outside use where exposed to the weather or where otherwise called for on the drawings.

Pull boxes located in "hazardous areas" shall be in strict accordance with National Electric Code requirements for the type of area classification and as identified on the drawings.

P. Outlet Boxes

Cast steel outlet boxes shall be used for every outlet and switch where called for on the drawings and as herein specified. All cast boxes shall meet the requirements for galvanized finish specified for steel conduits.

All outlet boxes for exposed work shall be of cast steel construction with threaded openings Type "FS" or “FD” unless noted otherwise.

Provide temporary caps on boxes similar to Gedney, "Red Caps" during construction.

Outlet boxes installed in hazardous areas shall be approved for the Hazardous Class,

Division and Group as required by NEC and identified on the drawings.

Q. Receptacles

In general, the receptacles shall be duplex convenience grounding type with weathertight gasket and covers and shall be installed in exposed cast metal conduit boxes type FD with mounting ears. This also includes receptacles used for disconnects.

Receptacles in office areas shall be flush mounted in handy boxes with stainless steel covers.

Convenience receptacles shall be rated 20 amps with back and side wiring and with exposed metal parts finished to resist corrosion.

Weatherproof duplex receptacles shall have a separate spring type cover for each receptacle mounted on a FS or FD box.

Receptacles in wet locations, bathrooms, and as indicated on the drawings shall be provided with ground fault circuit interrupting breakers.

Explosion proof receptacles shall be 20 ampere, 2 wire, 3 pole, 120 volts, Killark KRS-215-220 Appleton Crouse-Hinds or equal. Supply one matching plug each.

R. Light Switches

Switches shall be "T" rated. Switches, and receptacles shall be specification grade and as called for on the drawings.

Covers shall be stainless steel unless otherwise called for on the drawings.

S. Switch and Receptacle Plates

Plates for switch, receptacles, telephone, and miscellaneous signal outlets shall be .040 inches stainless steel with No. 4 finish in all areas unless otherwise noted.

Stainless steel plates shall be installed in equipment space and process areas.

Grouped devices shall be mounted in a single continuous gang plate.

T. Lighting Fixtures

The CONTRACTOR shall furnish all materials and equipment required to install and place in operation all fluorescent, metal halide, high pressure sodium and incandescent fixtures.

All lighting fixtures shall be complete, including all lamps and/or tubes, ballasts, fuses, support brackets and other parts and devices necessary for complete operation.

The lighting fixtures shown on the plans are selected for type and standard of quality. Other manufactures may be acceptable if approved by the ENGINEER in accordance with the requirements for “substitutes” in the General Conditions.

All lighting fixture supports and conduit connections and fittings shall have corrosion resistant qualities.

Underwriters' labels - all fixtures, signs, etc., shall carry the approval of the Underwriters

Laboratories, Inc., and be so labeled.

U. Lamps

The CONTRACTOR shall furnish and install all lamps for all types of lighting fixtures as shown on the schedules and drawings. All fixtures shall be cleaned and all lamps shall be relamped at the end of the job. See Article 3.05 for adjustment and cleaning.

Fluorescent lamps shall be rapid start, 48-inch, 34 watt, cool white type T-12. The average life shall be approximately 15,000 hours and the initial light output shall be 3,000 lumens.

Incandescent lamps shall be 125 volt and watts as shown on the drawings. The lamp life shall be approximately 1,000 hours and the light output shall be approximately 180 lumens per watt.

Metal halide lamps shall have a light output of approximately 100 lumens per watt with an average life of approximately 15,000 hours.

High pressure sodium lamps shall have a light output of approximately 100 to 115 lumens per watt for 250 to 400 watt lamps with an average life of approximately 24,000 hours.

V. Ballast

Ballast shall be an integral part of the fixtures as specified on the drawings.

Ballasts shall be high power factor, non PCB, E.T.L. certified and shall carry Certified Ballast Manufacturer's and Underwriters Laboratories' labels.

W. Exit Light

Exit fixtures shall be of a type suitable for the location in which they are installed and shall be single or double-faced, top or end mounted with directional arrows. Exit fixtures shall be of thin die cast aluminum frame type with stenciled letters of size and color required by local code. Exit lights shall have an automatic, rechargeable battery backup for continuous illumination during power failure.

X. Emergency Lighting

Emergency lighting shall be of the battery-operated type equipped with reliable type of rechargeable batteries provided with suitable facilities for maintaining the batteries in properly charged conditions. The emergency lighting system shall be capable to maintain a lighting level not less than 1-foot candle for a period of 1-1/2 hours in the event of failure of the normal lighting.

Y. Motor Control Centers

This specification describes the electrical equipment for motor control centers. It consists of a main circuit breaker, magnetic starters, and miscellaneous related control devices arranged in integral free standing units and suitable for indoor installation, designed, built, and tested in accordance with NEMA and UL standards.

Motor control center shall be NEMA 1A. Wiring shall be NEMA/Class 1, Type B. Each unit shall be designed to permit future additions, changes or regrouping of units by the purchaser. Units shall meet the minimum requirements of the latest published standards

of NEMA.

Motor control center shall be suitable for operation on 480 volts, 3 wire, with 1/4 x 2 ground bus 65 kA AIC, and 60 HZ service. Control voltage shall be 120 volts AC and furnished with every starter position. Horizontal and vertical busbars shall be copper and braced for 65 kA RMS symmetrical amperes.

All units shall be combination type, furnished complete, and wired. Control units shall be of the "draw out" type except for reduced voltage starters, with stab-on connections to the bus. Stab-on connectors shall be silver plated and have free floating spring construction to ensure positive silver-to-silver contact with vertical bus at all times. Means shall be provided in the stationary structure for supporting and aligning the control units during replacement. Each unit shall be held in place by quick captive screw fasteners arranged so that the units can be withdrawn from the vertical section without access to the rear of the structure. Each unit occupying a single space shall be interchangeable with every other unit occupying a single space on a size-by-size basis.

All units shall be fed and so constructed as to be properly ventilated regardless of location in control grouping.

All units shall have complete steel top and bottom plates to provide maximum isolated between units.

All power wiring shall be No. 12 AWG minimum, within the units. All control wiring shall be No. 14 AWG minimum, within the units, and shall be color coded. Vinyl wire markers shall be provided for all control wiring.

Unless specifically mentioned elsewhere in the specifications or indicated on the plans, all unused space shall be divided in Size 1 compartments to facilitate the future installation of Size 1 starters.

All buses shall be braced as indicated on the plans. Provide isolation of vertical bus via barriers of glass reinforced polyester running entire length of vertical bars.

Combination starter units shall be NEMA size as required and indicated on the drawings across the line full voltage or reduced voltage type as indicated.

An operating mechanism, with high mechanical advantage, shall be mounted on the primary disconnect of each starter unit. It shall be mechanically interlocked with the unit door to prevent access unless the disconnect is in the "OFF" position. A defeater shall be provided to bypass this interlock.

With the door open, an interlock shall be provided to prevent inadvertent closing of the disconnect. A second interlock shall be provided to prevent removal of the unit while in the "ON" position. Reinsertion of the unit while in the "ON" position shall be prevented by this same interlock. A defeater shall be provided by bypass this interlock.

Combination starter units shall utilize the motor fused/circuit breaker disconnect switch and shall have a minimal symmetrical short circuit current rating as required on the drawings.

Padlocking facilities shall be provided to positively lock the disconnect in the "OFF" position with from one to three padlocks with the door open or closed.

Line starters shall be electrically operated, electrically held, three pole assemblies with arc

extinguishing characteristics, and shall have silver-to-silver renewable contacts. They shall have provisions for adding a minimum of six normally open or normally closed electrical interlocks.

The overload relay assembly shall be of the thermal bimetallic type. Furnish ambient-corrected elements for the motors actual full-load amps as recommended by the manufacturer.

Draw-out units shall have a silver-plated stab assembly for connection to the vertical bus. No wiring to these stabs shall extend into the bus compartment. Interior of all units shall be painted white for increased visibility.
Units shall be equipped with side-mounted, pressure type terminal blocks. Knockouts shall be provided for the addition of future terminal blocks.

All unit heights shall be of modular dimensions to allow for unit layout in any combination, without structural interference.

Individual feeder breakers for lighting transformers and other equipment shall be of the thermal magnetic type with a minimum interrupting capacity as indicated on the one line drawings at rated voltage.

All major components shall be the same manufacture as the motor control center. Acceptable manufacturer is Square D.

The motor control centers shall consist of vertical sections joined together to form a rigid free standing, completely dead front assembly, having horizontal and vertical bus for power distribution through the control center unit.

Each vertical section shall be provided with a 3 phase, main horizontal silver plated copper bus rated as specified on the drawings. Vertical bus shall be silver-plated copper 600 ampere capacity minimum. Bus supports shall be formed of a nonhygroscopic, high dielectric strength, molded compound with a high impact strength and low creepage surface.

A silver-plated copper ground bus shall extend the full length of each motor control center.

Motor control center shall be manufactured by Square D.

Z. Motor Starters

1. 3-Phase Starters

The starter for each 3-phase single speed motor shall be on the non-reversing across the line combination magnetic type, minimum size 1 with magnetic circuit breaker and control transformer. The circuit breaker shall be externally operated, interlocked to prevent opening the cover when the switch is closed. The starter shall have, in addition to a holding circuit contact, two auxiliary contacts. Control transformer shall be rated 480 volts to 120 volt with fused secondary, minimum 50 VA but of sufficient capacity to service the starter coil plus such auxiliaries as may be indicated.

Each starter shall be provided with wiring and schematic control diagrams which applies to the unit it serves.

2. Single Phase Starters

Starters for single phase motors shall be manual type, with overload protection and on-off switch.

AA. Reduced Voltage Starters

Reduced voltage starters shall be used for all motors 200 HP and above. Reduced voltage starters shall be modular solid-state design using six SCRs and having the following design characteristics:

1. Stepless acceleration

2. Adjustable current limit - From 150% to 425% of rated current with automatic recalibration to 600% after acceleration (approximately 6% to 50% locked rotor torque)

3. Thermal Capacity
425% rated current for 5 seconds
300% rated current for 30 seconds
250% rated current for 60 seconds
115% rated current continuous

4. Power/energy-saver option to reduce voltage, current, and improve power factor at less than full load conditions

5. Soft start - Minimizes torque peaks for smooth acceleration

6. Electromagnetic interlock - One maintaining auxiliary

7. Six SCR configuration - For full wave control

8. Solid-state overload relay
Highly repeatable trip characteristics
Trip curves for both motor and controller with automatic hot starting recalibration
Retentive state indication with power loss manual reset standard, automatic available

9. Thermal characteristics – 40^{o}C. ambient enclosed

10. Phase sequence protection

11. Solderless lugs - For aluminum or copper wire

12. LED indicators - For "Line Voltage," "Incorrect Phase Sequence," and "On"

13. SCR protection - Including Metal Oxide Varistor, RC Network, and Overtemperature Switch

14. Shorted SCR detection

15. Undervoltage protection

16. UL and CSA listing

17. Circuit breaker - Undervoltage release mechanism controlled by the shorted SCR dectector

18. Phase unbalance/instantaneous overload - Protection against phase loss and phase unbalance

19. Up-to-speed indication

20. Overload relay with alarm contact

21. Current transformer for meter on face of starter

BB. Variable Speed Adjustable Frequency Controller

The variable speed power unit shall be an adjustable frequency controller which will convert 460 volt, 3 phase, 60 HZ, input power into an adjustable frequency output in an ambient temperature of zero to 40°C. Output power shall be of suitable capacity and waveform, with harmonic current content less than 5% of the fundamental, to provide stepless speed control of the specified horsepower throughout a continuous speed range under variable torque load not exceeding the motor's full-load rating.

The controller shall be of the constant voltage source type, with diode rectifier section, inductor and capacitor filtered DC link, and PWM (pulse width modulation) invertor using GTO (gate turn off) thyristor.

The variable speed power unit shall include a isolation contactor and bypass combination starter with circuit breaker, overload relay and VFC-Off-Line three position selector switch. This equipment is provided to isolate and bypass the variable frequency controller in the event of malfunction and to run the pumps at full voltage.

The controller shall be in accordance with the following:

Input Power:	460 VAC, 3 phase, 60 HZ +10%-5%
Output Power:	0-460 VAC
Output Frequency:	1.5 to 60 HZ
Output Waveform:	Sine Coded PWM
Control Power:	120 VAC (from Control Transformer)
Speed Control (Manual):	5K ohm 1/2 watt Potentiometer
Speed Control (Auto):	4-20 mA DC into 630 ohm impedance
Operating Temp:	32 F to 104 F (fan cooled)
Rel. Humidity:	Maximum 95% noncondensing
Acceleration:	Adjustable 1 to 60 seconds

Deceleration:	Adjustable 1 to 60 seconds
Current Limit:	Adjustable 60 to 120% of rated output current
Overload Trip:	Adjustable 0 to 100% of rated output current
Instantaneous Overcurrent:	250% of rated output current
Ground Fault:	Nonadjustable trip
Overtemperature:	Heatsink thermal switch
Over Voltage:	DC bus monitor trips at 900V DC
Under Voltage:	AC line monitor trips at 87.5% and resets at 95% of rated input voltage
Speed Indicator:	Digital 0 to 100% of rated speed
Volt Meter:	Digital 0 to 600 volts
Ammeter:	Digital-amps range 0 to 150% of rated current

Diagnostic/Status Indicator Module shall include the following:

Under Voltage	Drive Lockout
Over Voltage	Power Supply OK
Ground Fault	Motor Current Limit
Instantaneous Overcurrent	Power Up Delay
Shoot Through	Drive Enabled
Overtemperature	Bus Under Voltage
Overload	Gate Driven Boards Functioning
Overload Timer	
Enclosure:	NEMA 1 Motor Control Center Section
Manufacturer:	Square D

CC. Substation, Switchgear, and Motor Control Center Numbering

Substation, switchgear, and motor control center, numbering shall be of laminated white plastic with black lettering and shall be attached to cubicles with sheet metal screws. Nameplate size shall be 3" wide x 1-1/2" high. First line character size 1/4-inch high, second line 3/16-inch high, third line 3/16-inch high.

DD. Caution Tags

Each panel receiving power from a separate source which is not disconnected by the primary disconnect means shall have a laminated orange tag 3" wide x 1-1/2" high with 1/4-inch high white lettering reading:

"CAUTION SEPARATE VOLTAGE SOURCE"

EE. Nameplates

Safety switches, lighting panels, starter enclosures, panelboards, etc., nameplates shall be of laminated white plastic with black lettering and shall be attached with sheet metal screws. Nameplates size shall be 2 1/2" wide x 3/4" high. First line character size 1/4-inch high, second line 3/16-inch high. For panel designations, refer to electrical panel schedule on drawings. All panelboards shall contain a typed circuit schedule inside of cover.

Field located instruments and devices shall be equipped and identified with 1" x 3" engraved nameplates (similar to the panelboard nameplates) and affixed to their respective devices in a positive but flexible method (wire strap or other similar means).

FF. Lighting Poles

Precast concrete poles shall be fabricated 35 feet long with prestressed steel strands and with 0.162 inch taper per foot of pole length. Pole shall be for direct placement in earth to a 5-foot depth. Pole shall have a 2-3/8 inches diameter tenon top for luminaire securement and a 7/8 inch diameter internal raceway for wiring, three feet from pole butt and up through tenon. Pole shall be complete with a No. 4 stranded copper grounding wire emanating at three feet from pole butt and also at pole top tenon; all grounding wire loops and pigtails shall be at least 24 inches in length and shall exit from face view of pole. Poles with installed luminaries shall be capable of resisting a wind velocity of 150 mph with a EPA of 12 square feet.

All poles indicated with a duplex convenience outlet receptacle, on the plans, shall be furnished with duplex outlet box near pole base.

Poles and installation shall be per "Guide for the Design and Use of Concrete Poles," by the Concrete Pole Tasks Committee of the Committee on Electrical Transmission Structures of the Structural Division of the American Society of Civil Engineers, April, 1987, New York, New York.

GG. Welder Receptacle Switch

Welder station and power receptacle shall be 600 volt non-fusible 60 amp interlocked receptacle switches furnished with 3 phase, 4 wire grounded type special receptacle and mating plug. The unit shall be prewired, and mounted with interlock linkage to the switch mechanism.

Interlock linkage shall prevent insertion or removal of the plug while switch is in the "ON" position.

HH. Time Switch

The time switch shall be a solid state electronic control capable of permitting 20 ON/OFF set points to be distributed on independent daily schedules through a 7-day time period. The time switch shall include a 7-day repeat feature for simplifying programming of identical set points. The time and set points shall be programmable to the nearest minute

with a minimum ON duration of 1 minute and a maximum ON duration of 6 days, 23 hours, 59 minutes. The timer shall have a digital LCD readout to show day of week and time-of-day using 12 hour AM/PM indicator. The time switch shall provide a manual override control for both temporary or permanent override. Time switch shall operate over a temperature range of -40°F (-40°C) to 155°F (68°C).

An industrial grade AA alkaline battery shall protect program information and time-of-day for a minimum of 3 years. Switch configuration to be SPST each circuit with a UL listed rating of:
30 amp Inductive/Resistive, 24/120/240 Volts AC, 60 Hz
20 amps Resistive, 28 VDC
1 HP, 120 Volts AC, 60 Hz
2 HP, 240 Volts AC, 60 Hz
5 amps Tungsten, 120/240 Volts AC, 60 Hz
5 amps Ballast, 277 Volts AC, 60 Hz

The time switch shall be powered by a (120) volt 50/60 Hz source. The time switch shall be enclosed in a lockable steel NEMA 1 rated enclosure. The time switch shall be UL listed under UL category 916 Energy Management Equipment and shall be INTERMATIC ModelET279C SPST or ENGINEER approved equal.

Time switch shall provide for control of two independent circuits on a 7-day schedule and shall provide a field selectable momentary (1 to 8 second) output for either or both circuits.

2.02 MIXES

Patches, conduit sealing compound, fire stop compounds, etc., shall be mixed in accordance with the manufacturer's recommendations.

2.03 FABRICATION AND MANUFACTURE

The CONTRACTOR shall, to the degree possible, preassemble switchgear, panel boards, motor control centers, control panels, relay panels, etc. This preassembly should be done off site in a clean shop environment by the CONTRACTOR or manufacturer.

Control panels, motor control centers, and switchgear shall be fabricated in sections not exceeding 10 feet in length and provided with jumpers for field connections of bus and interconnecting wiring. Panels shall be provided with adequate lifting eyes.

2.04 EQUIPMENT

All electrical devices furnished under this Contract will be of the most recent manufacture and received at the job site in the manufacturer's shipping container which clearly identifies the item. Only new electrical equipment will be acceptable. Used, rebuilt, or discontinued models will not be accepted for installation under this Contract.

2.05 ACCEPTABLE MANUFACTURERS

Only manufacturers recognized as producing new, top quality products meeting applicable standards will be considered acceptable.

The ENGINEER may require the CONTRACTOR to furnish acceptable material from other sources of supply, if he finds the Work will be delayed or adversely affected in any way because the stated source of supply cannot furnish a satisfactory product in sufficient quantities or if it is

known to be unsuitable for the purpose for which it is proposed to be used. The CONTRACTOR shall have no claim for additional compensation because of such requirement.

PART 3 – EXECUTION

3.01 CONTRACTOR'S VERIFICATION

A. General

All dimensions which tie mechanical and/or electrical installations to the building structure shall be thoroughly field checked for accuracy and possibility of interference due to field conditions. Ignorance of such field conditions because of the CONTRACTOR's failure to field check the dimensions in question will be no excuse for additional compensation.

B. Surveys

The CONTRACTOR shall lay out and establish the lines and grades of all underground conduits on the site in accordance with the drawings and he shall employ a competent surveyor for this portion of the work. In the event of unforeseen obstructions, the CONTRACTOR shall confer with the ENGINEER and obtain his written approval before proceeding with any work deviating from the governing drawings. The CONTRACTOR shall assume full responsibility for locations and grades throughout this portion of the Work.

C. Locations

All wall outlets, telephone outlets, clock outlets, specialized outlets, fixtures, and equipment rough-ins shall be field located except as otherwise shown on the drawings.

D. Points of Termination

The points of connection and termination of related work under this Division of this Project are indicated on the Plans or stated in the Specifications, but in case of doubt as to such points of connection or termination, the decision of the ENGINEER shall be final.

3.02 PREPARATION

All conduit, fittings, and accessories shall be free of foreign matter. All conduit ends shall be reamed and deburred to prevent damage to the wire and cable.

3.03 INSTALLATION

A. General Requirements

Electrical system layouts indicated on the Plans are generally diagrammatic and locations of outlets and equipment are approximate. Exact routing of conduits and wiring, locations of outlets and equipment shall be governed by structural conditions and obstructions. Equipment requiring maintenance shall be located and installed so that it shall be readily accessible.

The CONTRACTOR shall not burn, cut or drill structural steel for the installation of conduit in any manner except where written permission is granted by the ENGINEER

All wiring shall be installed in raceway, including low voltage work, except where otherwise shown or specified.

Minimum conduit size shall be 3/4-inch unless noted otherwise.

Conduit shall be installed to be concealed wherever possible, unless otherwise indicated. In unfinished mechanical equipment rooms where the exact location of ventilation ducts, etc., is not shown, install the conduit exposed and avoid interferences.

Conduits shall be separated by at least 12 inches from parallel runs of steam or hot water piping.

Rigid aluminum conduit shall be used for exposed service drops in mechanical equipment and process area rooms, in exposed outdoor areas, except where another type of raceway is specified. Locknuts shall be steel or malleable iron (as size requires).

Conduit runs in floor slabs and direct buried underground between structures shall be Schedule 40 PVC. All stub ups shall be rigid aluminum.

Where PVC conduit is permitted as noted on drawings, underground PVC conduit runs shall be installed on approved plastic spacers and encased in a 3-inch Granular Material envelope with red-oxide pigmented concrete over top. Envelopes shall have a yellow colored, plastic, detectable caution tape buried a minimum of 12-inches above the conduit. Caution tape shall be labeled “Caution – Buried Electrical Lines”.

Duct banks shall be strengthened with reinforcing steel as shown on the drawings and details.

Connections to vibrating or rotating equipment shall be made with flexible liquid tight conduit.

Provide expansion fittings at all expansion joints and/or where required to compensate for expansion and contraction in long conduit runs. Connectors shall be compatible with flexible conduit used.

All conduits shall be installed in floors and walls, wherever possible, unless otherwise indicated on the Plans or specified herein.

Conduits in process areas shall be rigid aluminum and may be run exposed.

All empty feeder and riser conduits shall contain one pull string.
Conduit joints shall be set up tight. Runs shall be straight and true. Elbows, offsets, and bends shall be uniform and symmetrical.

Multiple conduit runs exposed shall be mounted with rustproofed steel supports arranged so that each conduit is individually clamped or bolted.

Concealed conduits or outlets installed flush in masonry or concrete construction shall be rigidly braced against movement during the construction period to ensure accurate termination points.

Conduits hidden by suspended ceilings may be run exposed between ceiling construction and structural slab. All conduits, where exposed in service rooms, mechanical equipment rooms, etc., and other work areas, shall be racked in neat symmetrical lines with proper supports. Conduits shall be run at right angles and parallel to floors, ceilings, and walls.

Underground conduit shall be tested to determine that all fittings are completely sealed. The tests shall be performed during and after installation of conduit, but before cable is pulled and before any conduit is encased in concrete.

All 90^{o} bends 1-1/4 inches and larger shall be made with factory elbows. Elbows of 3-inch conduit size and larger shall be long radius. Field bends shall be made so that the conduit will not be injured, and the internal diameter shall not be effectively reduced. Factory elbows, nipples, and couplings shall be the same type as the conduit with which they are used.

B. Hazardous Locations

All equipment, fittings, and wiring installed in hazardous areas, shall be approved by the N.E.C. for respective class and division which is applicable to area(s) where installed.

Sealing fittings shall be properly installed at all required locations in accordance with code regulations. Automatic drain conduit seals shall be used wherever necessary to ensure the prevention of moisture accumulation. Approved breathers shall be installed in appropriate locations.

C. Conduit Supports

Conduit supports shall be suitably spaced and secured so as to provide adequate mechanical support and shall meet the code requirements. Supports shall be of steel bar, unistrut, angle or channel and of a size to provide a firm, rigid support. Fabricated supports and mounting brackets shall be hot dip galvanized after fabrication and drilling is complete. Rod hangers may be used when laterally braced. Structural steel flanges of I beams or channels shall not be drilled. Prefabricated sections may be used with approval of the ENGINEER.

All electrical equipment including raceways, outlet boxes, panels, fixtures, etc., shall be substantially secured to the building structure. Inserts or insert bolts for support of the electrical equipment shall be installed during the building construction wherever practical.

Exposed multiple horizontal and vertical parallel runs of conduit shall consist of framing channels, conduit clamps, and rod hangers, where required, installed in accordance with the manufacturer's recommendation for the carried loads.

Where exposed isolated conduit needs clamping to flat surfaces, clamps shall consist of one-hole pipe straps for conduit up to and including 1-1/2 inches. Straps for conduits above 1-1/2 inches shall be two-hole, extra heavy steel. Steel bolts of appropriate size to fill the holes of the straps shall be used.

Conduit shall be supported in accordance with N.E.C.

D. Conduit Fittings

Conduit fittings shall be made of a compatible material as the conduit. All conduit fittings with blank covers shall have rubber gaskets except in clean, dry areas and shall be accessible after the Work is completed.

E. Sleeves and Inserts

The CONTRACTOR shall provide all openings and sleeves on walls and floors as

required for his work. Inserts shall be the tapered nut type with lead alloy expansive retainer sleeve. The use of wooden plugs will not be permitted.

F. Lighting

Lighting fixtures shall be mounted level at the height as indicated on the Plans.

G. Primary Cable

Installation of primary cable, where applicable, shall be per the requirements of Florida Power & Light Co.

H. Taps and Splices

Splices and taps shall be made by means of screw type pressure connectors. Spring pressure type connectors may be used for No. 10 AWG conductors and smaller. Instrument pigtail splices shall be made with solderless crimp type connectors.

All connections for No. 8 wire and larger to switches, panels, and controllers shall be made with solderless lugs of proper style and size to handle full wire capacity.

Stranded cable terminations shall be equipped with solderless lugs.

No splices outside of enclosures will be allowed. No splices except for lighting fixture and instrument pigtail connections shall be permitted unless specifically indicated on the Plans or written approval is given by the ENGINEER.

All joints not supported and enclosed on terminal strips or equipment lugs shall be insulated with high-quality tape or material in an approved manner.

I. Wiring

All wiring for power, lighting, telephone, sound, and low voltage control shall be run in one of the types of conduit described in these Specifications, unless indicated otherwise on the Plans.

Multi-wire branch circuits shall be color coded as stipulated in the National Electrical Code, and as herein specified.

Circuits feeding duplicate processing equipment shall be installed in separate conduits.

All instrumentation cable shall be run in conduits so as to isolate the cable from power or electrical wiring.

Cable insulation shall not be cut back beyond what is reasonably required to make connection, splice, or termination.

All wires and cables shall be tagged at both ends and in pull boxes or panel box gutters they pass through.

No conductors shall be pulled into any conduit run before all joints are made up tightly and the entire run rigidly secured in place.

Approved pulling-in compounds shall be permitted for ease of pulling cables. Pulling of cables shall in no way cause injury to conductors by elongation or to insulation by

abrasion, binding, etc. Damaged cable shall be replaced.

J. Vibration and Shock Mounts

Each floor-mounted transformer shall be placed on vibration/shock pads of proper type and size to reduce sound transmission. Further, make primary and secondary connections with flexible conduit.

K. Foundations

The electrical subcontractor shall arrange with the CONTRACTOR to provide concrete pad foundations for all floor-mounted equipment installed under this Division. Pad shall be four inches high, unless noted otherwise.

L. Access Panels

Access panels or hatches shall be provided wherever electrical equipment concealed by the building construction requires access for inspection, operation, or maintenance. CONTRACTOR shall furnish all such panels required for access to his work. The CONTRACTOR shall install all panels.

A subcontractor requiring access panels shall confer with the CONTRACTOR in regard to access panel locations and shall, wherever practicable, group equipment requiring access such that a single panel with serve all and eliminate additional panels.

M. Grounding

The CONTRACTOR is responsible for providing all grounding, whether or not shown on the Plans, and all grounding shall be provided in accordance with NEC and local codes and ordinances. Grounding as shown on the plans is the minimum acceptable. Electrical grounding shall be grouped into two (2) classifications as follows: system grounding and equipment grounding.

1. System

The neutral of the substation transformer, and all dry type transformers shall be effectively and solidly grounded to continuous and interconnected ground mats. All grounding electrode conductors shall be sized in accordance with the N.E.C. No splicing will be allowed in any of the grounding electrode conductors.

Use of the metallic conduit or fittings or piping as a grounding path shall not be acceptable.

2. Equipment

All metal or conducting type enclosure frames, raceways, cable trays, conduit, panelboards, substation, motor frames, switches, switch boxes, outlet boxes, junction boxes, lighting fixture frames, building steel, metal siding, rebar, piping, etc., shall be grounded by a green colored or bare equipment grounding conductor of size called for in tables of the most recent applicable N.E.C. edition.

When a separate equipment grounding conductor is used, it must be contained within the same raceway or cable with the circuit conductors.

Grounding rods, hereinafter referred to as ground rods, shall be solid cylindrical

rods, 3/4-inch in diameter and 10 feet in length, or longer, as required to reach specified resistance. Rods shall be of copper-clad steel tinned at top end for connection.

Resistance from the building ground loop to earth before connection to the building steel and the water system shall not exceed 2 ohms.

Bare copper bar, cables, or fittings used for grounding shall not be installed in cinder fill or covered with soil containing cinders or other corrosive materials. Cables shall be installed with enough slack to prevent stresses.

Where ground conductors pass through floor slabs, building walls, etc., and are not encased in rigid metal conduit as specified elsewhere, shall be provided with sleeves of transit, plastic, fiber or other approved nonmetallic material, and of the required size, shape, and length unless otherwise specified or indicated on the Plans.

All bonding jumpers shall be copper and of a cross-sectional area at least equal to their corresponding grounding conductors. Where attached to equipment, conduits, cabinets, etc., suitable approved solderless lugs, compression connectors or clamps shall be used. No soldered connections shall be used on grounding circuits at any point, except where ground conductors are attached to lead cable sheaths.

All grounding mediums shall be bonded together. This shall include electric, telephone, antenna systems, ground and underground piping systems which enter the structure.

All compression connectors, lugs, etc., used in grounding circuits in any location shall have bolts, nuts, etc., of silicone bronze alloy metal. Ground connections, clamps, etc., shall be as manufactured by Burndy Engineering Company, Thomas & Betts Company, Penn-Union Electric Company, or equal.

Voltage surge protectors shall be installed at every incoming power feeder at each respective distribution panel, device panel, motor control center, switchgear and all miscellaneous panels, indoors or outdoors. The voltage surge protectors shall be voltage rated and energy absorption rated to match the rating of the respective electrical equipment to be protected. For example: all switchgear and motor control center shall utilize MCG Corporation Model No. SPC-277Y, rated voltage 277/480 volts, 3 phase wye, energy absorption 18,000 joules total, 3,000 joules per leg with clamp voltage at 1 mA of 460 volts; or equal, i.e., Leviton Company, Current Technology Corporation or Polyphaser Corporation.

Lesser amperage panels shall utilize either MCG Corporations SPB series or SPA series, matched to equipment; or equal as noted above. Every installation shall be in conformance to local and state of Florida ordinances, statutes and guidelines as well as per "IEEE Guide for Surge Voltages in Low-Voltage AC Power Circuits," ANSI/IEEE C62.41.

The minimum number, spacing, and location of ground rods to be driven shall be per the site soil conditions during dry weather. All connections to ground rods shall be below finished grade level and shall be connected by a "cadweld", or other thermal process.

Use of the water system as the grounding electrode shall not be acceptable.

However, the water system shall be grounded to the grounding system.

Taps and splices in grounding cables shall be made by the "cadweld", or equal process.

Conduits which run to boxes or cabinets having concentric or eccentric knockouts which partially perforate the metal around the conduit and impair the electrical connection to ground shall be provided with approved bonding jumpers. Jumpers shall consist of a stranded, braided copper wire at least No. 6 AWG with solderless lug on each end. Jumper shall be connected inside the box to a stud or silicone bronze alloy bolt in the cabinet frame.

Conduit expansion joints and telescoping sections of metal raceways not thoroughly bonded otherwise shall be provided with approved bonding jumpers of not less than No. 6 AWG stranded bare copper.

N. Electrical Equipment Identification

All electrical devices shall be labeled in a clear and permanent manner to identify its electrical circuit.

Motor circuits shall have the functional description on motor starter panel and distribution panelboard doors, remote safety switches and manual switches.

All receptacles and wall switches shall be identified using the distribution panel "letter designation" and circuit breaker numerical assignment.

Motor starters, switch boards, and panelboards shall have laminated plastic identification nameplates attached to the unit with screws as specified herein. Other electrical devices shall be identified using 1/4-inch plastic adhesive-backed embossed tape securely fastened to the face of the device.

O. Telephone System

Provide all labor, material, equipment, and services and perform all operations required for complete telephone system installation and related work as required by the Contract Documents.

This portion of the Work shall include a raceway system complete in place with conduit, terminal boards in apparatus spaces, pull and outlet boxes, cabinets, wiring, outlets, connectors etc.

Terminate all conduit with bushings.

All conduit runs shall not exceed 150 feet in length. A pull box shall be used to keep the conduit within the 150-foot length. Underground conduit runs shall be run continuous.

A conduit run shall have not more than three bends nor more than two, 90` bends in a run between outlet boxes or between an outlet box and backboard or pull box. When a run requires more than three bends, or two 90` bends, pull boxes shall be placed in a suitable location and of a suitable size to reduce the number of bends to three or less. Conduit installation shall conform to specifications for light and power installation.

All plates shall be standard telephone plates with standard modular plug connector.

Telephone equipment board shall be made of 3/4 inch thick plywood painted with two coats of black insulating varnish. Provide a 3/4 inch conduit with a No. 8 copper ground wire installed and run to the nearest equipment ground bus. Provide two, 120 volt duplex receptacles installed 12 inches above the floor. Receptacles shall be connected to lighting panel.

The incoming telephone service to the building shall be via underground PVC conduits from a telephone pole to the telephone equipment board in building as indicated on the plans. Perform all required trenching, excavation, concrete work and backfill for the underground conduits.

The work performed for the telephone system shall conform in all respects to the requirements of the telephone company having jurisdiction in the area.

P. Painting and Finishing

All concealed iron work, panel boxes, junction and pull boxes, and support boxes not galvanized shall be given one coat of rust resisting paint inside and out. In addition, junction boxes shall be given one coat of white enamel inside only.

Equipment which was finish painted by the manufacturer or fabricator shall remain as is unless paint has become marred or damaged during installation, in which case the equipment shall be repainted to its original condition by the CONTRACTOR.

3.04 FIELD QUALITY CONTROL

A. Requirements of Regulatory Agencies

All materials and equipment required for the work and the installation shall conform to all national, state, and local codes, rules, regulations, and ordinances. The CONTRACTOR shall secure all permits, inspections, and tests required in connection with his portion of the Project.

B. Tests

After the installation of apparatus and wiring has been completed, all electrical conductors shall be tested by the CONTRACTOR to ensure continuity, phasing, proper splicing, freedom from unwanted grounds, and insulation values.

A 1,000 volt hand-driven megger shall be used on all 600 volt insulated service conductors and a 500 volt hand-driven megger may be used on all lower voltage insulated service conductors. Conductors shall be isolated from other equipment during test and each cable shall be tested until reaching a constant value for 15 seconds.

All megger and high potential tests of multiple conductor cables shall be applied between one conductor and ground with all other conductors connected to the same ground. Each conductor shall be tested in like manner.

All wiring not measuring up to minimum ICEA field testing standards shall be replaced.

Minimum acceptable reading is 100 megohms for 600 volt insulated service conductors and 1.0 megohms for lower voltage insulated services such as instrumentation cables.

All tests shall be made with lightning arrestors removed and disconnections made at points of final termination.

Motor rotation shall be checked with the motor disconnected mechanically from equipment to be driven, to prevent damage to the equipment. Motor rotation shall be as directed by the equipment manufacturer and shall be checked for accuracy in cooperation with the manufacturer.

Do not test the equipment unless it is sufficiently lubricated.

1. Tests on Grounding

   Inspect ground conductors and connections for conformance with design specifications and for satisfactory workmanship. Test resistance to earth of each ground rod and each ground grid. Test ground paths for equipment and structural steel grounding.

   Maintain each ground rod isolated from the associated ground grid for tests on individual rods for resistance to earth.

   Include associated ground rods and interconnecting wiring in tests on each grid system for resistance to earth.

   Include ground bus on equipment, grid connection, and associated intermediate copper ground conductors in tests on ground paths for electrical equipment.

   Include structural steel connection, grid connection and intermediate conductor in tests on ground paths for structural steel.

   Test each ground rod for resistance to earth by a standard method. Use a Biddle ground tester or the method of using two auxiliary ground rods as described in IEEE Standard No. 550, paragraph 3.42. The IEEE method requires the use of AC test current. Place auxiliary test rods sufficiently far away from the rod under test so that the regions in which their resistance is localized do not overlap. Calculate ground resistance from the readings taken. Maximum acceptable resistance to earth at each ground rod: 25 ohms.

   If the resistance is found to be higher than 25 ohms, drive additional rods with a minimum separation of 10 feet and connect in parallel with the rod under test until 25 ohms or less is obtained, or increase the length of the rod under test until 25 ohms maximum is obtained.

   Test each isolated ground grid as specified for individual ground rods, except the maximum acceptable resistance to earth is five ohms. In tests on total ground systems, the maximum acceptable resistance to earth is two ohms.

   Test ground paths for electrical equipment and structural steel for continuity by applying a low voltage DC source of current, capable of furnishing up to 100 amperes. The ground path for electrical equipment using structural steel must conduct 100 amperes. Resistance as calculated from the current and voltage must not exceed 0.010 ohms.

   Grounding materials and connections must pass all inspections and must meet all specified maximum and minimum values.

   Make complete records of all tests. Include resistance values obtained, calculations of same, and methods of test and calculation.

Notice of tests to be performed shall be sent to the ENGINEER and OWNER before tests are made.

Duplicate certified records of all insulation tests shall be furnished to the ENGINEER.

3.05 ADJUSTMENT AND CLEANING (REFERENCED AS ARTICLE 3.05 UNDER “LAMPS” IN ARTICLE 2.01)

A. Adjustments

The CONTRACTOR shall be responsible for making any equipment and instrument adjustments necessary to provide a complete and safe working system under normal operating conditions. The equipment to be adjusted shall include, but not limited to, ground fault circuit interrupters, circuit breaker trip settings, motor starter overload settings, thermostats, pressure switches, level switches, limit switches, control instruments, etc. The CONTRACTOR shall provide a coordination study of the electrical system.

B. Manufacturer's Services

The services of a factory trained, qualified service representative of the equipment manufacturer shall be provided by the CONTRACTOR to inspect the complete equipment installation to ensure that it is installed in accordance with the manufacturer's recommendations, make all adjustments necessary to place the system in trouble-free operation, and instruct the operating personnel in the proper care and operation of the equipment furnished. This will be required for the main switch gear/motor control center, main control panel including all instrumentation and any other major equipment.

C. Cleaning and Finishing

Before turning the systems over to the OWNER, clean all fixtures, equipment, exposed metal surfaces, and leave all in clean condition at the end of the Work as specified elsewhere in the Contract Documents.

D. Final Inspection

Upon completion of the Work, the CONTRACTOR shall conduct a complete inspection of all items of Work and make whatever corrections and adjustments are deemed necessary to a well functioning system that will meet with the satisfaction of the ENGINEER and the OWNER.

END OF SECTION

SECTION 16110
LIGHTNING PROTECTION

PART I – GENERAL

1.01 WORK INCLUDED

A. The CONTRACTOR shall furnish all labor and materials and items of service required for the completion of an all functional and unobtrusive system of grounds, conductors and air terminals for protection against damage by lighting of designated structures as approved by the ENGINEER. Complete installation shall conform in all respects to the current requirements of L.P.I. certified system program and all legal, labor, insurance or other authorities having jurisdiction. The installing CONTRACTOR shall have a minimum of five (5) years experience in this specialized work and be a certified master installer of the Lightning Protection Institute. All materials used shall be furnished and recommended for their intended use by a reputable lightning protection manufacturer who is a Manufacturer Member of the Lightning Protection Institute. All materials shall be provided by Thompson Lightning Protection or an equal. Installer shall be Bonded Lightning Protection System, Inc., Jupiter, Florida or equal.

B. As a minimum, the following structures and or buildings shall be provided with lightning protection systems.

1. Operations Building
2. Treatment Structures
3. Generators
4. Chlorine Contact Tank
5. Ground Storage Tank

1.02 SUBMITTALS

A. Submittals for approval shall be provided for any and all materials. No materials shall be used without approval from the ENGINEER.

B. Refer to the General Requirements of Section 01300, Submittals for documentation of Shop Drawings and Section 01730 for O&M Manuals.

C. Provide scaled plan and elevation views of all structures for which lightning protection shall be provided. These Drawings shall show the proposed location of all air terminals, typical air terminals, size and location for ground rods, cable, connectors and proposed methods of bonding. Bond to telephone and power service ground systems.

PART 2 – PRODUCTS

2.01 TERMINALS

Provide terminals as per material vendor Shop Drawings. Terminal materials shall be as follows, bronze saddle and pressure plate, nickel tip highly polished, pure copper point. Provide mounting type and cable connections as required.

2.02 CABLE AND ACCESSORIES

Provide stranded copper cable per material vendor. Provide braces, saddle, fittings and connectors as required compatible with materials.

2.03 GROUND RODS

Provide copper clad ground rods, 5/8" x 10' minimum. Provide bronze compression clamps as required.

PART 3 – EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Locate terminals per vendor Shop Drawings. All points shall be a minimum of 2" of outside building edges, corners, and ridge ends. Maximum spacing shall be 20'. Maximum protection above object to be protected shall be 10".

B. Maintain horizontal and downward coursing of main conductor and insure that all bends have at least an 8" radius and do not exceed 90 degrees.

C. Support all exposed roof, downlead and bonding cables at 3' intervals.

D. Ground electrodes shall be installed per Vendor Shop Drawings but install at least 1' below final grade.

E. Interconnect Lightning Protection ground to electric, telephone and other building ground systems per State, National and Local Codes.

F. System shall be installed per Vendor Shop Drawings to insure proper code compliance and system certification. Any variance shall entail resubmittal and reapproval and all costs shall be paid by the CONTRACTOR.

G. As built Drawings shall be provided and submitted by the Material Vendor in accordance with certification procedures.

H. All materials shall be U.L. approved with "A" labels on conductors at 10' intervals and "B" labels on air terminals.

I. Complete installation shall bear U.L. Master Label "C" to be secured to the building by the system installer per U.L. 96A.

J. Installation shall comply in all respects L.P.I. Code 175. Installation shall be made by or under the supervision of an L.P.I. Certified Master Installer. The completed installation shall receive system certification including submittal of forms L.P.I. CI-01, 02, and 03.

K. Restoration to existing conditions. CONTRACTOR is responsible for restoring all areas which are disturbed by electrical work to original conditions.

END OF SECTION

SECTION 16231
ELECTRIC STANDBY GENERATOR

PART I – GENERAL

1.01 DESCRIPTION

A. Scope

This Section includes furnishing electric generators to provide standby electric power generating capacity to maintain operations during electrical power outages. The generator is to consist of a liquid cooled engine, an AC alternator, protective enclosure and system controls with all necessary accessories for a complete operating system.

B. Related Work Specified Elsewhere

1. Section 03300: Cast-in-Place Concrete
2. Section 16010: Electrical General Requirements
3. Section 16050: Basic Materials and Methods

1.02 QUALITY ASSURANCE

A. Reference Standards

Unless otherwise specified, the Work of this Section shall conform to the applicable portions of the following Standard Specifications:

1. NEC - National Electrical Code
2. NEMA - National Electrical Manufacturer's Association
3. ANSI - American National Standards Institute
4. UL - Underwriter's Laboratories
5. OSHA - Occupational Safety & Health Administration

B. Manufacturer Qualifications

The engine, generator, and all major items of auxiliary equipment shall be manufactured in the U.S. by manufacturers currently engaged in the production of such equipment. The unit shall be factory assembled and tested by the manufacturer and shipped to the job site by his authorized dealer having a parts and service facility in the area.

C. Factory Testing

Before shipment of the equipment, the engine-generator set shall be tested under rated load for performance and proper functioning of control and interfacing circuits. Tests shall include:

1. Verifying all safety shutdowns are functioning properly.

2. Verify single step load pick-up per NFPA 110-1996, Paragraph 5-13.2.6.

3. Verify transient and voltage dip responses and steady state voltage and speed (frequency) checks.

D. Source Quality Control

This system shall be built, tested, and shipped by the supplier of the generator so there is one source of supply and responsibility.

The generator set shall receive the manufacturer's standard factory load testing and ratings. These ratings must be substantiated by manufacturer's standard published curves. Special ratings or maximum ratings are not acceptable. The performance of this generating set series shall be certified by an independent testing laboratory as to the set's full power rating, stability and voltage, and frequency regulation.

E. Warranty

Equipment furnished under this Section shall be guaranteed against defective parts or workmanship under terms of the manufacturer's and dealer's five year warranty.

1.03 REQUIREMENTS OF REGULATORY AGENCIES

An electric generating system, consisting of a prime mover, generator, governor, coupling and all controls, must have been tested, as a complete unit, on a representative engineering prototype model of the equipment to be sold.

The generator set must conform to applicable National Electrical Code and applicable inspection authorities.

The generator set must be available with the Underwriters Laboratories listing as a stationary engine generator assembly.

1.04 PERFORMANCE CRITERIA

Standby rating shall be 480/277 volt 3-phase at 60 HZ and have a 0.8 power factor.

The specified standby 1000 kW shall be for continuous electrical service during interruption of the normal utility source.

A factory mounted circuit breaker shall be installed to provide adequate circuit protection for generator and system short circuit interrupting capacities.

1.05 SUBMITTALS

A. Product Data

Submit manufacturer's product data showing model number, dimensions, and weight of assembled and mounted unit as well as pertinent drawings and wiring diagrams. Include information for all major accessories and appurtenances to be furnished as part of power generation unit.

Provide three complete sets of Engineering Submittal for approval, prior to production release, showing all components, in addition to the engine and generator. Submittals shall include compliance with these specifications.

B. Certificates

Submit test report certifying the generator set's full power, rating, stability, voltage, and frequency regulation as required in Article 1.03.E of Section 16050, Electrical General Requirements.

C. Operation and Maintenance Data

Submit operating instructions, repair parts listing and recommended maintenance schedule of inspection, cleaning, and lubrication. Include manufacturer's recommended lubricants. Manuals shall be delivered with the power generation unit unless otherwise directed by the ENGINEER.

D. Owner's Manuals

Three (3) sets of owner's manuals specific to the product supplied must accompany delivery of the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included.

PART 2 – PRODUCTS

2.01 PROTECTIVE ENCLOSURE

A. General

The following equipment is to be installed at the engine-generator set manufacturer's facility:

1. Weather protective sound attenuating enclosure: The engine-generator set shall be factory enclosed in a 12 gauge aluminum enclosure constructed with corner posts, uprights and headers. The roof shall be made of aluminum, aid in the runoff of water and include a drip edge. The enclosure shall be coated with electrostatically applied power paint, baked and finished to manufacturer's specifications. The color will be tan-standard. The enclosure shall be completely lined with 1" thick, UL 94 HF-1 listed, sound deadening material. This material must be of a self extinguishing design. The enclosure is to have large, hinged, removable doors to allow access to the engine, alternator and control panel. Hinges and all exposed fasteners will be stainless steel. Each door will have lockable hardware with identical keys. Padlocks do not meet this specification.

2. The exhaust silencer(s) shall be provided of the size as recommended by the manufacturer and shall be of critical grade. The silencer(s) shall be mounted within the weather protective enclosure for reduced exhaust noise and provide a clean, smooth exterior design. It shall be connected to the engine with a flexible, seamless, stainless steel exhaust connection. A rain cap will terminate the exhaust pipe. All components must be properly sized to assure operation without excessive back pressure when installed.

3. Provide an automatic dual rate battery charger manufactured by the engine-generator set supplier. The automatic equalizer system shall monitor and limit the charge current to 10 amps. The output voltage is to be determined by the charge current rate. The charger must be protected against a reverse polarity connection. The battery charger is to be factory installed on the generator set. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable.

The following equipment is to be provided by the engine-generator set manufacturer and shipped loose with the unit:

1. Pad type vibration isolators to mount between the mounting base and pad to reduce noise and transmitted vibrations shall be supplied by the manufacturer.

2.02 DIESEL-GENERATOR SET

A. General

It is the intent and purpose of the Specifications to secure for the OWNER a diesel-generator set of the latest commercial type and design. The diesel-generator set shall be capable of continuous duty service at rated output for the duration of a utility power failure. The engine and generator assembly shall be supplied by one company; and that company, and its authorized dealer, along with the CONTRACTOR, shall have responsibility for the performance of the diesel-generator set and its accessories. The diesel-generator set shall be a new, factory-assembled and tested set. It is the intent and purpose of the Specifications to also secure for the OWNER the necessary controls and accessories to the extent that such equipment, in conjunction with the diesel-generator set, will comprise a complete operating package for installation 50 feet above sea level in an ambient temperature of 120^{o}F maximum, 30^{o}F minimum.

A general outline of the Work to be done and products to be furnished by the CONTRACTOR is given in the Specifications, but is not intended that same is all inclusive. The CONTRACTOR shall do any and all other Work or operations as may be necessary to provide a complete emergency diesel-generator set in accordance with the Specifications or that may be reasonably interpreted therefrom for a complete package ready for installation and operation. The diesel-generator set manufacturer, or his authorized dealer, through the CONTRACTOR, shall submit satisfactory evidence that he maintains a fully-equipped service and replacement parts organization within a reasonable proximity to the Project installation in order to be capable in all respects of furnishing complete inspections and service by trained field service mechanics 24 hours a day, seven days a week. Delegation of this service responsibility for any or all of the equipment listed herein will not be considered fulfillment of the Specifications.

Rating of the diesel-generator set shall be based on operation of the set when equipped with all necessary operating accessories, such as radiator, fan, air cleaners, lubricating oil pump, fuel transfer pump, fuel injection pump, jacket water pump, governor, charging generator, alternating current generator, and exciter regulator.

The diesel-generator set shall be capable of supplying power to the normally varying load placed on the essential service motor control centers by producing the rated KW as specified at 0.8PF continuously, 24 hours per day, with no derating or time limit, at the ambient temperature and altitude stated. The kilowatt power output rating shall conform to the recommendation of the Building Research Advisory Board in Federal Construction Council Technical Report No. 46, Paragraph 3.1, entitled "Diesel Engines for Use with Generators to Supply Emergency and Short-Term Power."

B. Engine specifications

1. The prime mover shall be a liquid cooled, diesel fueled, turbocharged after-cooled engine of 4-cycle design. It will have a 12 cylinder block with a minimum displacement of 32 liters (1959 cubic inches), with a minimum rating of 1495 BHP. The unit requires a minimum rated output of 1000 kW at an operating speed of 1800 RPM.

2. The engine is to be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system providing visual diagnostic means to determine if the system is operating with a normal engine coolant level. The radiator shall be designed for operation in 120 degrees F ambient temperature.

3. The intake air filter(s) with replaceable element must be mounted on the unit. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter(s) with internal bypass and replaceable element(s). Engine coolant and oil drain extensions, equipped with pipe plugs, must be provided to outside of the mounting base for cleaner and more convenient engine servicing. A fan guard must be installed for personnel safety.

4. The engine shall have a battery charging DC alternator with a transistorized voltage regulator. Remote 2-wire starting shall be by a solenoid shift, electric starter.

5. Engine speed shall be controlled by isochronous governor to maintain alternator frequency within 0.5% from no load to full load alternator output. Steady state regulation is to be 0.25%.

6. The engine fuel system shall be designed for operation on No. 2 diesel fuel. A primary fuel filter, water separator, manual fuel priming pump, fuel shutoff solenoid and all fuel lines must be installed at the point of manufacture.

7. The primary diesel fuel filter shall be capable of removing contaminants of 10 microns. Element shall be replaceable paper type.

8. The engine shall have (a) unit mounted, thermostatically controlled water jacket heater(s) to aid in quick starting. The operating voltage shall be 208 VAC, 1-phase. The wattage shall be as recommended by the manufacturer.

9. Sensing elements to be located on the engine for low oil pressure shutdown, high coolant temperature shutdown, low coolant level shutdown, overspeed shutdown and overcrank shutdown. These sensors are to be connected to the control panel using a wiring harness with the following features:
   a. Wire number labeling on each end of the wire run for easy identification
   b. A molded rubber boot to cover the electrical connection on each sensor to prevent corrosion and all wiring to be run in flexible conduit for protection from the environment and any moving objects.

10. Provide the following items installed at the factory:
    a. The manufacturer shall supply its recommended stainless steel, flexible connector to couple the engine exhaust manifold to the exhaust system.
    b. A secondary diesel fuel filter with heater shall be installed and be capable of removing contaminants of 10 microns or larger. Element shall be replaceable paper type. This filter is in addition to the standard filter(s) supplied with the engine.
    c. The fuel system shall include a 5184 gallon (usable), double wall base mounted fuel tank. It shall have a stub-up area convenient for electrical conduit entry. It shall have the structural integrity to support the engine-generator set and carry the UL 142 mark. Minimum features shall include all welded construction, a lockable fuel filler cap, fuel gauge, low fuel level alarm, fuel line check valve, vent and fittings for fuel supply, return, fill and emergency vent. This tank must be supplied by the engine-generator set manufacturer and be installed before shipment.

C. Alternator Specifications

1. The alternator shall be a 4 pole revolving field type, 12 lead, wired for 277/480 VAC 3 phase, 60 Hz, sized at 1000 kW with a permanent magnet driven exciter. Photosensitive components will not be permitted in the rotating exciter. The stator shall be direct connected to the engine to insure permanent alignment. The generator shall meet temperature rise standards for Class "H" insulation, operate within Class "F" standards for extended life. All leads must be extended into an AC connection panel. The alternator shall be protected by internal thermal overload protection and an automatic reset field circuit breaker.

2. One step load acceptance shall be 100% of engine-generator set nameplate rating and meet the requirements of NFPA 110 paragraph 5-13.2.6. The generator set and regulator must sustain at least 90% of rated voltage for 10 seconds with 250% of rated load at near zero power factor connected to its terminals when equipped with direct or brushless excitation. 300% short circuit current must be selectable on units equipped with permanent magnet exciters. Generators equipped with permanent magnet exciters not allowing the selection of the short circuit current ratings are not allowed.

3. A solid state voltage regulator designed and built by the alternator manufacturer must be used to control output voltage by varying the exciter magnetic field to provide + or - 1% regulation during stable load conditions. Should an extremely heavy load drop the output frequency, the regulator shall have a voltage droop of 4 Volts/Hertz to maximize motor starting capability. The frequency at which this droop operation begins must be adjustable, allowing the generator set to be properly matched to the load characteristics insuring optimum system performance. Additional rheostats for matching generator voltage, droop, and stability characteristics to the specific load conditions must be available.

4. The voltage regulator must contain a limiting circuit to prevent output voltage surges in excess of 125% of rated voltage during generator set operation. On loss or near loss of the voltage sensing signal, the voltage regulator must be capable of shutting down to prevent an over voltage condition from occurring. It must have a second mode of operation allowing 300% of rated current to flow through the electrical distribution circuit(s) for ten (10) seconds under the same conditions. Voltage regulators not capable of selecting either mode of operation are not acceptable. LED indication will be provided on the regulator to monitor the sensing (yellow), excitation (green), and output circuit (red).

5. A NEMA 1 panel that is an integral part of the generator set must be provided to allow the installer a convenient location in which to make electrical output connections. A fully rated, isolated neutral must be included by the generator set manufacturer to insure proper sizing.

6. The electric plant shall be mounted with vibration isolators on a welded steel base that shall permit suitable mounting to any level surface.

7. Provide the following items installed at the factory:

8. A main line circuit breaker carrying the UL mark shall be factory installed. The breaker shall be rated per the manufacturer’s recommendations unless specified below and mounted in the genset connection box. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections. A system utilizing manual reset field circuit breakers and current transformers is unacceptable.

9. A 120 VAC alternator strip heater shall be installed to prevent moisture condensation from forming on the alternator windings.

D. Controls

i. All engine alternator controls and instrumentation shall be designed, built, wired, tested and shock mounted in a NEMA 1 enclosure to the engine-generator set by the manufacturer. It shall contain panel lighting, a fused DC circuit to protect the controls and a +/-5% voltage adjusting control. This panel must be able to be rotated 90 degrees in either direction for correct installation.

2. The engine-generator set shall contain a complete 2 wire automatic engine start-stop control which starts the engine on closing contacts and stop the engine on opening contacts. A programmable cyclic cranking limiter shall be provided to open the starting circuit after eight attempts if the engine has not started within that time. Engine control modules must be solid state plug-in type for high reliability and easy service.

3. The panel shall include; analog meters to monitor AC voltage, AC current and AC frequency with a phase selector switch, an emergency stop switch, an audible alarm, battery charger fuse, and a programmable engine control and monitoring module.

4. The programmable module shall include: a manual, off, auto switch; four LEDs to indicate:

    1) Not in Auto
    2) Alarm Active
    3) Generator Running
    4) Generator Ready

5. A data entry keypad and a digital display panel. The module will display all pertinent unit parameters including:
    a. Generator Status: Current unit status in real time
    b. Instrumentation: Real time readouts of the engine and alternator analog values
        i. Oil pressure
        ii. Coolant temperature
        iii. Fuel level (where applicable)
        iv. DC battery voltage
        v. Run time hours
    c. Generator Commands: Current engine start/stop status
    d. Alarm Status: Current alarm(s) condition
        i. High or low AC voltage
        ii. High or low battery voltage
        iii. High or low frequency
        iv. Low or pre-low oil pressure
        v. Low water level
        vi. Low water temperature
        vii. High and pre-high engine temperature
        viii. High, low and critical low fuel levels (where applicable)
        ix. Overcrank
        x. Overspeed
        xi. Unit not in "Automatic Mode"
        xii. 8 user programmable digital channels

xiii. 4 user programmable analog channels

e. Alarm Log: Memory of last fifty alarm events

f. Operating parameters: Access to and manipulation of the current operating parameters and alarm limits

g. Software Information: Version information and module display test function

6. The panel must be accessible by PC based software via either standard RS232, RS485 or modem. The software must display the module face, be updated in real time and allow for complete access to all applicable module functions. Communication output and its software must be fully compatible and allow for incorporation into an existing control program.

7. The following equipment is to be installed at the engine-generator set manufacturer's facility:

a. A DPDT relay shall be mounted in the generator control panel and operate on engine start and run for customer connection.

b. A DPDT relay shall be mounted in the generator control panel and operate on low fuel for customer connection.

c. A DPDT relay shall be mounted in the generator control panel and operate on generator fault for customer connection.

d. The panel mounted 5% voltage adjusting control shall have a positive locking mechanism to prevent the accidental movement of the control.

8. The generator shall be coordinated with and be compatible with the automatic transfer switch.

9. A 16-light, NEMA 1, remote annunciator panel shall be shipped loose for installation within the building.

2.03 ACCEPTABLE MANUFACTURERS

The electric generation unit shall be as manufactured by Caterpillar, Kohler, or Cummins.

PART 3 – EXECUTION

3.01 FIELD QUALITY CONTROL

Prior to acceptance of the electric generation unit, it shall be tested to show it is free of defects and that starting is automatic. The generator shall be subjected to a full load test using manufacturer simulation load facility.

3.02 INSTALLATION

CONTRACTOR shall install the complete electrical generating system including all fuel connections in accordance with the manufacturer’s recommendations as reviewed by the Engineer.

3.03 SERVICE

Supplier of the electric plant and associated items shall have permanent service facilities in this trade area. These facilities shall comprise a permanent force of factory trained service personnel on 24 hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the owner maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these

specifications. Service contracts shall also be available.

3.04 STARTUP AND CHECKOUT

The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to checkout the completed installation and to perform an initial startup inspection to include:

1. Ensuring the engine starts (both hot and cold) within the specified time.

2. Verification of engine parameters within specification.

3. Verify no load frequency and voltage, adjusting if required.

4. Test all automatic shutdowns of the engine-generator.

5. Perform a resistance load bank test of the electric plant, ensuring full load frequency and voltage are within specification.

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END OF SECTION

SECTION 16460
ELECTRIC MOTORS

PART I – GENERAL

1.01 DESCRIPTION

This section specifies the quality criteria, design standards, materials, and installation procedures not otherwise specified, required for electrical motors furnished under these Contract Documents.

1.02 CONTRACTOR'S RESPONSIBILITY

A. Furnish and submit shop drawings, operation and maintenance manuals, etc. per the general conditions. In addition, the submission shall include the following technical information:

1. Motor efficiency
2. Motor torque speed curves from zero to full load speed.
3. Nameplate data

B. The above information shall be supplied as part of the submittal on the equipment which the motor drives.

1.03 STANDARDS

Electric motors shall conform to the latest standards of IEEE, ANSI, and NEMA except as otherwise specified herein.

1.04 CONDITIONS OF SERVICE

A. Electric motors shall be designed and manufactured to operate under the following conditions except for specific variations stated in other sections of these specifications:

1. Continuous Duty
2. Altitude below 3300 feet.
3. Ambient temperature 32° to 120° F maximum.
4. Voltage variation plus or minus 10 percent.
5. Unit shall be suitable for starting and running with power and control equipment provided for it.

1.05 TESTING

A. Motors less than 50 hp: Each motor shall be subjected to a standard short commercial test including the following:

1. Running light current
2. Locked rotor current
3. Secondary voltage at collector rings (wound rotor motors).
4. High potential.
5. Winding resistance
6. Bearing inspection

B. Motors 50 through 100 hp: Each motor shall be subjected to the above tests and shall be furnished with certified test results.

C. Efficiency: Motors rated 25 through 100 hp shall be individually tested for efficiency.

D. Motors larger than 100 hp: One motor from each identical order shall be furnished with certified test results. Each motor shall be subjected to a complete factory test consisting of full load heat run, percent slip, running light current, locked rotor current, breakdown torque (calculated), starting torque, winding resistance, high potential, efficiencies at 100, 75 and 50 percent of full load, and bearing inspection. The Engineer and Owner reserve the right to witness these tests.

E. Test Reports: Seven (7) copies of all test results shall be submitted to the Engineer for approval. Single copies of witnessed test raw data shall be submitted to the Engineer immediately upon completion of such tests.

1.06 TOOLS AND SUPPLIES

Furnish all special tools necessary to disassemble, service and adjust the equipment.

PART 2 – PRODUCTS

2.01 GENERAL

A. The driven equipment manufacturer shall be responsible for supplying the motor and shall factory mount the motor to ensure proper coordination.

B. Review plans and other specifications. Provide motor suitable for starting method.

C. Where motors are used with variable frequency drive systems, they shall be provided as inverter duty, premium efficiency.

2.02 DESIGN OF MOTORS

A. Horsepower: The driven equipment manufacturer shall be responsible for sizing the motors in coordination with the driven equipment so that the nameplate rated horsepowers are not exceeded and motors are not required to operate within their service factor at any point within the driven equipment operating range. For variable speed application, the motor shall be designed for operation at the rated maximum speed and at reduced speeds down to 30% without overloading. The Engineer reserves the right to reject driven equipment which requires motors larger than the minimums specified in the other sections of these specifications or to require the Contractor to bear additional costs if larger electrical equipment is required.

B. Temperature Rise: Motors shall conform to standards of NEMA Class F Insulation System with a Class B rise unless otherwise listed in the other parts of these specifications.

C. Voltage and Current: Fractional horsepower motors (less than ½ hp) shall be 115/208V or 115/230V, 60 hz single phase. Motors ½ horsepower through 600 horsepower shall be 460 volts, 60hz, 3- phase.

D. Service Factor: Unless otherwise specified, service factor shall be a minimum of 1.15.

E. Speed: As specified with equipment.

F. Torque: At least 20 percent greater than the maximum full load torque requirements of

the driven equipment throughout the full operating range of the driven equipment from start to full load.

G. Efficiency:

1. Motors in the range of 1 hp to 200 hp, inclusive shall be designed specifically for energy efficiency and high power factor. In accordance with NEMA Standard MG 1-12.53b, each motor shall meet the minimum guaranteed efficiency for the specified nameplate efficiency. All motor efficiency test shall be performed utilizing the NEMA preferred test method IEEE 112 method B, Dynamometer.

2. Motors larger than 200 hp shall have a minimum efficiency at full load, of 95% and a minimum power factor of 85%.

3. Motors above 20 hp shall be “premium efficiency motors”: U.S. Electric Motors, General Electric or an approved equal.

H. Inverter Duty

Motor used on VFD systems shall be inverter duty.

2.03 MATERIALS AND CONSTRUCTION

A. Enclosure

The enclosure shall be the type as specified in respective parts of equipment specifications and shall be constructed of cast iron or fabricated steel components in proper position. Fans may form part of the rotor and shall be of non-sparking material on totally enclosed motors. Enclosures for motors not specified elsewhere, shall be TEFC, unless otherwise stated. Fractional horsepower motor enclosures shall be totally enclosed non-ventilated.

B. Insulation

1. Motors shall have inorganic, non-hygroscopic insulation unless otherwise noted in other parts of these specifications. Insulation shall be Class F rating.

2. Motors used on variable frequency drives shall have 1600V peak winding insulation systems.

C. Stator

1. The stator shall be assembled from high grade electrical sheet steel laminations adequately secured together.

2. The stator windings shall consist of materials such as polyester film, synthetic varnish or glass cloth. Windings shall be random or from wound, adequately insulated and securely braced to resist failure due to electrical stress and vibrations.

3. Any junction in motor insulation, such as coil connections or between slot and end winding sections, shall have protection equivalent to that of the slot sections of coils. The entire winding of all motors when finished, shall be epoxy encapsulated, after subjecting to a process which removes all moisture and insures freedom of air pockets.

D. Rotor

The shaft shall be made of high grade machine steel or steel forging of size and design adequate to withstand the load stresses. The rotor shall be fabricated of high grade electrical sheet steel laminations adequately fastened together and to the shaft. Squirrel cage windings may be cast aluminum or bar-type construction with brazed end rings.

E. Bearings shall be ball or roller type

1. Motors up to 1,000 horsepower shall have grease lubricated sealed bearings. Above 1,000 horsepower, lubrication shall be oil. Unless specified otherwise, the bearings shall have a B-10 life as follows:

Motor Size (hp)	B-10 Life (hrs.)
Less than 50	24,000
50 to 200	40,000
Greater than 200	100,000

2. For vertical motors, thrust bearings shall be Kinsbury type, ball or roller bearings as required for the design thrust load. Guide bearings shall be radical type ball bearing.

F. Temperature Switches

Provide motor winding thermostatic-controlled switch. The switch shall be normally closed and shall open upon high temperature condition.

G. Leads and Terminals

Leads shall be suitably marked and identified. Terminal housing locations, which are not shown on the Contract Drawings, shall be NEMA Assembly F-1.

H. Motor Terminal Boxes

Motor terminal boxes shall be provided separately for the power connections. The thermal switch and heater connections shall be in a common box. All terminal boxes shall be provided with threaded hubs.

I. Grounding Means

Each motor shall have adequate means for attaching #4/0 AWG copper grounding conductor to the motor frame near the base. It shall be a mechanical clamp terminal connector located on the same side as the stator lead junction box.

J. Direction of Rotation

Motors shall be designed and manufactured for operation in a direction as required for driven equipment. The phase sequence, at the specification rotation, shall be marked permanently and plainly inside the stator lead junction box.

K. Noise

All motors shall have an equivalent A-weighted sound level of 80 dp A as determined in accordance with IEEE Standard No. 85.

L. Nameplates

Each motor shall have a stainless steel nameplate including the following minimum amount of information:

a. Manufacturer's type designation
b. Frame number
c. Output horsepower rating
d. Duty (time rating)
e. Rated load speed (rpm)
f. Temperature rise in degrees centigrade at rated load, rotor and stator.
g. Stator voltage rating
h. Stator full load amperes
i. Service factor (marked for operation at 40°C ambient)
j. Frequency
k. Number of Phases
l. Inrush of locked rotor KVA
m. Code letter designation
n. Efficiency
o. Bearing type, size, lubricant

PART 3 – EXECUTION

3.01 INSTALLATION

A. Motors shall be mounted in accordance with the motor manufacturer's drawings and instructions. Field installation of the unit shall include final alignment.

B. Installation shall also include furnishing necessary oil and grease for initial operation and making final adjustments to place the equipment in operable condition.

3.02 FIELD TESTS

All motors, their driven equipment and speed controllers (if applicable) shall be tested together after installation as described in the applicable sections of these specifications.

3.03 PAINTING

Motors shall be assembled with pump at pump manufacturer's plant and shipped to the site with manufacturer's standard finishes. After installation and before being placed in final operation, the motors shall be painted in accordance with the requirements of the specifications and consistent with the split case pump finish.

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END OF SECTION

APPENDIX A
FDEP PERMIT

FLORIDA DEPARTMENT OF
Environmental Protection

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Rick Scott
Governor

Carlos Lopez-Cantera
Lt. Governor

Noah Valenstein
Secretary

NOTICE OF PERMIT ISSUANCE

Sent by email to:
Christopher.little@pbfl.org

Christopher A. Little, P.E., Interim Utilities Director
City of Palm Bay
250 Osmosis Drive
Palm Bay, FL 32909
Christopher.little@pbfl.org

Brevard County - DW
Palm Bay South WRF

Enclosed is Permit Number FLA693782 to construct and operate a domestic wastewater facility issued under Sections 403.087 and 403.0885 of the Florida Statutes.

Monitoring requirements under this permit are effective on the first day of the second month following the treatment plant is placed into operation.

This action is final and effective on the date filed with the Clerk of the Department unless a petition for an administrative hearing is timely filed under Sections 120.569 and 120.57, F.S., before the deadline for filing a petition. On the filing of a timely and sufficient petition, this action will not be final and effective until further order of the Department. Because the administrative hearing process is designed to formulate final agency action, the hearing process may result in a modification of the agency action or even denial of the application.

Petition for Administrative Hearing
A person whose substantial interests are affected by the Department's action may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, F.S. Pursuant to Rules 28-106.201 and 28-106.301, F.A.C., a petition for an administrative hearing 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 are or will be affected by the agency determination;
(c) A statement of when and how 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 that the petitioner contends warrant reversal or modification of the agency's proposed action;
(f) A statement of the specific rules or statutes that the petitioner contends require reversal or modification of the agency's proposed 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 the petitioner, stating precisely the action that the petitioner wishes the agency to take with respect to the agency's proposed action.

The petition must be filed (received by the Clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, or via electronic correspondence at Agency_Clerk@dep.state.fl.us. Also, a copy of the petition shall be mailed to the applicant at the address indicated above at the time of filing.

Time Period for Filing a Petition

In accordance with Rule 62-110.106(3), F.A.C., petitions for an administrative hearing by the applicant and persons entitled to written notice under Section 120.60(3), F.S., must be filed within **14** days of receipt of this written notice. Petitions filed by any persons other than the applicant, and other than those entitled to written notice under Section 120.60(3), F.S., must be filed within **14** days of publication of the notice or within 14 days of receipt of the written notice, whichever occurs first. The failure to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57, F.S., or to intervene in this proceeding and participate as a party to it. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, F.A.C.

Extension of Time

Under Rule 62-110.106(4), F.A.C., a person whose substantial interests are affected by the Department's action may also request an extension of time to file a petition for an administrative hearing. The Department may, for good cause shown, grant the request for an extension of time. Requests for extension of time must be filed with the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, or via electronic correspondence at Agency_Clerk@dep.state.fl.us, before the deadline for filing a petition for an administrative hearing. A timely request for extension of time shall toll the running of the time period for filing a petition until the request is acted upon.

Mediation

Mediation is not available in this proceeding.

Judicial Review

Once this decision becomes final, any party to this action has the right to seek judicial review pursuant to Section 120.68, F.S., by filing a Notice of Appeal pursuant to Florida Rules of Appellate Procedure 9.110 and 9.190 with the Clerk of the Department in the Office of General Counsel (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 must be filed within 30 days from the date this action is filed with the Clerk of the Department.

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

_____

Nathan Hess
Program Administrator
Permitting and Waste Cleanup Program

RP/dj

Enclosures: Permit, DMR and SOB

CERTIFICATE OF SERVICE
The undersigned duly designated deputy clerk hereby certifies that this document and all attachments were sent on the filing date below to the following listed persons:

David Smicherko, DEP, david.smicherko@dep.state.fl.us
Mary Ann Kraus, DEP, mary.kraus@dep.state.fl.us
Dennise Judy, DEP, dennise.judy@dep.state.fl.us
Matthew S. Love, P.E., Wade Trim, Inc., mlove@wadetrim.com

FILING AND ACKNOWLEDGMENT
FILED, on this date, pursuant to Section 120.52, F. S., with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk November 30, 2018 **Date**

FLORIDA DEPARTMENT OF
Environmental Protection

Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Rick Scott
Governor

Carlos Lopez-Cantera
Lt. Governor

Noah Valenstein
Secretary

STATE OF FLORIDA
DOMESTIC WASTEWATER FACILITY PERMIT

PERMITTEE:
City of Palm Bay

RESPONSIBLE OFFICIAL:
Dan Roberts
120 Malabar Rd SE
Palm Bay, Florida 32907-3009
(321) 952-3410

PERMIT NUMBER: FLA693782
FILE NUMBER: FLA693782-003-DW1P
EFFECTIVE DATE: **April 26, 2016**
1st REVISION DATE: **November 30, 2018**
EXPIRATION DATE: **April 25, 2021**

FACILITY:

Palm Bay South Regional WRF
250 Osmosis Dr SE
Palm Bay, FL 32909
Brevard County
Latitude: 27°56' .8174" N Longitude: 80°40' 14.0751" W

This permit is issued under the provisions of Chapter 403, Florida Statutes (F.S.), and applicable rules of the Florida Administrative Code (F.A.C.). This permit does not constitute authorization to discharge wastewater other than as expressly stated in this permit. The above named permittee is hereby authorized to construct and operate the facilities in accordance with the documents attached hereto and specifically described as follows:

WASTEWATER TREATMENT:

The previously permitted new 2.0 million gallons per day (MGD) annual average daily flow (AADF) permitted capacity activated sludge domestic wastewater treatment plant is being modified prior to its construction. The capacity and type of treatment are the same as previously permitted.

This revised permit authorizes the construction of the modified treatment plant as follows:

- Elimination of the Septage Receiving Station and Master Lift Station at the plant;
- Addition of an odor control system for the headworks, grit removal unit, anaerobic basin, and biosolids holding tank, that previously only covered the headworks;
- Influent screening and grit removal, as previously permitted;
- Addition of an Anaerobic Selector Basin between the headwork and anoxic basin,
- Anoxic basin, as previously permitted
- Reconfiguration of the previously permitted membrane bioreactors (MBRs);
- Dual chlorine contact chambers, re-sized for more effective chlorination;
- Aerated sludge holding tanks for storage of biosolids prior to transfer to the Palm Bay Troutman #2 WWTF, as previously permitted;
- Reconfigured Effluent Transfer Pumping Station
- Upgrades to the Emergency Standby Power System

REUSE OR DISPOSAL:

Underground Injection U-001: An existing 7.0 MGD annual average daily flow permitted capacity underground injection well system consisting of a Class I underground injection well, DEP permit number 328497-001-UO, discharging to Class G-IV ground water. Reject or wet-weather flows of reclaimed water up to 2.0 MGD AADF may be discharged to this system from the treatment plant. Underground Injection Well System U-001 is located approximately at latitude 27°55' 54" N, longitude 80°39' 57" W.

Land Application R-001: A new 0.66 MGD annual average daily flow permitted capacity slow-rate public access reuse system. R-001 consists of a new 3 MG storage tank. The revised permit also includes three new 1 MG lined reclaimed storage ponds for future use, with irrigation at the sites listed in Condition IV.A.1. of this permit as major users, and additional sites with flows less than 0.1 MGD. Reject flow will be sent to U-001.

IN ACCORDANCE WITH: The limitations, monitoring requirements, and other conditions set forth in this cover sheet and Part I through Part IX on pages 1 through 18 of this permit.

I. RECLAIMED WATER AND EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Underground Injection Control Systems

1. During the period beginning on the effective date and lasting through the expiration date of this permit, the permittee is authorized to discharge effluent to Underground Injection Well System U-001. Such discharge shall be limited and monitored by the permittee as specified below and reported in accordance with Permit Condition I.C.8.:

			Reclaimed Water Limitations		Monitoring Requirements			
Parameter	Units	Max/ Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Flow (Total to UIC well)	MGD	Max Max	2.0 Report	Annual Average Monthly Average	Continuous	Recording Flow Meter with Totalizer	FLW-2	See I.A.4
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	Weekly	16-hr FPC	EFA-1	
Solids, Total Suspended	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	Weekly	16-hr FPC	EFA-1	
pH	s.u.	Min Max	6.0 8.5	Single Sample Single Sample	Continuous	Meter	EFA-1	See I.A.3

2. Effluent samples shall be taken at the monitoring site locations listed in Permit Condition I.A.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-2	Flow meter to injection well
EFA-1	Effluent sampling point at transfer wet well

3. Hourly measurement of pH during the period of required operator attendance may be substituted for continuous measurement. *[62-600.660(1)]*

4. A recording flow meter with totalizer shall be utilized to measure flow and calibrated at least once every 12 months. *[62-600.200(25)]*

5. Disinfection is not required for discharge to Class G-IV waters using Class I wells. However, the permittee must maintain the capability for disinfection at a level that is consistent with the alternate disposal mechanism approved for this facility pursuant to Rule 62-600.540(5), F.A.C. *[62-600.540(1)]*

B. Reuse and Land Application Systems

1. During the period beginning on the effective date and lasting through the expiration date of this permit, the permittee is authorized to direct reclaimed water to Reuse System R-001. Such reclaimed water shall be limited and monitored by the permittee as specified below and reported in accordance with Permit Condition I.C.8.:

			Reclaimed Water Limitations		Monitoring Requirements			
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Flow, to Public Access Reuse	MGD	Max Max	0.66 Report	Annual Average Monthly Average	Continuous	Recording Flow Meter with Totalizer	FLW-3	See I.B.4
BOD, Carbonaceous 5 day, 20C	mg/L	Max Max Max Max	20.0 30.0 45.0 60.0	Annual Average Monthly Average Weekly Average Single Sample	Weekly	16-hr FPC	EFA-1	
Solids, Total Suspended	mg/L	Max	5.0	Single Sample	Daily; 24 hours	Grab	EFB-1	
Coliform, Fecal	#/100mL	Max	25	Single Sample	Daily; 24 hours	Grab	EFA-1	
Coliform, Fecal, % less than detection	percent	Min	75	Monthly Total	Daily; 24 hours	Calculated	EFA-1	See I.B.5
pH	s.u.	Min Max	6.0 8.5	Single Sample Single Sample	Continuous	Meter	EFA-1	See I.B.3
Chlorine, Total Residual (For Disinfection)	mg/L	Min	1.0	Single Sample	Continuous	Meter	EFA-1	See I.B.6 and I.B.9
Turbidity	NTU	Max	Report	Single Sample	Continuous	Meter	EFB-1	See I.B.7 and I.B.9
Giardia	cysts/100L	Max	Report	Single Sample	Bi-annually; every 2 years	Grab	EFA-1	See I.B.10
Cryptosporidium	oocysts/100L	Max	Report	Single Sample	Bi-annually; every 2 years	Grab	EFA-1	See I.B.10
Nitrogen, Total	mg/L	Max Max	Report Report	Annual Average Monthly Average	Weekly	16-hr FPC	EFA-1	See I.B.11
Phosphorus, Total (as P)	mg/L	Max Max	Report Report	Annual Average Monthly Average	Weekly	16-hr FPC	EFA-1	See I.B.11

2. Reclaimed water samples shall be taken at the monitoring site locations listed in Permit Condition I.B.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-3	Flow to Public Access Reuse
EFA-1	Effluent sampling point at transfer wet well
EFB-1	MBR effluent, prior to chlorination

3. Hourly measurement of pH during the period of required operator attendance may be substituted for continuous measurement. *[62-600.660(1)]*

4. A recording flow meter with totalizer shall be utilized to measure flow and calibrated at least once every 12 months. *[62-600.200(25)]*

5. To report the "% less than detection," count the number of fecal coliform observations that were less than detection, divide by the total number of fecal coliform observations in the month, and multiply by 100% (round to the nearest integer). *[62-600.440(6)(a)]*

6. The minimum total chlorine residual shall be limited as described in the approved operating protocol, such that the permit limitation for fecal coliform bacteria will be achieved. In no case shall the total chlorine residual be less than 1.0 mg/L. *[62-600.440(6)(b); 62-610.460(2); and 62-610.463(2)]*

7. The maximum turbidity shall be limited as described in the approved operating protocol, such that the permit limitations for total suspended solids and fecal coliforms will be achieved. *[62-610.463(2)]*

8. The treatment facilities shall be operated in accordance with all approved operating protocols. Only reclaimed water that meets the criteria established in the approved operating protocol(s) may be released to system storage or to the reuse system. Reclaimed water that fails to meet the criteria in the approved operating protocol(s) shall be directed to the following permitted alternate discharge system: U-001. *[62-610.320(6) and 62-610.463(2)]*

9. Instruments for continuous on-line monitoring of total residual chlorine and turbidity shall be equipped with an automated data logging or recording device. *[62-610.463(2)]*

10. Intervals between sampling for Giardia and Cryptosporidium shall not exceed two years. *[62-610.463(4)]*

11. Monitoring for total nitrogen (TN) and total phosphorus (TP) are required as allowed by Rule 62-600.650(3), FAC, to evaluate impacts of reclaimed water to ground and surface waters in an impaired water basin. *[62-600.650(3)]*

C. Other Limitations and Monitoring and Reporting Requirements

1. During the period beginning on the effective date and lasting through the expiration date of this permit, the treatment facility shall be limited and monitored by the permittee as specified below and reported in accordance with condition I.C.8.:

			Limitations		Monitoring Requirements			
Parameter	Units	Max/ Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Flow (Total through plant)	MGD	Max Max Max	2.0 Report Report	Annual Average Monthly Average Quarterly Average	Continuous	Recording Flow Meter with Totalizer	FLW-1	See I.C.4
Percent Capacity, (TMADF/Permitted Capacity) x 100	percent	Max	Report	Monthly Average	Monthly	Calculated	FLW-1	
BOD, Carbonaceous 5 day, 20C (Influent)	mg/L	Max	Report	Single Sample	Weekly	16-hr FPC	INF-1	See I.C.3

			Limitations		Monitoring Requirements			
Parameter	Units	Max/ Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Solids, Total Suspended (Influent)	mg/L	Max	Report	Single Sample	Weekly	16-hr FPC	INF-1	See I.C.3

2. Samples shall be taken at the monitoring site locations listed in Permit Condition I.C.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
FLW-1	Influent flow meter
INF-1	Influent sampling point

3. Influent samples shall be collected so that they do not contain digester supernatant or return activated sludge, or any other plant process recycled waters. *[62-600.660(4)(a)]*

4. A recording flow meter with totalizer shall be utilized to measure flow and calibrated at least once every 12 months. *[62-600.200(25)]*

5. Sampling results for giardia and cryptosporidium shall be reported on DEP Form 62-610.300(4)(a)4, Pathogen Monitoring, which is attached to this permit. This form shall be submitted to the Department's Central District Office and to DEP's Reuse Coordinator in Tallahassee. *[62-610.300(4)(a)]*

6. The sample collection, analytical test methods, and method detection limits (MDLs) applicable to this permit shall be conducted using a sufficiently sensitive method to ensure compliance with applicable water quality standards and effluent limitations and shall be in accordance with Rule 62-4.246, Chapters 62-160 and 62-600, F.A.C., and 40 CFR 136, as appropriate. The list of Department established analytical methods, and corresponding MDLs (method detection limits) and PQLs (practical quantitation limits), which is titled "FAC 62-4 MDL/PQL Table (April 26, 2006)" is available at http://www.dep.state.fl.us/labs/library/index.htm. The MDLs and PQLs as described in this list shall constitute the minimum acceptable MDL/PQL values and the Department shall not accept results for which the laboratory's MDLs or PQLs are greater than those described above unless alternate MDLs and/or PQLs have been specifically approved by the Department for this permit. Any method included in the list may be used for reporting as long as it meets the following requirements:

   a. The laboratory's reported MDL and PQL values for the particular method must be equal or less than the corresponding method values specified in the Department's approved MDL and PQL list;

   b. The laboratory reported MDL for the specific parameter is less than or equal to the permit limit or the applicable water quality criteria, if any, stated in Chapter 62-302, F.A.C. Parameters that are listed as "report only" in the permit shall use methods that provide an MDL, which is equal to or less than the applicable water quality criteria stated in 62-302, F.A.C.; and

   c. If the MDLs for all methods available in the approved list are above the stated permit limit or applicable water quality criteria for that parameter, then the method with the lowest stated MDL shall be used.

   When the analytical results are below method detection or practical quantitation limits, the permittee shall report the actual laboratory MDL and/or PQL values for the analyses that were performed following the instructions on the applicable discharge monitoring report.

   Where necessary, the permittee may request approval of alternate methods or for alternative MDLs or PQLs for any approved analytical method. Approval of alternate laboratory MDLs or PQLs are not necessary if the laboratory reported MDLs and PQLs are less than or equal to the permit limit or the applicable water quality criteria, if any, stated in Chapter 62-302, F.A.C. Approval of an analytical method not included in the above-referenced list is not necessary if the analytical method is approved in accordance with 40 CFR 136 or deemed acceptable by the Department. *[62-4.246, 62-160]*

7. The permittee shall provide safe access points for obtaining representative influent, reclaimed water, and effluent samples which are required by this permit. *[62-600.650(2)]*

8. **Monitoring requirements under this permit are effective when the facility is placed into operation**. During the period of operation authorized by this permit, the permittee shall complete and submit to the Department Discharge Monitoring Reports (DMRs) in accordance with the frequencies specified by the REPORT type (i.e. monthly, quarterly, semiannual, annual, etc.) indicated on the DMR forms attached to this permit. Unless specified otherwise in this permit, monitoring results for each monitoring period shall be submitted in accordance with the associated DMR due dates below. DMRs shall be submitted for each required monitoring period including periods of no discharge.

REPORT Type on DMR	Monitoring Period	Mail or Electronically Submit by
Monthly	first day of month - last day of month	28th day of following month
Quarterly	January 1 - March 31 April 1 - June 30 July 1 - September 30 October 1 - December 31	April 28 July 28 October 28 January 28
Semiannual	January 1 - June 30 July 1 - December 31	July 28 January 28
Annual	January 1 - December 31	January 28

The permittee may submit either paper or electronic DMR forms. If submitting electronic DMR forms, the permittee shall use the electronic DMR system approved by the Department (EzDMR) and shall electronically submit the completed DMR forms using the DEP Business Portal at http://www.fldepportal.com/go/. Reports shall be submitted to the Department by the twenty-eighth (28th) of the month following the month of operation. Data submitted in electronic format is equivalent to data submitted on signed and certified paper DMR forms.

If submitting paper DMR forms, the permittee shall make copies of the attached DMR forms, without altering the original format or content unless approved by the Department, and shall mail the completed DMR forms to the Department's Central District Office at the address specified in Permit Condition I.C.13. by the twenty-eighth (28th) of the month following the month of operation.

[62-620.610(18)][62-600.680(1)]

9. During the period of operation authorized by this permit, reclaimed water or effluent shall be monitored annually for the primary and secondary drinking water standards contained in Chapter 62-550, F.A.C., (except for asbestos, color, odor, and corrosivity). These monitoring results shall be reported to the Department's Central District Office annually on the DMR. During years when a permit is not renewed, a certification stating that no new non-domestic wastewater dischargers have been added to the collection system since the last reclaimed water or effluent analysis was conducted may be submitted in lieu of the report. The annual reclaimed water or effluent analysis report or the certification shall be completed and submitted in a timely manner so as to be received by the Department at the address identified on the DMR by January 28 of each year. Approved analytical methods identified in Rule 62-620.100(3)(j), F.A.C., shall be used for the analysis. If no method is included for a parameter, methods specified in Chapter 62-550, F.A.C., shall be used. *[62-600.660(2) and (3)(d)][62-600.680(2)][62-610.300(4)]*

10. The permittee shall submit an Annual Reuse Report using DEP Form 62-610.300(4)(a)2. on or before January 1 of each year. *[62-610.870(3)]*

11. Operating protocol(s) shall be reviewed and updated periodically to ensure continuous compliance with the minimum treatment and disinfection requirements. Updated operating protocols shall be submitted to the Department's Central District Office for review and approval prior to placing the public access reuse system into service. *[62-610.320(6)][62-610.463(2)]*

12. The permittee shall maintain an inventory of storage systems. The inventory shall be submitted to the Department's Central District Office at least 30 days before reclaimed water will be introduced into any new storage system. The inventory of storage systems shall be attached to the annual submittal of the Annual Reuse Report. *[62-610.464(5)]*

13. Unless specified otherwise in this permit, all reports and other information required by this permit, including 24-hour notifications, shall be submitted or reported, as appropriate, to the Department's Central District Office at one of the addresses specified below.

    Electronic submittal is preferred, by sending to DEP_CD@dep.state.fl.us.

    Florida Department of Environmental Protection
    Central District Office
    3319 Maguire Blvd
    Suite 232
    Orlando, Florida 32803-3767
    Phone Number - (407)897-4100

    [62-620.305]

14. All reports and other information shall be signed in accordance with the requirements of Rule 62-620.305, F.A.C. *[62-620.305]*

II. BIOSOLIDS MANAGEMENT REQUIREMENTS

1. Biosolids generated by this facility may be transferred to Palm Bay WWTF #2 or disposed of in a Class I solid waste landfill. Transferring biosolids to an alternative biosolids treatment facility does not require a permit modification. However, use of an alternative biosolids treatment facility requires submittal of a copy of the agreement pursuant to Rule 62-640.880(1)(c), F.A.C., along with a written notification to the Department at least 30 days before transport of the biosolids. *[62-620.320(6), 62-640.880(1)]*

2. The permittee shall monitor and keep records of the quantities of biosolids generated, received from source facilities, treated, distributed and marketed, land applied, used as a biofuel or for bioenergy, transferred to another facility, or landfilled. These records shall be kept for a minimum of five years. *[62-640.650(4)(a)]*

3. Biosolids quantities shall be monitored by the permittee as specified below. Results shall be reported on the permittee's Discharge Monitoring Report for Monitoring Group RMP-Q in accordance with Condition I.C.8.

			Biosolids Limitations		Monitoring Requirements		
Parameter	Units	Max/ Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number
Biosolids Quantity (Transferred)	dry tons	Max	Report	Monthly Total	Monthly	Calculated	RMP-1
Biosolids Quantity (Landfilled)	dry tons	Max	Report	Monthly Total	Monthly	Calculated	RMP-1

[62-640.650(5)(a)1]

4. Biosolids quantities shall be calculated as listed in Permit Condition II.3 and as described below:

Monitoring Site Number	Description of Monitoring Site Calculations
RMP-1	Calculated (based on volume and estimated % solids)

5. The treatment, management, transportation, use, land application, or disposal of biosolids shall not cause a violation of the odor prohibition in subsection 62-296.320(2), F.A.C. *[62-640.400(6)]*

6. Storage of biosolids or other solids at this facility shall be in accordance with the Facility Biosolids Storage Plan. *[62-640.300(4)]*

7. Biosolids shall not be spilled from or tracked off the treatment facility site by the hauling vehicle. *[62-640.400(9)]*

8. Disposal of biosolids, septage, and "other solids" in a solid waste disposal facility, or disposal by placement on land for purposes other than soil conditioning or fertilization, such as at a monofill, surface impoundment, waste pile, or dedicated site, shall be in accordance with Chapter 62-701, F.A.C. *[62-640.100(6)(b) & (c)]*

9. The permittee shall not be held responsible for treatment and management violations that occur after its biosolids have been accepted by a permitted biosolids treatment facility with which the source facility has an agreement in accordance with subsection 62-640.880(1)(c), F.A.C., for further treatment, management, or disposal. *[62-640.880(1)(b)]*

10. The permittee shall keep hauling records to track the transport of biosolids between the facilities. The hauling records shall contain the following information:

Source Facility
1. Date and time shipped
2. Amount of biosolids shipped
3. Degree of treatment (if applicable)
4. Name and ID Number of treatment facility
5. Signature of responsible party at source facility
6. Signature of hauler and name of hauling firm

Biosolids Treatment Facility or Treatment Facility
1. Date and time received
2. Amount of biosolids received
3. Name and ID number of source facility
4. Signature of hauler
5. Signature of responsible party at treatment facility

A copy of the source facility hauling records for each shipment shall be provided upon delivery of the biosolids to the biosolids treatment facility or treatment facility. The treatment facility permittee shall report to the Department within 24 hours of discovery any discrepancy in the quantity of biosolids leaving the source facility and arriving at the biosolids treatment facility or treatment facility.

[62-640.880(4)]

11. If the permittee intends to accept biosolids from other facilities, a permit revision is required pursuant to paragraph 62-640.880(2)(d), F.A.C. *[62-640.880(2)(d)]*

III. GROUND WATER REQUIREMENTS

1. Section III is not applicable to this facility at this time,; however, a Ground Water Monitoring Plan shall be submitted for approval and implementation prior to placing the public access reuse system into operation.

IV. ADDITIONAL REUSE AND LAND APPLICATION REQUIREMENTS

A. Part III Public Access System(s)

1. This reuse system includes the following major user(s) of reclaimed water (i.e., using 0.1 MGD or more) and general service area(s):

Site Number	User Name	User Type	Capacity (MGD)	Acreage
PAA-1	Majors Golf Club and Course	Golf Courses	0.32	129
PAA-2	In-plant process water	Industrial Uses at the WWTP (Cooling Water, Process Water, and Wash Water)	0.18	0
		Total	0.5	129

[62-610.800(5)][62-620.630(10)(b)]

2. Cross-connections to the potable water system are prohibited. *[62-610.469(7)]*

3. A cross-connection control program shall be implemented and/or remain in effect within the areas where reclaimed water will be provided for use and shall be in compliance with the Rule 62-555.360, F.A.C. *[62-610.469(7)]*

4. The permittee shall conduct inspections within the reclaimed water service area to verify proper connections, to minimize illegal cross-connections, and to verify both the proper use of reclaimed water and that the proper backflow prevention assemblies or devices have been installed and tested. Inspections are required when a customer first connects to the reuse distribution system. Subsequent inspections are required as specified in the cross-connection control and inspection program. *[62-610.469(7)(h)]*

5. If an actual or potential (e.g. no dual check device on residential connections served by a reuse system) cross-connection between the potable and reclaimed water systems is discovered, the permittee shall:

   a. Immediately discontinue potable water and/or reclaimed water service to the affected area if an actual cross-connection is discovered.

   b. If the potable water system is contaminated, clear the potable water lines.

   c. Eliminate the cross-connection and install a backflow prevention device as required by the Rule 62-555.360.F.A.C.

   d. Test the affected area for other possible cross-connections.

   e. Within 24 hours, notify the Department's Central District Office's domestic wastewater and drinking water programs.

   f. Within 5 days of discovery of an actual or potential cross-connection, submit a written report to the Department's Central District Office detailing: a description of the cross-connection, how the cross-connection was discovered, the exact date and time of discovery, approximate time that the cross-connection existed, the location, the cause, steps taken to eliminate the cross-connection, whether reclaimed water was consumed, and reports of possible illness, whether the drinking water system was contaminated and the steps taken to clear the drinking water system, when the cross-connection was eliminated, plan of action for testing for other possible cross-connections in the area, and an evaluation of the cross-connection control and inspection program to ensure that future cross-connections do not occur.

   [62-555.350(3) and 62-555.360][62-620.610(20)]

6. Maximum obtainable separation of reclaimed water lines and potable water lines shall be provided and the minimum separation distances specified in Rule 62-610.469(7), F.A.C., shall be provided. Reuse facilities shall be color coded or marked. Underground piping which is not manufactured of metal or concrete shall be color coded using Pantone Purple 522C using light stable colorants. Underground metal and concrete pipe shall be color coded or marked using purple as the predominant color. *[62-610.469(7)]*

7. In constructing reclaimed water distribution piping, the permittee shall maintain a 75-foot setback distance from a reclaimed water transmission facility to public water supply wells. No setback distances are required to other potable water supply wells or to any nonpotable water supply wells. *[62-610.471(3)]*

8. A setback distance of 75 feet shall be maintained between the edge of the wetted area and potable water supply wells, unless the utility adopts and enforces an ordinance prohibiting potable water supply wells within the reuse service area. No setback distances are required to any nonpotable water supply well, to any surface water, to any developed areas, or to any private swimming pools, hot tubs, spas, saunas, picnic tables, barbecue pits, or barbecue grills. *[62-610.471(1), (2), (5), and (7)]*

9. Reclaimed water shall not be used to fill swimming pools, hot tubs, or wading pools. *[62-610.469(4)]*

10. Low trajectory nozzles, or other means to minimize aerosol formation shall be used within 100 feet from outdoor public eating, drinking, or bathing facilities. *[62-610.471(6)]*

11. A setback distance of 100 feet shall be maintained from indoor aesthetic features using reclaimed water to adjacent indoor public eating and drinking facilities. *[62-610.471(8)]*

12. The public shall be notified of the use of reclaimed water. This shall be accomplished by posting of advisory signs in areas where reuse is practiced, notes on scorecards, or other methods. *[62-610.468(2)]*

13. All advisory signs and labels on vaults, service boxes, or compartments that house hose bibbs along with all labels on hose bibbs, valves, and outlets shall bear the words "do not drink" and "no beber" along with the equivalent standard international symbol. In addition to the words "do not drink" and "no beber," advisory signs posted at storage ponds and decorative water features shall also bear the words "do not swim" and "no nadar" along with the equivalent standard international symbols. *[62-610.468 & .469]*

14. The permittee shall ensure that users of reclaimed water are informed about the origin, nature, and characteristics of reclaimed water; the manner in which reclaimed water can be safely used; and limitations on the use of reclaimed water. Notification is required at the time of initial connection to the reclaimed water distribution system and annually after the reuse system is placed into operation. A description of on-going public notification activities shall be included in the Annual Reuse Report. *[62-610.468(6)]*

15. Routine aquatic weed control and regular maintenance of storage pond embankments and access areas are required. *[62-610.414(8)]*

16. Overflows from emergency discharge facilities on storage ponds shall be reported as abnormal events in accordance with Permit Condition IX.20. *[62-610.800(9)]*

V. OPERATION AND MAINTENANCE REQUIREMENTS

A. Staffing Requirements

1. During the period of operation authorized by this permit, the wastewater facilities shall be operated under the supervision of operators certified in accordance with Chapter 62-602, F.A.C. In accordance with Chapter 62-699, F.A.C., this facility is a Category I, Class B facility and, at a minimum, operators with appropriate certification must be on the site as follows:

   A Class C or higher operator 16 hours/day for 7 days/week. The lead/chief operator must be a Class B operator, or higher.

   [62-620.630(3)][62-699.310] [62-610.462]

2. The lead/chief operator shall be employed at the plant full time. "Full time" shall mean at least 4 days per week, working a minimum of 35 hours per week, including leave time. A licensed operator shall be on-site and in charge of each required shift for periods of required staffing time when the lead/chief operator is not on-site. An operator meeting the lead/chief operator class for the treatment plant shall be available during all periods of plant operation. "Available" means able to be contacted as needed to initiate the appropriate action in a timely manner. *[62-699.311(10), (6) and (1)]*

3. An operator meeting the lead/chief operator class for the plant shall be available during all periods of plant operation. "Available" means able to be contacted as needed to initiate the appropriate action in a timely manner. *[62-699.311(1)]*

B. Capacity Analysis Report and Operation and Maintenance Performance Report Requirements

1. When the three-month average daily flow for the most recent three consecutive months exceeds 50 percent of the permitted capacity of the treatment plant or reuse and disposal systems, the permittee shall submit to the Department a capacity analysis report. This initial capacity analysis report shall be submitted within 180 days after the last day of the last month of the three-month period referenced above. The capacity analysis report shall be prepared in accordance with Rule 62-600.405, F.A.C. *[62-600.405(4)]*

2. The application to renew this permit shall include a detailed operation and maintenance performance report prepared in accordance with Rule 62-600.735, F.A.C. *[62-600.735(1)]*

C. Recordkeeping Requirements

1. The permittee shall maintain the following records and make them available for inspection on the site of the permitted facility.

   a. Records of all compliance monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, including, if applicable, a copy of the laboratory certification showing the certification number of the laboratory, for at least three years from the date the sample or measurement was taken;

   b. Copies of all reports required by the permit for at least three years from the date the report was prepared;

c. Records of all data, including reports and documents, used to complete the application for the permit for at least three years from the date the application was filed;

d. Monitoring information, including a copy of the laboratory certification showing the laboratory certification number, related to the residuals use and disposal activities for the time period set forth in Chapter 62-640, F.A.C., for at least three years from the date of sampling or measurement;

e. A copy of the current permit;

f. A copy of the current operation and maintenance manual as required by Chapter 62-600, F.A.C.;

g. A copy of any required record drawings;

h. Copies of the licenses of the current certified operators;

i. Copies of the logs and schedules showing plant operations and equipment maintenance for three years from the date of the logs or schedules. The logs shall, at a minimum, include identification of the plant; the signature and license number of the operator(s) and the signature of the person(s) making any entries; date and time in and out; specific operation and maintenance activities, including any preventive maintenance or repairs made or requested; results of tests performed and samples taken, unless documented on a laboratory sheet; and notation of any notification or reporting completed in accordance with Rule 62-602.650(3), F.A.C. The logs shall be maintained on-site in a location accessible to 24-hour inspection, protected from weather damage, and current to the last operation and maintenance performed; and

j. Records of biosolids quantities, treatment, monitoring, and hauling for at least five years.

[62-620.350, 62-602.650, 62-640.650(4)]

VI. SCHEDULES

1. The following improvement actions shall be completed according to the following schedule:

Improvement Action	Completion Date
1. Prior to placing the Public Access Reuse System into operation the following items shall be submitted to the Department for review and approval: Ground Water Monitoring Plan, Operating Protocol	Prior to Placing the Public Access Reuse System into Operation

[62-620.320(6)]

2. Prior to placing the new facilities into operation or any individual unit processes into operation, for any purpose other than testing for leaks and equipment operation, the permittee shall complete and submit to the Department DEP Form 62-620.910(12), Notification of Completion of Construction for Wastewater Facilities or Activities. *[62-620.410(7) and 62-620.630(2)]*

3. The newly constructed Part III reuse system shall not be placed in service for any purpose without written approval from the Department. For projects identified in the permit as being constructed in phases, written permission is only required for the first phase. Application for approval shall be made to the Department on DEP Form 62-610.300(4)(a)3., Application for Permission to Place a Public Access Reuse System in Operation. *[62-610.800(7)]*

4. Within six months after a facility is placed in operation, the permittee shall provide written certification to the Department on Form 62-620.910(13) that record drawings pursuant to Chapter 62-600, F.A.C., and that an operation and maintenance manual pursuant to Chapters 62-600 and 62-610, F.A.C., as applicable, are available at the location specified on the form. *[62-620.410(6) and 62-620.630(7)]*

5. The permittee is not authorized to discharge to waters of the state after the expiration date of this permit, unless:

   a. The permittee has applied for renewal of this permit at least 180 days before the expiration date of this permit using the appropriate forms listed in Rule 62-620.910, F.A.C., and in the manner established in the Department of Environmental Protection Guide to Permitting Wastewater Facilities or Activities Under Chapter 62-620, F.A.C., including submittal of the appropriate processing fee set forth in Rule 62-4.050, F.A.C.; or

b. The permittee has made complete the application for renewal of this permit before the permit expiration date.

[62-620.335(1) - (4)]

VII. INDUSTRIAL PRETREATMENT PROGRAM REQUIREMENTS

1. This facility is not required to have a pretreatment program at this time. *[62-625.500]*

VIII. OTHER SPECIFIC CONDITIONS

1. The permittee shall comply with all conditions and requirements for reuse contained in their consumptive use permit issued by the Water Management District, if such requirements are consistent with Department rules. *[62-610.800(10)]*
2. In the event that the treatment facilities or equipment no longer function as intended, are no longer safe in terms of public health and safety, or odor, noise, aerosol drift, or lighting adversely affects neighboring developed areas at the levels prohibited by Rule 62-600.400(2)(a), F.A.C., corrective action (which may include additional maintenance or modifications of the permitted facilities) shall be taken by the permittee. Other corrective action may be required to ensure compliance with rules of the Department. Additionally, the treatment, management, use or land application of residuals shall not cause a violation of the odor prohibition in Rule 62-296.320(2), F.A.C. *[62-600.410(5) and 62-640.400(6)]*
3. The deliberate introduction of stormwater in any amount into collection/transmission systems designed solely for the introduction (and conveyance) of domestic/industrial wastewater; or the deliberate introduction of stormwater into collection/transmission systems designed for the introduction or conveyance of combinations of storm and domestic/industrial wastewater in amounts which may reduce the efficiency of pollutant removal by the treatment plant is prohibited, except as provided by Rule 62-610.472, F.A.C. *[62-604.130(3)]*
4. Collection/transmission system overflows shall be reported to the Department in accordance with Permit Condition IX. 20. *[62-604.550] [62-620.610(20)]*
5. The operating authority of a collection/transmission system and the permittee of a treatment plant are prohibited from accepting connections of wastewater discharges which have not received necessary pretreatment or which contain materials or pollutants (other than normal domestic wastewater constituents):
   a. Which may cause fire or explosion hazards; or
   b. Which may cause excessive corrosion or other deterioration of wastewater facilities due to chemical action or pH levels; or
   c. Which are solid or viscous and obstruct flow or otherwise interfere with wastewater facility operations or treatment; or
   d. Which result in the wastewater temperature at the introduction of the treatment plant exceeding $40^{o}C$ or otherwise inhibiting treatment; or
   e. Which result in the presence of toxic gases, vapors, or fumes that may cause worker health and safety problems.

   [62-604.130(5)]
6. The treatment facility, storage ponds for Part II systems, rapid infiltration basins, and/or infiltration trenches shall be enclosed with a fence or otherwise provided with features to discourage the entry of animals and unauthorized persons. *[62-600.400(2)(b)]*
7. Screenings and grit removed from the wastewater facilities shall be collected in suitable containers and hauled to a Department approved Class I landfill or to a landfill approved by the Department for receipt/disposal of screenings and grit. *[62-701.300(1)(a)]*
8. Where required by Chapter 471 or Chapter 492, F.S., applicable portions of reports that must be submitted under this permit shall be signed and sealed by a professional engineer or a professional geologist, as appropriate. *[62-620.310(4)]*

9. The permittee shall provide verbal notice to the Department's Central District Office as soon as practical after discovery of a sinkhole or other karst feature within an area for the management or application of wastewater, wastewater residuals (sludges), or reclaimed water. The permittee shall immediately implement measures appropriate to control the entry of contaminants, and shall detail these measures to the Department's Central District Office in a written report within 7 days of the sinkhole discovery. *[62-620.320(6)]*

10. The permittee shall provide notice to the Department of the following:
    a. Any new introduction of pollutants into the facility from an industrial discharger which would be subject to Chapter 403, F.S., and the requirements of Chapter 62-620, F.A.C., if it were directly discharging those pollutants; and
    b. Any substantial change in the volume or character of pollutants being introduced into that facility by a source which was identified in the permit application and known to be discharging at the time the permit was issued.

    Notice shall include information on the quality and quantity of effluent introduced into the facility and any anticipated impact of the change on the quantity or quality of effluent or reclaimed water to be discharged from the facility.

[62-620.625(2)]

IX. GENERAL CONDITIONS

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are binding and enforceable pursuant to Chapter 403, Florida Statutes. Any permit noncompliance constitutes a violation of Chapter 403, Florida Statutes, and is grounds for enforcement action, permit termination, permit revocation and reissuance, or permit revision. *[62-620.610(1)]*

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviations from the approved drawings, exhibits, specifications, or conditions of this permit constitutes grounds for revocation and enforcement action by the Department. *[62-620.610(2)]*

3. As provided in subsection 403.087(7), 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 authorize any infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit or authorization that may be required for other aspects of the total project which are not addressed in this permit. *[62-620.610(3)]*

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. *[62-620.610(4)]*

5. This permit does not relieve the permittee from liability and penalties 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; 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. The permittee shall take all reasonable steps to minimize or prevent any discharge, reuse of reclaimed water, or residuals use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. *[62-620.610(5)]*

6. If the permittee wishes to continue an activity regulated by this permit after its expiration date, the permittee shall apply for and obtain a new permit. *[62-620.610(6)]*

7. The permittee shall at all times 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. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to maintain or achieve compliance with the conditions of the permit. *[62-620.610(7)]*

8. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit revision, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition. *[62-620.610(8)]*

9. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, including an authorized representative of the Department and authorized EPA personnel, when applicable, upon presentation of credentials or other documents as may be required by law, and at reasonable times, depending upon the nature of the concern being investigated, to:
   a. Enter upon the permittee's premises where a regulated facility, system, or activity is located or conducted, or where records shall be kept under the conditions of this permit;
   b. Have access to and copy any records that shall be kept under the conditions of this permit;
   c. Inspect the facilities, equipment, practices, or operations regulated or required under this permit; and
   d. Sample or monitor any substances or parameters at any location necessary to assure compliance with this permit or Department rules.

   [62-620.610(9)]

10. 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 as such use is proscribed by Section 403.111, F.S., or Rule 62-620.302, F.A.C. Such evidence shall only be used to the extent that it is consistent with the Florida Rules of Civil Procedure and applicable evidentiary rules. *[62-620.610(10)]*

11. When requested by the Department, the permittee shall within a reasonable time provide any information required by law which is needed to determine whether there is cause for revising, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The permittee shall also provide to the Department upon request copies of records required by this permit to be kept. If the permittee becomes aware of relevant facts that were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be promptly submitted or corrections promptly reported to the Department. *[62-620.610(11)]*

12. Unless specifically stated otherwise in Department rules, the permittee, in accepting this permit, 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, F.A.C., shall include a reasonable time to obtain or be denied a mixing zone for the new or amended standard. *[62-620.610(12)]*

13. The permittee, in accepting this permit, agrees to pay the applicable regulatory program and surveillance fee in accordance with Rule 62-4.052, F.A.C. *[62-620.610(13)]*

14. This permit is transferable only upon Department approval in accordance with Rule 62-620.340, F.A.C. The permittee shall be liable for any noncompliance of the permitted activity until the transfer is approved by the Department. *[62-620.610(14)]*

15. The permittee shall give the Department written notice at least 60 days before inactivation or abandonment of a wastewater facility or activity and shall specify what steps will be taken to safeguard public health and safety during and following inactivation or abandonment. *[62-620.610(15)]*

16. The permittee shall apply for a revision to the Department permit in accordance with Rules 62-620.300, F.A.C., and the Department of Environmental Protection Guide to Permitting Wastewater Facilities or Activities Under Chapter 62-620, F.A.C., at least 90 days before construction of any planned substantial modifications to the permitted facility is to commence or with Rule 62-620.325(2), F.A.C., for minor modifications to the permitted facility. A revised permit shall be obtained before construction begins except as provided in Rule 62-620.300, F.A.C. *[62-620.610(16)]*

17. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. The permittee shall be responsible for any and all damages which may result from the changes and may be subject to enforcement action by the Department for penalties or revocation of this permit. The notice shall include the following information:
   a. A description of the anticipated noncompliance;
   b. The period of the anticipated noncompliance, including dates and times; and
   c. Steps being taken to prevent future occurrence of the noncompliance.

   [62-620.610(17)]

18. Sampling and monitoring data shall be collected and analyzed in accordance with Rule 62-4.246 and Chapters 62-160, 62-601, and 62-610, F.A.C., and 40 CFR 136, as appropriate.

    a. Monitoring results shall be reported at the intervals specified elsewhere in this permit and shall be reported on a Discharge Monitoring Report (DMR), DEP Form 62-620.910(10), or as specified elsewhere in the permit.

    b. If the permittee monitors any contaminant more frequently than required by the permit, using Department approved test procedures, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

    c. Calculations for all limitations which require averaging of measurements shall use an arithmetic mean unless otherwise specified in this permit.

    d. Except as specifically provided in Rule 62-160.300, F.A.C., any laboratory test required by this permit shall be performed by a laboratory that has been certified by the Department of Health Environmental Laboratory Certification Program (DOH ELCP). Such certification shall be for the matrix, test method and analyte(s) being measured to comply with this permit. For domestic wastewater facilities, testing for parameters listed in Rule 62-160.300(4), F.A.C., shall be conducted under the direction of a certified operator.

    e. Field activities including on-site tests and sample collection shall follow the applicable standard operating procedures described in DEP-SOP-001/01 adopted by reference in Chapter 62-160, F.A.C.

    f. Alternate field procedures and laboratory methods may be used where they have been approved in accordance with Rules 62-160.220, and 62-160.330, F.A.C.

    [62-620.610(18)]

19. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule detailed elsewhere in this permit shall be submitted no later than 14 days following each schedule date. *[62-620.610(19)]*

20. The permittee shall report to the Department's Central District Office any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the permittee becomes aware of the circumstances. The written submission shall contain: a description of the noncompliance and its cause; the period of noncompliance including exact dates and time, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

    a. The following shall be included as information which must be reported within 24 hours under this condition:
        (1) Any unanticipated bypass which causes any reclaimed water or effluent to exceed any permit limitation or results in an unpermitted discharge,
        (2) Any upset which causes any reclaimed water or the effluent to exceed any limitation in the permit,
        (3) Violation of a maximum daily discharge limitation for any of the pollutants specifically listed in the permit for such notice, and
        (4) Any unauthorized discharge to surface or ground waters.

    b. Oral reports as required by this subsection shall be provided as follows:
        (1) For unauthorized releases or spills of treated or untreated wastewater reported pursuant to subparagraph (a)4. that are in excess of 1,000 gallons per incident, or where information indicates that public health or the environment will be endangered, oral reports shall be provided to the STATE WATCH OFFICE TOLL FREE NUMBER (800) 320-0519, as soon as practical, but no later than 24 hours from the time the permittee becomes aware of the discharge. The permittee, to the extent known, shall provide the following information to the State Watch Office:
            (a) Name, address, and telephone number of person reporting;
            (b) Name, address, and telephone number of permittee or responsible person for the discharge;
            (c) Date and time of the discharge and status of discharge (ongoing or ceased);
            (d) Characteristics of the wastewater spilled or released (untreated or treated, industrial or domestic wastewater);

(e) Estimated amount of the discharge;
(f) Location or address of the discharge;
(g) Source and cause of the discharge;
(h) Whether the discharge was contained on-site, and cleanup actions taken to date;
(i) Description of area affected by the discharge, including name of water body affected, if any; and
(j) Other persons or agencies contacted.

(2) Oral reports, not otherwise required to be provided pursuant to subparagraph b.1 above, shall be provided to the Department's Central District Office within 24 hours from the time the permittee becomes aware of the circumstances.

c. If the oral report has been received within 24 hours, the noncompliance has been corrected, and the noncompliance did not endanger health or the environment, the Department's Central District Office shall waive the written report.

[62-620.610(20)]

21. The permittee shall report all instances of noncompliance not reported under Permit Conditions IX.17., IX.18., or IX.19. of this permit at the time monitoring reports are submitted. This report shall contain the same information required by Permit Condition IX.20. of this permit. *[62-620.610(21)]*

22. Bypass Provisions.

a. "Bypass" means the intentional diversion of waste streams from any portion of a treatment works.

b. Bypass is prohibited, and the Department may take enforcement action against a permittee for bypass, unless the permittee affirmatively demonstrates that:
(1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage; and
(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
(3) The permittee submitted notices as required under Permit Condition IX.22.c. of this permit.

c. If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least 10 days before the date of the bypass. The permittee shall submit notice of an unanticipated bypass within 24 hours of learning about the bypass as required in Permit Condition IX.20. of this permit. A notice shall include a description of the bypass and its cause; the period of the bypass, including exact dates and times; if the bypass has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.

d. The Department shall approve an anticipated bypass, after considering its adverse effect, if the permittee demonstrates that it will meet the three conditions listed in Permit Condition IX.22.b.(1) through (3) of this permit.

e. A permittee may allow any bypass to occur which does not cause reclaimed water or effluent limitations to be exceeded if it is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Permit Condition IX.22.b. through d. of this permit.

[62-620.610(22)]

23. Upset Provisions.

a. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based effluent limitations because of factors beyond the reasonable control of the permittee.
(1) An upset does not include noncompliance caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, careless or improper operation.
(2) An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of upset provisions of Rule 62-620.610, F.A.C., are met.

b. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed contemporaneous operating logs, or other relevant evidence that:
   (1) An upset occurred and that the permittee can identify the cause(s) of the upset;
   (2) The permitted facility was at the time being properly operated;
   (3) The permittee submitted notice of the upset as required in Permit Condition IX.20. of this permit; and
   (4) The permittee complied with any remedial measures required under Permit Condition IX.5. of this permit.

c. In any enforcement proceeding, the burden of proof for establishing the occurrence of an upset rests with the permittee.

d. Before an enforcement proceeding is instituted, no representation made during the Department review of a claim that noncompliance was caused by an upset is final agency action subject to judicial review.

[62-620.610(23)]

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

_____
Nathan Hess
Program Administrator
Permitting and Waste Clean Up Section

Permit Issuance Date: November 30, 2018

Attachment(s):
Discharge Monitoring Report
"Pathogen Monitoring" Form

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, 3319 Maguire Blvd, Suite 232, Orlando, FL 32803-3767

PERMITTEE NAME:	City of Palm Bay,	PERMIT NUMBER:	FLA693782-002-DW1P	**Effective Date of DMR**	**TBD**
MAILING ADDRESS:	120 Malabar Rd SE			**Expiration Date**	**April 25, 2021**
	Palm Bay, Florida 32907-3009	LIMIT:	Final	REPORT FREQUENCY:	Monthly
		CLASS SIZE:	N/A	PROGRAM:	Domestic
FACILITY:	Palm Bay South Regional WRF	MONITORING GROUP NUMBER:	R-001		
LOCATION:	250 Osmosis Dr SE	MONITORING GROUP DESCRIPTION:	Public Access Reuse, with Influent		
	Palm Bay, FL 32909	RE-SUBMITTED DMR: ☐			
		NO DISCHARGE FROM SITE: ☐			
COUNTY:	Brevard	MONITORING PERIOD From:	_____ To: _____		
OFFICE:	Central District				

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Flow	Sample Measurement										
PARM Code 50050 Y Mon. Site No. FLW-3	Permit Requirement		0.66 (An.Avg.)	MGD						Continuous	Flow Totalizer
Flow	Sample Measurement										
PARM Code 50050 1 Mon. Site No. FLW-3	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 Y Mon. Site No. EFA-1	Permit Requirement					20.0 (An.Avg.)		mg/L		Weekly	16-hr FPC
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 A Mon. Site No. EFA-1	Permit Requirement				60.0 (Max.)	45.0 (Max.Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		Weekly	16-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 B Mon. Site No. EFB-1	Permit Requirement						5.0 (Max.)	mg/L		Daily; 24 hours	Grab
Coliform, Fecal	Sample Measurement										
PARM Code 74055 A Mon. Site No. EFA-1	Permit Requirement						25 (Max.)	#/100mL		Daily; 24 hours	Grab

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

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

ISSUANCE/REISSUANCE DATE: November 30, 2018
DMR EFFECTIVE DATE: 1st day of the 2nd month following completion of construction - Permit expiration
DEP Form 62-620.910(10), Effective Nov. 29, 1994

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Palm Bay South Regional WRF MONITORING GROUP NUMBER: R-001 PERMIT NUMBER: FLA693782-002-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Coliform, Fecal, % less than detection	Sample Measurement										
PARM Code 51005 A Mon. Site No. EFA-1	Permit Requirement				75 (Min.Mo.Total)			percent		Daily; 24 hours	Calculated
pH	Sample Measurement										
PARM Code 00400 A Mon. Site No. EFA-1	Permit Requirement				6.0 (Min.)		8.5 (Max.)	s.u.		Continuous	Meter
Chlorine, Total Residual (For Disinfection)	Sample Measurement										
PARM Code 50060 A Mon. Site No. EFA-1	Permit Requirement				1.0 (Min.)			mg/L		Continuous	Meter
Turbidity	Sample Measurement										
PARM Code 00070 B Mon. Site No. EFB-1	Permit Requirement						Report (Max.)	NTU		Continuous	Meter
Nitrogen, Total	Sample Measurement										
PARM Code 00600 Y Mon. Site No. EFA-1	Permit Requirement					Report (An.Avg.)		mg/L		Weekly	16-hr FPC
Nitrogen, Total	Sample Measurement										
PARM Code 00600 A Mon. Site No. EFA-1	Permit Requirement						Report (Mo.Avg.)	mg/L		Weekly	16-hr FPC
Phosphorus, Total (as P)	Sample Measurement										
PARM Code 00665 Y Mon. Site No. EFA-1	Permit Requirement					Report (An.Avg.)		mg/L		Weekly	16-hr FPC
Phosphorus, Total (as P)	Sample Measurement										
PARM Code 00665 A Mon. Site No. EFA-1	Permit Requirement						Report (Mo.Avg.)	mg/L		Weekly	16-hr FPC
Flow (Total through plant)	Sample Measurement										
PARM Code 50050 P Mon. Site No. FLW-1	Permit Requirement		2.0 (An.Avg.)	MGD						Continuous	Flow Totalizer
Flow (Total through plant)	Sample Measurement										
PARM Code 50050 Q Mon. Site No. FLW-1	Permit Requirement	Report (Qt.Avg.)	Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Palm Bay South Regional WRF MONITORING GROUP NUMBER: R-001 PERMIT NUMBER: FLA693782-002-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Percent Capacity, (TMADF/Permitted Capacity) x 100	Sample Measurement										
PARM Code 00180 1 Mon. Site No. FLW-1	Permit Requirement						Report (Mo.Avg.)	percent		Monthly	Calculated
BOD, Carbonaceous 5 day, 20C (Influent)	Sample Measurement										
PARM Code 80082 G Mon. Site No. INF-1	Permit Requirement						Report (Max.)	mg/L		Weekly	16-hr FPC
Solids, Total Suspended (Influent)	Sample Measurement										
PARM Code 00530 G Mon. Site No. INF-1	Permit Requirement						Report (Max.)	mg/L		Weekly	16-hr FPC

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, 3319 Maguire Blvd, Suite 232, Orlando, FL 32803-3767

PERMITTEE NAME: Palm Bay, City of
MAILING ADDRESS: 120 Malabar Rd SE
Palm Bay, Florida 32907-3009

FACILITY: Palm Bay South Regional WRF
LOCATION: 250 Osmosis Dr SE
Palm Bay, FL 32909

COUNTY: Brevard
OFFICE: Central District

PERMIT NUMBER: FLA693782-002-DW1P

LIMIT: Final
CLASS SIZE: N/A
MONITORING GROUP NUMBER: U-001
MONITORING GROUP DESCRIPTION: Underground Injection Well
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Flow (Total to UIC well)	Sample Measurement										
PARM Code 50050 Y Mon. Site No. FLW-2	Permit Requirement		7.0 (An.Avg.)	MGD						Continuous	Flow Totalizer
Flow (Total to UIC well)	Sample Measurement										
PARM Code 50050 1 Mon. Site No. FLW-2	Permit Requirement		Report (Mo.Avg.)	MGD						Continuous	Flow Totalizer
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 Y Mon. Site No. EFA-1	Permit Requirement					20.0 (An.Avg.)		mg/L		Weekly	16-hr FPC
BOD, Carbonaceous 5 day, 20C	Sample Measurement										
PARM Code 80082 A Mon. Site No. EFA-1	Permit Requirement				60.0 (Max.)	45.0 (Max.Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		Weekly	16-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 Y Mon. Site No. EFA-1	Permit Requirement					20.0 (An.Avg.)		mg/L		Weekly	16-hr FPC
Solids, Total Suspended	Sample Measurement										
PARM Code 00530 A Mon. Site No. EFA-1	Permit Requirement				60.0 (Max.)	45.0 (Max.Wk.Avg.)	30.0 (Mo.Avg.)	mg/L		Weekly	16-hr FPC

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

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Palm Bay South Regional WRF

MONITORING GROUP NUMBER: U-001

PERMIT NUMBER: FLA693782-002-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
pH	Sample Measurement										
PARM Code 00400 A Mon. Site No. EFA-1	Permit Requirement				6.0 (Min.)		8.5 (Max.)	s.u.		Continuous	Meter

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, 3319 Maguire Blvd, Suite 232, Orlando, FL 32803-3767

PERMITTEE NAME:	Palm Bay, City of	PERMIT NUMBER:	FLA693782-002-DW1P		
MAILING ADDRESS:	120 Malabar Rd SE				
	Palm Bay, Florida 32907-3009	LIMIT:	Final	REPORT FREQUENCY:	Monthly
		CLASS SIZE:	N/A	PROGRAM:	Domestic
FACILITY:	Palm Bay South Regional WRF	MONITORING GROUP NUMBER:	RMP-Q		
LOCATION:	250 Osmosis Dr SE	MONITORING GROUP DESCRIPTION:	Biosolids Quantity		
	Palm Bay, FL 32909-	RE-SUBMITTED DMR: ☐			
		NO DISCHARGE FROM SITE: ☐			
COUNTY:	Brevard	MONITORING PERIOD From:	_____ To:	_____	
OFFICE:	Central District				

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Biosolids Quantity (Transferred)	Sample Measurement										
PARM Code B0007 + Mon. Site No. RMP-1	Permit Requirement		Report (Mo.Total)	dry tons						Monthly	Calculated
Biosolids Quantity (Landfilled)	Sample Measurement										
PARM Code B0008 + Mon. Site No. RMP-1	Permit Requirement		Report (Mo.Total)	dry tons						Monthly	Calculated

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

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, 3319 Maguire Blvd, Suite 232, Orlando, FL 32803-3767

PERMITTEE NAME: Palm Bay, City of
MAILING ADDRESS: 120 Malabar Rd SE
Palm Bay, Florida 32907-3009

FACILITY: Palm Bay South Regional WRF
LOCATION: 250 Osmosis Dr SE
Palm Bay, FL 32909

COUNTY: Brevard
OFFICE: Central District

PERMIT NUMBER: FLA693782-002-DW1P

LIMIT: Final
CLASS SIZE: N/A
REPORT FREQUENCY: Annually
PROGRAM: Domestic
MONITORING GROUP NUMBER: RWS-A
MONITORING GROUP DESCRIPTION: Annual Reclaimed Water or Effluent Analysis
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING NOT REQUIRED: ☐
MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Antimony, Total Recoverable (GWS = 6)*	Sample Measurement										
PARM Code 01268 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Arsenic, Total Recoverable (GWS = 10)	Sample Measurement										
PARM Code 00978 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Barium, Total Recoverable (GWS = 2,000)	Sample Measurement										
PARM Code 01009 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Beryllium, Total Recoverable (GWS = 4)	Sample Measurement										
PARM Code 00998 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Cadmium, Total Recoverable (GWS = 5)	Sample Measurement										
PARM Code 01113 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Chromium, Total Recoverable (GWS =100)	Sample Measurement										
PARM Code 01118 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC

*GROUND WATER STANDARD (GWS) FOR REFERENCE AND REVIEW ONLY.

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

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Palm Bay South Regional WRF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLA693782-002-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Cyanide, Free (amen. to chlorination)(GWS = 200)	Sample Measurement										
PARM Code 00722 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Fluoride, Total (as F) (GWS = 4.0/2.0)	Sample Measurement										
PARM Code 00951 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Lead, Total Recoverable (GWS = 15)	Sample Measurement										
PARM Code 01114 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Mercury, Total Recoverable (GWS = 2)	Sample Measurement										
PARM Code 71901 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Nickel, Total Recoverable (GWS = 100)	Sample Measurement										
PARM Code 01074 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Nitrogen, Nitrate, Total (as N) (GWS = 10)	Sample Measurement										
PARM Code 00620 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Nitrogen, Nitrite, Total (as N) (GWS = 1)	Sample Measurement										
PARM Code 00615 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Nitrite plus Nitrate, Total 1 det. (as N)(GWS = 10)	Sample Measurement										
PARM Code 00630 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Selenium, Total Recoverable (GWS =50)	Sample Measurement										
PARM Code 00981 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Sodium, Total Recoverable (GWS = 160)	Sample Measurement										
PARM Code 00923 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Palm Bay South Regional WRF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLA693782-002-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Thallium, Total Recoverable (GWS = 2)	Sample Measurement										
PARM Code 00982 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
1,1-dichloroethylene (GWS = 7)	Sample Measurement										
PARM Code 34501 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,1,1-trichloroethane (GWS = 200)	Sample Measurement										
PARM Code 34506 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,1,2-trichloroethane (GWS = 5)	Sample Measurement										
PARM Code 34511 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2-dichloroethane (GWS = 3)	Sample Measurement										
PARM Code 32103 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2-dichloropropane (GWS = 5)	Sample Measurement										
PARM Code 34541 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2,4-trichlorobenzene (GWS = 70)	Sample Measurement										
PARM Code 34551 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Benzene (GWS = 1)	Sample Measurement										
PARM Code 34030 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Carbon tetrachloride (GWS = 3)	Sample Measurement										
PARM Code 32102 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Cis-1,2-dichloroethene (GWS = 70)	Sample Measurement										
PARM Code 81686 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Palm Bay South Regional WRF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLA693782-002-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Dichloromethane (methylene chloride)(GWS = 5)	Sample Measurement										
PARM Code 03821 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Ethylbenzene (GWS = 700)	Sample Measurement										
PARM Code 34371 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Monochlorobenzene (GWS = 100)	Sample Measurement										
PARM Code 34031 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2-dichlorobenzene (GWS = 600)	Sample Measurement										
PARM Code 34536 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,4-dichlorobenzene (GWS = 75)	Sample Measurement										
PARM Code 34571 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Styrene, Total (GWS = 100)	Sample Measurement										
PARM Code 77128 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Tetrachloroethylene (GWS = 3)	Sample Measurement										
PARM Code 34475 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Toluene (GWS = 1,000)	Sample Measurement										
PARM Code 34010 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
1,2-trans-dichloroethylene (GWS = 100)	Sample Measurement										
PARM Code 34546 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Trichloroethylene (GWS = 3)	Sample Measurement										
PARM Code 39180 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Palm Bay South Regional WRF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLA693782-002-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Vinyl chloride (GWS = 1)	Sample Measurement										
PARM Code 39175 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Xylenes (GWS = 10,000)	Sample Measurement										
PARM Code 81551 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
2,3,7,8-tetrachlorodibenzo-p-dioxin(GWS = 3x10^-5)	Sample Measurement										
PARM Code 34675 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
2,4-dichlorophenoxyacetic acid (GWS = 70)	Sample Measurement										
PARM Code 39730 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Silvex (GWS = 50)	Sample Measurement										
PARM Code 39760 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Alachlor (GWS = 2)	Sample Measurement										
PARM Code 39161 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Atrazine (GWS = 3)	Sample Measurement										
PARM Code 39033 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Benzo(a)pyrene (GWS = 0.2)	Sample Measurement										
PARM Code 34247 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Carbofuran (GWS = 40)	Sample Measurement										
PARM Code 81405 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Chlordane (tech mix. and metabolites)(GWS = 2)	Sample Measurement										
PARM Code 39350 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Palm Bay South Regional WRF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLA693782-002-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Dalapon (GWS = 200)	Sample Measurement										
PARM Code 38432 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Bis(2-ethylhexyl)adipate (GWS = 400)	Sample Measurement										
PARM Code 77903 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Bis (2-ethylhexyl) phthalate (GWS = 6)	Sample Measurement										
PARM Code 39100 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Dibromochloropropane (DBCP) (GWS = 0.2)	Sample Measurement										
PARM Code 82625 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Dinoseb (GWS = 7)	Sample Measurement										
PARM Code 30191 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Diquat (GWS = 20)	Sample Measurement										
PARM Code 04443 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Endothall (GWS = 100)	Sample Measurement										
PARM Code 38926 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Endrin (GWS = 2)	Sample Measurement										
PARM Code 39390 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Ethylene dibromide (1,2-dibromoethane)(GWS = 0.02)	Sample Measurement										
PARM Code 77651 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	Grab
Glyphosate (GWS = 0.7)	Sample Measurement										
PARM Code 79743 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Palm Bay South Regional WRF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLA693782-002-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Heptachlor (GWS = 0.4)	Sample Measurement										
PARM Code 39410 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Heptachlor epoxide (GWS = 0.2)	Sample Measurement										
PARM Code 39420 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Hexachlorobenzene (GWS = 1)	Sample Measurement										
PARM Code 39700 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Hexachlorocyclopentadiene (GWS = 50)	Sample Measurement										
PARM Code 34386 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Gamma BHC (Lindane) (GWS = 0.2)	Sample Measurement										
PARM Code 39782 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Methoxychlor (GWS = 40)	Sample Measurement										
PARM Code 39480 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Oxamyl (vydate) (GWS = 200)	Sample Measurement										
PARM Code 38865 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Pentachlorophenol (GWS = 1)	Sample Measurement										
PARM Code 39032 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Picloram (GWS = 500)	Sample Measurement										
PARM Code 39720 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Polychlorinated Biphenyls (PCBs)(GWS = 0.5)	Sample Measurement										
PARM Code 39516 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Palm Bay South Regional WRF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLA693782-002-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Simazine (GWS = 4)	Sample Measurement										
PARM Code 39055 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Toxaphene (GWS = 3)	Sample Measurement										
PARM Code 39400 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Trihalomethane, Total by summation(GWS = 0.080)	Sample Measurement										
PARM Code 82080 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	Grab
Radium 226 + Radium 228, Total (GWS = 5)	Sample Measurement										
PARM Code 11503 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	pCi/L		Annually	24-hr FPC
Alpha, Gross Particle Activity (GWS = 15)	Sample Measurement										
PARM Code 80045 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	pCi/L		Annually	24-hr FPC
Aluminum, Total Recoverable (GWS = 0.2)	Sample Measurement										
PARM Code 01104 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Chloride (as Cl) (GWS = 250)	Sample Measurement										
PARM Code 00940 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Iron, Total Recoverable (GWS = 0.3)	Sample Measurement										
PARM Code 00980 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Copper, Total Recoverable (GWS = 1,000)	Sample Measurement										
PARM Code 01119 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Manganese, Total Recoverable (GWS = 50)	Sample Measurement										
PARM Code 11123 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: Palm Bay South Regional WRF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLA693782-002-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Silver, Total Recoverable (GWS = 100)	Sample Measurement										
PARM Code 01079 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
Sulfate, Total (GWS = 250)	Sample Measurement										
PARM Code 00945 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Zinc, Total Recoverable (GWS = 5,000)	Sample Measurement										
PARM Code 01094 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L		Annually	24-hr FPC
pH (GWS = 6.5-8.5)	Sample Measurement										
PARM Code 00400 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	s.u.		Annually	Grab
Solids, Total Dissolved (TDS) (GWS = 500)	Sample Measurement										
PARM Code 70295 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC
Foaming Agents (GWS = 0.5)	Sample Measurement										
PARM Code 01288 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L		Annually	24-hr FPC

DAILY SAMPLE RESULTS - PART B

Permit Number: FLA693782-002-DW1P Facility: Palm Bay South Regional WRF
Monitoring Period From: _____ To: _____

	BOD, Carbonaceous 5 day, 20C mg/L	Chlorine, Total Residual (For Disinfection) mg/L	Coliform, Fecal #/100mL	Nitrogen, Total mg/L	Phosphorus, Total (as P) mg/L	Solids, Total Suspended mg/L	pH s.u. (Min.)	pH s.u. (Max.)	Solids, Total Suspended mg/L
Code	80082	50060	74055	00600	00665	00530	00400	00400	00530
Mon. Site	EFA-1	EFA-1	EFA-1	EFA-1	EFA-1	EFA-1	EFA-1	EFA-1	EFB-1
1									
2									
3									
4									
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25									
26									
27									
28									
29									
30									
31									
Total									
Mo. Avg.									

PLANT STAFFING:

Day Shift Operator Class: _____ Certificate No: _____ Name: _____

Evening Shift Operator Class: _____ Certificate No: _____ Name: _____

Night Shift Operator Class: _____ Certificate No: _____ Name: _____

Lead Operator Class: _____ Certificate No: _____ Name: _____

DAILY SAMPLE RESULTS - PART B

Permit Number: FLA693782-002-DW1P Facility: Palm Bay South Regional WRF
Monitoring Period From: _____ To: _____

	Turbidity NTU	Flow (Total through plant) MGD	Flow (Total to UIC well) MGD	Flow MGD	BOD, Carbonaceous 5 day, 20C (Influent) mg/L	Solids, Total Suspended (Influent) mg/L			
Code	00070	50050	50050	50050	80082	00530			
Mon. Site	EFB-1	FLW-1	FLW-2	FLW-3	INF-1	INF-1			
1									
2									
3									
4									
5									
6									
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28									
29									
30									
31									
Total									
Mo. Avg.									

PLANT STAFFING:

Day Shift Operator Class: _____ Certificate No: _____ Name: _____

Evening Shift Operator Class: _____ Certificate No: _____ Name: _____

Night Shift Operator Class: _____ Certificate No: _____ Name: _____

Lead Operator Class: _____ Certificate No: _____ Name: _____

INSTRUCTIONS FOR COMPLETING THE WASTEWATER DISCHARGE MONITORING REPORT

Read these instructions before completing the DMR. Hard copies and/or electronic copies of the required parts of the DMR were provided with the permit. All required information shall be completed in full and typed or printed in ink. A signed, original DMR shall be mailed to the address printed on the DMR by the 28th of the month following the monitoring period. Facilities who submit their DMR(s) electronically through eDMR do not need to submit a hardcopy DMR. The DMR shall not be submitted before the end of the monitoring period.

The DMR consists of three parts--A, B, and D--all of which may or may not be applicable to every facility. Facilities may have one or more Part A's for reporting effluent or reclaimed water data. All domestic wastewater facilities will have a Part B for reporting daily sample results. Part D is used for reporting ground water monitoring well data.

When results are not available, the following codes should be used on parts A and D of the DMR and an explanation provided where appropriate. Note: Codes used on Part B for raw data are different.

CODE	DESCRIPTION/INSTRUCTIONS
ANC	Analysis not conducted.
DRY	Dry Well
FLD	Flood disaster.
IFS	Insufficient flow for sampling.
LS	Lost sample.
MNR	Monitoring not required this period.

CODE	DESCRIPTION/INSTRUCTIONS
NOD	No discharge from/to site.
OPS	Operations were shutdown so no sample could be taken.
OTH	Other. Please enter an explanation of why monitoring data were not available.
SEF	Sampling equipment failure.

When reporting analytical results that fall below a laboratory's reported method detection limits or practical quantification limits, the following instructions should be used, unless indicated otherwise in the permit or on the DMR:

1. Results greater than or equal to the PQL shall be reported as the measured quantity.
2. Results less than the PQL and greater than or equal to the MDL shall be reported as the laboratory's MDL value. These values shall be deemed equal to the MDL when necessary to calculate an average for that parameter and when determining compliance with permit limits.
3. Results less than the MDL shall be reported by entering a less than sign ("<") followed by the laboratory's MDL value, e.g. < 0.001. A value of one-half the MDL or one-half the effluent limit, whichever is lower, shall be used for that sample when necessary to calculate an average for that parameter. Values less than the MDL are considered to demonstrate compliance with an effluent limitation.

PART A -DISCHARGE MONITORING REPORT (DMR)

Part A of the DMR is comprised of one or more sections, each having its own header information. Facility information is preprinted in the header as well as the monitoring group number, whether the limits and monitoring requirements are interim or final, and the required submittal frequency (e.g. monthly, annually, quarterly, etc.). Submit Part A based on the required reporting frequency in the header and the instructions shown in the permit. The following should be completed by the permittee or authorized representative:

Resubmitted DMR: Check this box if this DMR is being re-submitted because there was information missing from or information that needed correction on a previously submitted DMR. The information that is being revised should be clearly noted on the re-submitted DMR (e.g. highlight, circle, etc.)
No Discharge From Site: Check this box if no discharge occurs and, as a result, there are no data or codes to be entered for all of the parameters on the DMR for the entire monitoring group number; however, if the monitoring group includes other monitoring locations (e.g., influent sampling), the "NOD" code should be used to individually denote those parameters for which there was no discharge.
Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Sample Measurement: Before filling in sample measurements in the table, check to see that the data collected correspond to the limit indicated on the DMR (i.e. interim or final) and that the data correspond to the monitoring group number in the header. Enter the data or calculated results for each parameter on this row in the non-shaded area above the limit. Be sure the result being entered corresponds to the appropriate statistical base code (e.g. annual average, monthly average, single sample maximum, etc.) and units. Data qualifier codes are not to be reported on Part A.
No. Ex.: Enter the number of sample measurements during the monitoring period that exceeded the permit limit for each parameter in the non-shaded area. If none, enter zero.
Frequency of Analysis: The shaded areas in this column contain the minimum number of times the measurement is required to be made according to the permit. Enter the actual number of times the measurement was made in the space above the shaded area.
Sample Type: The shaded areas in this column contain the type of sample (e.g. grab, composite, continuous) required by the permit. Enter the actual sample type that was taken in the space above the shaded area.
Signature: This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.
Comment and Explanation of Any Violations: Use this area to explain any exceedances, any upset or by-pass events, or other items which require explanation. If more space is needed, reference all attachments in this area.

PART B - DAILY SAMPLE RESULTS

Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Daily Monitoring Results: Transfer all analytical data from your facility's laboratory or a contract laboratory's data sheets for all day(s) that samples were collected. Record the data in the units indicated. Table 1 in Chapter 62-160, F.A.C., contains a complete list of all the data qualifier codes that your laboratory may use when reporting analytical results. However, when transferring numerical results onto Part B of the DMR, only the following data qualifier codes should be used and an explanation provided where appropriate.

CODE	DESCRIPTION/INSTRUCTIONS
<	The compound was analyzed for but not detected.
A	Value reported is the mean (average) of two or more determinations.
J	Estimated value, value not accurate.
Q	Sample held beyond the actual holding time.
Y	Laboratory analysis was from an unpreserved or improperly preserved sample.

To calculate the monthly average, add each reported value to get a total. For flow, divide this total by the number of days in the month. For all other parameters, divide the total by the number of observations.
Plant Staffing: List the name, certificate number, and class of all state certified operators operating the facility during the monitoring period. Use additional sheets as necessary.

PART D - GROUND WATER MONITORING REPORT

Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Date Sample Obtained: Enter the date the sample was taken. Also, check whether or not the well was purged before sampling.
Time Sample Obtained: Enter the time the sample was taken.
Sample Measurement: Record the results of the analysis. If the result was below the minimum detection limit, indicate that. Data qualifier codes are not to be reported on Part D.
Detection Limits: Record the detection limits of the analytical methods used.
Analysis Method: Indicate the analytical method used. Record the method number from Chapter 62-160 or Chapter 62-601, F.A.C., or from other sources.
Sampling Equipment Used: Indicate the procedure used to collect the sample (e.g. airlift, bucket/bailer, centrifugal pump, etc.)
Samples Filtered: Indicate whether the sample obtained was filtered by laboratory (L), filtered in field (F), or unfiltered (N).
Signature: This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.
Comments and Explanation: Use this space to make any comments on or explanations of results that are unexpected. If more space is needed, reference all attachments in this area.

SPECIAL INSTRUCTIONS FOR LIMITED WET WEATHER DISCHARGES

Flow (Limited Wet Weather Discharge): Enter the measured average flow rate during the period of discharge or divide gallons discharged by duration of discharge (converted into days). Record in million gallons per day (MGD).
Flow (Upstream): Enter the average flow rate in the receiving stream upstream from the point of discharge for the period of discharge. The average flow rate can be calculated based on two measurements; one made at the start and one made at the end of the discharge period. Measurements are to be made at the upstream gauging station described in the permit.
Actual Stream Dilution Ratio: To calculate the Actual Stream Dilution Ratio, divide the average upstream flow rate by the average discharge flow rate. Enter the Actual Stream Dilution Ratio accurate to the nearest 0.1.
No. of Days the SDF > Stream Dilution Ratio: For each day of discharge, compare the minimum Stream Dilution Factor (SDF) from the permit to the calculated Stream Dilution Ratio. On Part B of the DMR, enter an asterisk (*) if the SDF is greater than the Stream Dilution Ratio on any day of discharge. On Part A of the DMR, add up the days with an "*" and record the total number of days the Stream Dilution Factor was greater than the Stream Dilution Ratio.
$CBOD_5$: Enter the average $CBOD_5$ of the reclaimed water discharged during the period shown in duration of discharge.
TKN: Enter the average TKN of the reclaimed water discharged during the period shown in duration of discharge.
Actual Rainfall: Enter the actual rainfall for each day on Part B. Enter the actual cumulative rainfall to date for this calendar year and the actual total monthly rainfall on Part A. The cumulative rainfall to date for this calendar year is the total amount of rain, in inches, that has been recorded since January 1 of the current year through the month for which this DMR contains data.
Rainfall During Average Rainfall Year: On Part A, enter the total monthly rainfall during the average rainfall year and the cumulative rainfall for the average rainfall year. The cumulative rainfall for the average rainfall year is the amount of rain, in inches, which fell during the average rainfall year from January through the month for which this DMR contains data.
No. of Days LWWD Activated During Calendar Year: Enter the cumulative number of days that the limited wet weather discharge was activated since January 1 of the current year.
Reason for Discharge: Attach to the DMR a brief explanation of the factors contributing to the need to activate the limited wet weather discharge.

STATEMENT OF BASIS FOR
STATE OF FLORIDA DOMESTIC WASTEWATER FACILITY PERMIT

PERMIT NUMBER: FLA693782-002

FACILITY NAME: Palm Bay South Regional WRF

FACILITY LOCATION: 250 Osmosis Dr SE, Palm Bay, FL 32909
Brevard County

NAME OF PERMITTEE: Palm Bay, City of

PERMIT WRITER: Dennise Judy

1. SUMMARY OF APPLICATION

a. Chronology of Application

Application Number: FLA693782-003-DW1P
Application Submittal Date: October 5, 2018

b. Type of Facility

Domestic Wastewater Treatment Plant
Ownership Type: Municipal
SIC Code: 4952

c. Facility Capacity

Existing Permitted Capacity:	2.0 mgd Annual Average Daily Flow
Proposed Increase in Permitted Capacity:	0 mgd Annual Average Daily Flow
Proposed Total Permitted Capacity:	2.0 mgd Annual Average Daily Flow

d. Description of Wastewater Treatment

The previously permitted new 2.0 million gallons per day (MGD) annual average daily flow (AADF) permitted capacity activated sludge domestic wastewater treatment plant is being modified prior to construction. The capacity and type of treatment are the same as previously permitted.

This revised permit authorizes the construction of the modified treatment plant as follows:

- Elimination of the Septage Receiving Station and Master Lift Station at the plant;
- Addition of an odor control system for the headworks, grit removal unit, anaerobic basin, and biosolids holding tank, that previously only covered the headworks;
- Influent screening and grit removal, as previously permitted;
- Addition of an Anaerobic Selector Basin between the headwork and anoxic basin,
- Anoxic basin, as previously permitted
- Reconfiguration of the previously permitted membrane bioreactors (MBRs);
- Dual chlorine contact chambers, re-sized for more effective chlorination;
- Aerated sludge holding tanks for storage of biosolids prior to transfer to the Palm Bay Troutman #2 WWTF, as previously permitted;
- Reconfigured Effluent Transfer Pumping Station
- Upgrades to the Emergency Standby Power System

e. Description of Effluent Disposal and Land Application Sites

Underground Injection U-001: An existing 7.0 MGD annual average daily flow permitted capacity underground injection well system consisting of a Class I underground injection well, DEP permit number 328497-001-UO, discharging to Class G-IV ground water. Reject or wet-weather flows of reclaimed water up to 2.0 MGD AADF may be discharged to this system from the treatment plant. Underground Injection Well System U-001 is located approximately at latitude 27°55' 54" N, longitude 80°39' 57" W.

Land Application R-001: A new 0.66 MGD annual average daily flow permitted capacity slow-rate public access reuse system. R-001 consists of a new 3 MG storage tank to replace the previously permitted lined pond. Three new 1 MG lined reclaimed storage ponds are planned for future use, with irrigation at the sites listed in Condition IV.A.1. of this permit as major users, and additional sites with flows less than 0.1 MGD. Reject flow will be sent to U-001.

2. SUMMARY OF SURFACE WATER DISCHARGE - This facility does not discharge to surface waters.

3. BASIS FOR PERMIT LIMITATIONS AND MONITORING REQUIREMENTS

This facility is authorized to discharge reclaimed water to Underground Injection Well System U-001 which consists of a Class I injection wells discharging to Class G-IV ground water based on the following:

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Flow (Total to UIC well)	MGD	Max	2.0	Annual Average	62-600.400(3)(b) FAC
		Max	Report	Monthly Average	62-600.400(3)(b) FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	20.0	Annual Average	62-600.540(1) & 62-600.740(1)(b)1.a. FAC
		Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
		Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
		Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC
Solids, Total Suspended	mg/L	Max	20.0	Annual Average	62-600.540(1) & 62-600.740(1)(b)1.a. FAC
		Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
		Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
		Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC
pH	s.u.	Min	6.0	Single Sample	62-600.445 FAC
		Max	8.5	Single Sample	62-600.445 FAC

This facility is authorized to direct reclaimed water to Reuse System R-001, a slow-rate public access system, based on the following:

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Flow	MGD	Max	0.66	Annual Average	62-600.400(3)(b) & 62-610.810(5) FAC
		Max	Report	Monthly Average	62-600.400(3)(b) & 62-610.810(5) FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	20.0	Annual Average	62-610.460 & 62-600.740(1)(b)1.a. FAC
		Max	30.0	Monthly Average	62-600.740(1)(b)1.b. FAC
		Max	45.0	Weekly Average	62-600.740(1)(b)1.c. FAC
		Max	60.0	Single Sample	62-600.740(1)(b)1.d. FAC
Solids, Total Suspended	mg/L	Max	5.0	Single Sample	62-610.460(1) & 62-600.440(5)(f)3. FAC
Coliform, Fecal	#/100mL	Max	25	Single Sample	62-610.460 & 62-600.440(5)(f)2. FAC
Coliform, Fecal, % less than detection	percent	Min	75	Monthly Total	62-600.440(5)(f)1. FAC
pH	s.u.	Min	6.0	Single Sample	62-600.445 FAC
		Max	8.5	Single Sample	62-600.445 FAC
Chlorine, Total Residual (For Disinfection)	mg/L	Min	1.0	Single Sample	62-600.440(5)(b), 62-610.460(2), & 62-610.463(2) FAC
Turbidity	NTU	Max	Report	Single Sample	62-610.463(2) FAC
Giardia	cysts/100L	Max	Report	Single Sample	62-610.463(4) FAC
Cryptosporidium	oocysts/100L	Max	Report	Single Sample	62-610.463(4) FAC
Nitrogen, Total	mg/L	Max	Report	Annual Average	62-600.650(3)
		Max	Report	Monthly Average	62-600.650(3)
Phosphorus, Total (as P)	mg/L	Max	Report	Annual Average	62-600.650(3)
		Max	Report	Monthly Average	62-600.650(3)

Other Limitations and Monitoring Requirements:

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Flow (Total through plant)	MGD	Max	2.0	Annual Average	62-600.400(3)(b) FAC
		Max	Report	Monthly Average	62-600.400(3)(b) FAC
		Max	Report	Quarterly Average	62-600.400(3)(b) FAC
Percent Capacity, (TMADF/Permitted Capacity) x 100	percent	Max	Report	Monthly Average	62-600.405(4) FAC
BOD, Carbonaceous 5 day, 20C (Influent)	mg/L	Max	Report	Single Sample	62-601.300(1) FAC
Solids, Total Suspended (Influent)	mg/L	Max	Report	Single Sample	62-601.300(1) FAC
Monitoring Frequencies and Sample Types	-	-	-	All Parameters	62-601 FAC & 62-699 FAC and/or BPJ of permit writer
Sampling Locations	-	-	-	All Parameters	62-601, 62-610.412, 62-610.463(1), 62-610.568, 62-610.613 FAC and/or BPJ of permit writer

4. DISCUSSION OF CHANGES TO PERMIT LIMITATIONS

The current wastewater permit for this facility FLA693782-002-DW1P expires on April 25, 2021, and this revised permit, FLA693782-003, will replace -002.

5. BIOSOLIDS MANAGEMENT REQUIREMENTS

Biosolids generated by this facility may be transferred to Palm Bay WWTF #2 or disposed of in a Class I solid waste landfill.

See the table below for the rationale for the biosolids quantities monitoring requirements.

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Biosolids Quantity (Transferred)	dry tons	Max	Report	Monthly Total	62-640.650(5)(a)1. FAC
Biosolids Quantity (Landfilled)	dry tons	Max	Report	Monthly Total	62-640.650(5)(a)1. FAC
Monitoring Frequency		All Parameters			62-640.650(5)(a) FAC

6. GROUND WATER MONITORING REQUIREMENTS

This section is not applicable to this facility.

7. PERMIT SCHEDULES

The following improvement actions shall be completed according to the following schedule:

Improvement Action	Completion Date
1. Prior to placing the Public Access Reuse System into operation the following items shall be submitted to the Department for review and approval: Ground Water Monitoring Plan, Operating Protocol	Prior to Placing the Public Access Reuse System into Operation

8. INDUSTRIAL PRETREATMENT REQUIREMENTS

At this time, the facility is not required to develop an approved industrial pretreatment program. However, the Department reserves the right to require an approved program if future conditions warrant.

9. ADMINISTRATIVE ORDERS (AO) AND CONSENT ORDERS (CO)

This permit is not accompanied by an AO and the permittee has not entered into a CO with the Department.

10. REQUESTED VARIANCES OR ALTERNATIVES TO REQUIRED STANDARDS

No variances were requested for this facility.

11. THE ADMINISTRATIVE RECORD

The administrative record including application, draft permit, fact sheet, public notice (after release), comments received and additional information is available for public inspection during normal business hours at the location specified in item 13. Copies may be provided at a minimal charge per page. The Department's Oculus system is available to the public and may also be used to review the administrative record.

12. PROPOSED SCHEDULE FOR PERMIT ISSUANCE

Notice of Permit Issuance	November 30, 2018

13. DEPARTMENT CONTACT

Additional information concerning the permit and proposed schedule for permit issuance may be obtained during normal business hours from:

Dennise Judy, at: 407-897-4154
or
Dennise.Judy@dep.state.fl.us
or
FDEP Central District
3319 Maguire Blvd Suite 232
Orlando, FL 32803-3767

APPENDIX B
SJRWMD PERMIT

St. Johns River
Water Management District
Ann B. Shortelle, Ph.D., Executive Director

4049 Reid Street • P.O. Box 1429 • Palatka, FL 32178-1429 • 386-329-4500
On the internet at www.sjrwmd.com.

March 06, 2019

Christopher A Little
City of Palm Bay
250 Osmosis Dr Se
Palm Bay, FL 32909-2356

SUBJECT: Permit Number: 87977-4
Project Name: South Regional WRF

Dear Mr. Little:

Enclosed is your individual permit issued by the St. Johns River Water Management District on March 06, 2019. This permit is a legal document and should be kept with your other important documents. Permit issuance does not relieve you from the responsibility of obtaining any necessary permits from any federal, state, or local agencies for your project.

Technical Staff Report:
If you wish to review a copy of the Technical Staff Report (TSR) that provides the District's staff analysis of your permit application, you may view the TSR by going to the Permitting section of the District's website at www.sjrwmd.com/permitting. Using the "search applications and permits" feature, you can use your permit number or project name to find information about the permit. When you see the results of your search, click on the permit number and then on the TSR folder.

Noticing Your Permit:
For noticing instructions, please refer to the noticing materials in this package regarding closing the point of entry for someone to challenge the issuance of your permit. Please note that if a timely petition for administrative hearing is filed, your permit will become non-final and any activities that you choose to undertake pursuant to your permit will be at your own risk.

Compliance with Permit Conditions:
To submit your required permit compliance information, go to the District's website at www.sjrwmd.com/permitting. Under the "Apply for a permit or submit compliance data" section, click to sign-in to your existing account or to create a new account. Select the "Compliance Submittal" tab, enter your permit number, and select "No Specific Date" for the Compliance Due Date Range. You will then be able to view all the compliance submittal requirements for your project. Select the compliance item that you are ready to submit and then attach the appropriate information or form. The forms to comply with your permit conditions are available at www.sjrwmd.com/permitting under the section "Handbooks, forms, fees, final orders". Click on forms to view all permit compliance forms, then scroll to the ERP application forms section and select the applicable compliance forms. Alternatively, if you have difficulty finding forms or need copies of the appropriate forms, please contact the Bureau of Regulatory Support at (386) 329-4570.

Transferring Your Permit:
Your permit requires you to notify the District within 30 days of any change in ownership or control of the project or activity covered by the permit, or within 30 days of any change in ownership or control of the real property on which the permitted project or activity is located or occurs. You will need to provide the District with the information specified in rule 62-330.340, Florida Administrative Code (F.A.C.). Generally, this will require you to complete and submit Form 62-330.340(1), "Request to Transfer Permit," available at http://www.sjrwmd.com/permitting/permitforms.html.

Please note that a permittee is liable for compliance with the permit before the permit is transferred. The District, therefore, recommends that you request a permit transfer in advance in accordance with the applicable rules. You are encouraged to contact District staff for assistance with this process.

Thank you and please let us know if you have additional questions. For general questions contact e-permit@sjrwmd.com or (386) 329-4570.

Sincerely,

Michelle Reiber, Bureau Chief
Regulatory Services
St. Johns River Water Management District
525 Community College Parkway, S.E.
Palm Bay, FL 32909
(321) 409-2129

Enclosures: Permit

cc: District Permit File
Agent and Registered Professional Consultant: Scott M Glaubitz
BSE Consultants Inc
312 S Harbor City Blvd Ste 4
Melbourne, FL 32901-1351

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
Post Office Box 1429
Palatka, Florida 32178-1429

PERMIT NO: 87977-4 **DATE ISSUED:** March 06, 2019

PROJECT NAME: South Regional WRF

A PERMIT AUTHORIZING:
Authorization of the Stormwater Management System for South Regional WRF, a 31.5-acre project to be constructed and operated as per plans received by the District on January 25, 2019, and phasing plans submitted March 1, 2019. This permit is for Stage One (Phase 1 & 2).

LOCATION:
Section(s): 30 Township(s): 29S Range(s): 37E
Brevard County

Receiving Water Body:

Name	Class
Turkey Creek	III Fresh, IW

ISSUED TO:
City of Palm Bay
250 Osmosis Dr Se
Palm Bay, FL 32909-2356

The permittee agrees to hold and save the St. Johns River Water Management District and its successors harmless from any and all damages, claims, or liabilities which may arise from permit issuance. Said application, including all plans and specifications attached thereto, is by reference made a part hereof.

This permit does not convey to the permittee any property rights nor any rights or privileges other than those specified herein, nor relieve the permittee from complying with any law, regulation or requirement affecting the rights of other bodies or agencies. All structures and works installed by permittee hereunder shall remain the property of the permittee.

This permit may be revoked, modified or transferred at any time pursuant to the appropriate provisions of Chapter 373, Florida Statutes.

PERMIT IS CONDITIONED UPON:

See conditions on attached “Exhibit A”, dated March 06, 2019

AUTHORIZED BY: St. Johns River Water Management District
Division of Regulatory Services

By: 

Fariborz Zanganeh
Supervising Professional Engineer

"EXHIBIT A"
CONDITIONS FOR ISSUANCE OF PERMIT NUMBER 87977-4
South Regional WRF
DATED: March 06, 2019

1. All activities shall be implemented following the plans, specifications and performance criteria approved by this permit. Any deviations must be authorized in a permit modification in accordance with Rule 62-330.315, F.A.C. Any deviations that are not so authorized may subject the permittee to enforcement action and revocation of the permit under Chapter 373, F.S.

2. A complete copy of this permit shall be kept at the work site of the permitted activity during the construction phase, and shall be available for review at the work site upon request by the District staff. The permittee shall require the contractor to review the complete permit prior to beginning construction.

3. Activities shall be conducted in a manner that does not cause or contribute to violations of state water quality standards. Performance-based erosion and sediment control best management practices shall be installed immediately prior to, and be maintained during and after construction as needed, to prevent adverse impacts to the water resources and adjacent lands. Such practices shall be in accordance with the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (Florida Department of Environmental Protection and Florida Department of Transportation June 2007), and the Florida Stormwater Erosion and Sedimentation Control Inspector's Manual (Florida Department of Environmental Protection, Nonpoint Source Management Section, Tallahassee, Florida, July 2008), which are both incorporated by reference in subparagraph 62-330.050(9)(b)5, F.A.C., unless a project-specific erosion and sediment control plan is approved or other water quality control measures are required as part of the permit.

4. At least 48 hours prior to beginning the authorized activities, the permittee shall submit to the District a fully executed Form 62-330.350(1), "Construction Commencement Notice," (October 1, 2013) (http://www.flrules.org/Gateway/reference.asp?No=Ref-02505), incorporated by reference herein, indicating the expected start and completion dates. A copy of this form may be obtained from the District, as described in subsection 62-330.010(5), F.A.C., and shall be submitted electronically or by mail to the Agency. However, for activities involving more than one acre of construction that also require a NPDES stormwater construction general permit, submittal of the Notice of Intent to Use Generic Permit for Stormwater Discharge from Large and Small Construction Activities, DEP Form 62-621.300(4)(b), shall also serve as notice of commencement of construction under this chapter and, in such a case, submittal of Form 62-330.350(1) is not required.

5. Unless the permit is transferred under Rule 62-330.340, F.A.C., or transferred to an operating entity under Rule 62-330.310, F.A.C., the permittee is liable to comply with the plans, terms and conditions of the permit for the life of the project or activity.

6. Within 30 days after completing construction of the entire project, or any independent portion of the project, the permittee shall provide the following to the Agency, as applicable:

    a. For an individual, private single-family residential dwelling unit, duplex, triplex, or quadruplex — "Construction Completion and Inspection Certification for Activities Associated with a Private Single-Family Dwelling Unit" [Form 62-330.310(3)]; or

    b. For all other activities — "As-Built Certification and Request for Conversion to

Operation Phase" [Form 62-330.310(1)].

c. If available, an Agency website that fulfills this certification requirement may be used in lieu of the form.

7. If the final operation and maintenance entity is a third party:

   a. Prior to sales of any lot or unit served by the activity and within one year of permit issuance, or within 30 days of as-built certification, whichever comes first, the permittee shall submit, as applicable, a copy of the operation and maintenance documents (see sections 12.3 thru 12.3.4 of Volume I) as filed with the Florida Department of State, Division of Corporations and a copy of any easement, plat, or deed restriction needed to operate or maintain the project, as recorded with the Clerk of the Court in the County in which the activity is located.

   b. Within 30 days of submittal of the as- built certification, the permittee shall submit "Request for Transfer of Environmental Resource Permit to the Perpetual Operation and Maintenance Entity" [Form 62-330.310(2)] to transfer the permit to the operation and maintenance entity, along with the documentation requested in the form. If available, an Agency website that fulfills this transfer requirement may be used in lieu of the form.

8. The permittee shall notify the District in writing of changes required by any other regulatory District that require changes to the permitted activity, and any required modification of this permit must be obtained prior to implementing the changes.

9. This permit does not:

   a. Convey to the permittee any property rights or privileges, or any other rights or privileges other than those specified herein or in Chapter 62-330, F.A.C.;

   b. Convey to the permittee or create in the permittee any interest in real property;

   c. Relieve the permittee from the need to obtain and comply with any other required federal, state, and local authorization, law, rule, or ordinance; or

   d. Authorize any entrance upon or work on property that is not owned, held in easement, or controlled by the permittee.

10. Prior to conducting any activities on state-owned submerged lands or other lands of the state, title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund, the permittee must receive all necessary approvals and authorizations under Chapters 253 and 258, F.S. Written authorization that requires formal execution by the Board of Trustees of the Internal Improvement Trust Fund shall not be considered received until it has been fully executed.

11. The permittee shall hold and save the District harmless from any and all damages, claims, or liabilities that may arise by reason of the construction, alteration, operation, maintenance, removal, abandonment or use of any project authorized by the permit.

12. The permittee shall notify the District in writing:

    a. Immediately if any previously submitted information is discovered to be inaccurate; and

b. Within 30 days of any conveyance or division of ownership or control of the property or the system, other than conveyance via a long-term lease, and the new owner shall request transfer of the permit in accordance with Rule 62-330.340, F.A.C. This does not apply to the sale of lots or units in residential or commercial subdivisions or condominiums where the stormwater management system has been completed and converted to the operation phase.

13. Upon reasonable notice to the permittee, District staff with proper identification shall have permission to enter, inspect, sample and test the project or activities to ensure conformity with the plans and specifications authorized in the permit.

14. If prehistoric or historic artifacts, such as pottery or ceramics, projectile points, stone tools, dugout canoes, metal implements, historic building materials, or any other physical remains that could be associated with Native American, early European, or American settlement are encountered at any time within the project site area, the permitted project shall cease all activities involving subsurface disturbance in the vicinity of the discovery. The permittee or other designee shall contact the Florida Department of State, Division of Historical Resources, Compliance Review Section (DHR), at (850) 245-6333, as well as the appropriate permitting agency office. Project activities shall not resume without verbal or written authorization from the Division of Historical Resources. If unmarked human remains are encountered, all work shall stop immediately and the proper authorities notified in accordance with Section 872.05, F.S. For project activities subject to prior consultation with the DHR and as an alternative to the above requirements, the permittee may follow procedures for unanticipated discoveries as set forth within a cultural resources assessment survey determined complete and sufficient by DHR and included as a specific permit condition herein.

15. Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered binding unless a specific condition of this permit or a formal determination under Rule 62-330.201, F.A.C., provides otherwise.

16. The permittee shall provide routine maintenance of all components of the stormwater management system to remove trapped sediments and debris. Removed materials shall be disposed of in a landfill or other uplands in a manner that does not require a permit under Chapter 62-330, F.A.C., or cause violations of state water quality standards.

17. This permit is issued based on the applicant's submitted information that reasonably demonstrates that adverse water resource-related impacts will not be caused by the completed permit activity. If any adverse impacts result, the District will require the permittee to eliminate the cause, obtain any necessary permit modification, and take any necessary corrective actions to resolve the adverse impacts.

18. A Recorded Notice of Environmental Resource Permit may be recorded in the county public records in accordance with Rule 62-330.090(7), F.A.C. Such notice is not an encumbrance upon the property.

19. This permit for construction will expire five years from the date of issuance.

20. At a minimum, all retention and detention storage areas must be excavated to rough grade prior to building construction or placement of impervious surface within the area to be served by those facilities. To prevent reduction in storage volume and percolation rates, all accumulated sediment must be removed from the storage area prior to final grading and stabilization.

21. All wetland areas or water bodies that are outside the specific limits of construction authorized by this permit must be protected from erosion, siltation, scouring or excess turbidity, and dewatering.

22. The operation and maintenance entity shall inspect the stormwater or surface water management system once within two years after the completion of construction and every two years thereafter to determine if the system is functioning as designed and permitted. The operation and maintenance entity must maintain a record of each required inspection, including the date of the inspection, the name and contact information of the inspector, and whether the system was functioning as designed and permitted, and make such record available for inspection upon request by the District during normal business hours. If at any time the system is not functioning as designed and permitted, then within 30 days the entity shall submit a report electronically or in writing to the District using Form 62-330.311(1), “Operation and Maintenance Inspection Certification,” describing the remedial actions taken to resolve the failure or deviation.

23. The proposed project must be constructed and operated as per plans and calculations received by the District on January 25, 2019 and March 1, 2019.

24. This permit supersedes permit numbers 42-009-87977-1 & 42-009-87977-2 and the conditions of this permit now govern the project's construction, operation and maintenance.

Notice of Rights

1. A person whose substantial interests are or may be affected has the right to request an administrative hearing by filing a written petition with the St. Johns River Water Management District (District). Pursuant to Chapter 28-106 and Rule 40C-1.1007, Florida Administrative Code, the petition must be filed (received) either by delivery at the office of the District Clerk at District Headquarters, P. O. Box 1429, Palatka Florida 32178-1429 (4049 Reid St., Palatka, FL 32177) or by e-mail with the District Clerk at Clerk@sjrwmd.com, within twenty-six (26) days of the District depositing the notice of District decision in the mail (for those persons to whom the District mails actual notice), within twenty-one (21) days of the District emailing the notice of District decision (for those persons to whom the District emails actual notice), or within twenty-one (21) days of newspaper publication of the notice of District decision (for those persons to whom the District does not mail or email actual notice). A petition must comply with Sections 120.54(5)(b)4. and 120.569(2)(c), Florida Statutes, and Chapter 28-106, Florida Administrative Code. The District will not accept a petition sent by facsimile (fax), as explained in paragraph no. 4 below.

2. Please be advised that if you wish to dispute this District decision, mediation may be available and that choosing mediation does not affect your right to an administrative hearing. If you wish to request mediation, you must do so in a timely-filed petition. If all parties, including the District, agree to the details of the mediation procedure, in writing, within 10 days after the time period stated in the announcement for election of an administrative remedy under Sections 120.569 and 120.57, Florida Statutes, the time limitations imposed by Sections 120.569 and 120.57, Florida Statutes, shall be tolled to allow mediation of the disputed District decision. The mediation must be concluded within 60 days of the date of the parties' written agreement, or such other timeframe agreed to by the parties in writing. Any mediation agreement must include provisions for selecting a mediator, a statement that each party shall be responsible for paying its pro-rata share of the costs and fees associated with mediation, and the mediating parties' understanding regarding the confidentiality of discussions and documents introduced during mediation. If mediation results in settlement of the administrative dispute, the District will enter a final order consistent with the settlement agreement. If mediation terminates without settlement of the dispute, the District will notify all the parties in writing that the administrative hearing process under Sections 120.569 and 120.57, Florida Statutes, is resumed. Even if a party chooses not to engage in formal mediation, or if formal mediation does not result in a settlement agreement, the District will remain willing to engage in informal settlement discussions.

3. A person whose substantial interests are or may be affected has the right to an informal administrative hearing pursuant to Sections 120.569 and 120.57(2), Florida Statutes, where no material facts are in dispute. A petition for an informal hearing must also comply with the requirements set forth in Rule 28-106.301, Florida Administrative Code.

Notice of Rights

4. A petition for an administrative hearing is deemed filed upon receipt of the complete petition by the District Clerk at the District Headquarters in Palatka, Florida during the District's regular business hours. The District's regular business hours are 8:00 a.m. – 5:00 p.m., excluding weekends and District holidays. Petitions received by the District Clerk after the District's regular business hours shall be deemed filed as of 8:00 a.m. on the District's next regular business day. The District's acceptance of petitions filed by e-mail is subject to certain conditions set forth in the District's Statement of Agency Organization and Operation (issued pursuant to Rule 28-101.001, Florida Administrative Code), which is available for viewing at *sjrwmd.com*. These conditions include, but are not limited to, the petition being in the form of a PDF or TIFF file and being capable of being stored and printed by the District. Further, pursuant to the District's Statement of Agency Organization and Operation, attempting to file a petition by facsimile is prohibited and shall not constitute filing.

5. Failure to file a petition for an administrative hearing within the requisite timeframe shall constitute a waiver of the right to an administrative hearing. (Rule 28-106.111, Florida Administrative Code).

6. The right to an administrative hearing and the relevant procedures to be followed are governed by Chapter 120, Florida Statutes, Chapter 28-106, Florida Administrative Code, and Rule 40C-1.1007, Florida Administrative Code. Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means the District's final action may be different from the position taken by it in this notice. A person whose substantial interests are or may be affected by the District's final action has the right to become a party to the proceeding, in accordance with the requirements set forth above.

7. Pursuant to Section 120.68, Florida Statutes, a party to the proceeding before the District who is adversely affected by final District action may seek review of the action in the District Court of Appeal by filing a notice of appeal pursuant to Rules 9.110 and 9.190, Florida Rules of Appellate Procedure, within 30 days of the rendering of the final District action.

8. A District action is considered rendered, as referred to in paragraph no. 7 above, after it is signed on behalf of the District and filed by the District Clerk.

9. Failure to observe the relevant timeframes for filing a petition for judicial review as described in paragraph no. 7 above will result in waiver of that right to review.

Notice of Rights

Certificate of Service

I HEREBY CERTIFY that a copy of the foregoing Notice of Rights has been sent to the permittee:

Christopher A Little
City of Palm Bay
250 Osmosis Dr Se
Palm Bay, FL 32909-2356

This 6th day of March 2019.

Margaret Daniels, Office Director
Office of Business and Administrative Services
St. Johns River Water Management District
4049 Reid Street
Palatka, FL 32177-2529
(386) 329-4570

Permit Number: 87977-4

NOTICING INFORMATION

Dear Permittee:

Please be advised that the St. Johns River Water Management District will not publish a notice in the newspaper advising the public that it has issued a permit for this project.

Newspaper publication, using the District's notice form, notifies members of the public of their right to challenge the issuance of the permit. If proper notice is given by newspaper publication, then there is a 21-day time limit for someone to file a petition for an administrative hearing to challenge the issuance of the permit.

To close the point of entry for filing a petition, you may publish (at your own expense) a one-time notice of the District's decision in a newspaper of general circulation within the affected area as defined in Section 50.011 of the Florida Statutes. If you do not publish a newspaper notice to close the point of entry, the time to challenge the issuance of your permit will not expire and someone could file a petition even after your project is constructed.

A copy of the notice form and a partial list of newspapers of general circulation are attached for your convenience. However, you are not limited to those listed newspapers. If you choose to close the point of entry and the notice is published, the newspaper will return to you an affidavit of publication. In that event, it is important that you either submit a scanned copy of the affidavit by emailing it to *compliancesupport@sjrwmd.com* (preferred method) **or** send a copy of the original affidavit to:

Margaret Daniels, Office Director
Office of Business and Administrative Services
4049 Reid Street
Palatka, FL 32177

If you have any questions, please contact the Office of Business and Administrative Services at (386) 329-4570.

Sincerely,

M. Daniels

Margaret Daniels, Office Director
Office of Business and Administrative Services

NOTICE OF AGENCY ACTION TAKEN BY THE
ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

Notice is given that the following permit was issued on _____:

(Name and address of applicant) _____
permit#_____. The project is located in _____County, Section _____, Township _____ South, Range _____ East. The permit authorizes a surface water management system on _____ acres for _____ known as _____. The receiving water body is _____.

A person whose substantial interests are or may be affected has the right to request an administrative hearing by filing a written petition with the St. Johns River Water Management District (District). Pursuant to Chapter 28-106 and Rule 40C-1.1007, Florida Administrative Code (F.A.C.), the petition must be filed (received) either by delivery at the office of the District Clerk at District Headquarters, P.O. Box 1429, Palatka FL 32178-1429 (4049 Reid St, Palatka, FL 32177) or by e-mail with the District Clerk at Clerk@sjrwmd.com, within twenty-one (21) days of newspaper publication of the notice of District decision (for those persons to whom the District does not mail or email actual notice). A petition must comply with Sections 120.54(5)(b)4. and 120.569(2)(c), Florida Statutes (F.S.), and Chapter 28-106, F.A.C. The District will not accept a petition sent by facsimile (fax). Mediation pursuant to Section 120.573, F.S., may be available and choosing mediation does not affect your right to an administrative hearing.

A petition for an administrative hearing is deemed filed upon receipt of the complete petition by the District Clerk at the District Headquarters in Palatka, Florida during the District's regular business hours. The District's regular business hours are 8 a.m. – 5 p.m., excluding weekends and District holidays. Petitions received by the District Clerk after the District's regular business hours shall be deemed filed as of 8 a.m. on the District's next regular business day. The District's acceptance of petitions filed by e-mail is subject to certain conditions set forth in the District's Statement of Agency Organization and Operation (issued pursuant to Rule 28-101.001, Florida Administrative Code), which is available for viewing at www.sjrwmd.com. These conditions include, but are not limited to, the petition being in the form of a PDF or TIFF file and being capable of being stored and printed by the District. Further, pursuant to the District's Statement of Agency Organization and Operation, attempting to file a petition by facsimile (fax) is prohibited and shall not constitute filing.

The right to an administrative hearing and the relevant procedures to be followed are governed by Chapter 120, Florida Statutes, Chapter 28-106, Florida Administrative Code, and Rule 40C-1.1007, Florida Administrative Code. Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means the District's final action may be different from the position taken by it in this notice. **Failure to file a petition for an administrative hearing within the requisite time frame shall constitute a waiver of the right to an administrative hearing. (Rule 28-106.111, F.A.C.).**

If you wish to do so, please visit http://www.sjrwmd.com/nor_dec/ to read the complete Notice of Rights to determine any legal rights you may have concerning the District's decision(s) on the permit application(s) described above. You can also request the Notice of Rights by contacting the Director of Business and Administrative Services, 4049 Reid St., Palatka, FL 32177-2529, tele. no. (386)329-4570.

NEWSPAPER ADVERTISING

ALACHUA
The Alachua County Record, Legal Advertising
P. O. Box 806
Gainesville, FL 32602
352-377-2444/ fax 352-338-1986

BAKER
Baker County Press, Legal Advertising
P. O. Box 598
Maclenny, FL 32063
904-259-2400/ fax 904-259-6502

BRAFORD
Bradford County Telegraph, Legal Advertising
P. O. Drawer A
Starke, FL 32901
904-964-6305/ fax 904-964-8628

BREVARD
Florida Today, Legal Advertising
P. O. Box 419000
Melbourne, FL 32941-9000
321-242-3832/ fax 321-242-6618

CLAY
Clay Today, Legal Advertising
1560 Kinsley Ave., Suite 1
Orange Park, FL 32073
904-264-3200/ fax 904-264-3285

DUVAL
Daily Record, Legal Advertising
P. O. Box 1769
Jacksonville, FL 32201
904-356-2466 / fax 904-353-2628

FLAGLER
Flagler Tribune, c/o News Journal
P. O. Box 2831
Daytona Beach, FL 32120-2831
386- 681-2322

INDIAN RIVER
Vero Beach Press Journal, Legal Advertising
P. O. Box 1268
Vero Beach, FL 32961-1268
772-221-4282/ fax 772-978-2340

LAKE
Daily Commercial, Legal Advertising
P. O. Drawer 490007
Leesburg, FL 34749
352-365-8235/fax 352-365-1951

MARION
Ocala Star Banner, Legal Advertising
2121 SW 19th Avenue Road
Ocala, FL 34474
352-867-4010/fax 352-867-4126

NASSAU
News-Leader, Legal Advertising
P. O. Box 766
Fernandina Beach, FL 32035
904-261-3696/fax 904-261-3698

OKEECHOBEE
Okeechobee News, Legal Advertising
P. O. Box 639
Okeechobee, FL 34973-0639
863-763-3134/fax 863-763-5901

ORANGE
Sentinel Communications, Legal Advertising
633 N. Orange Avenue
Orlando, FL 32801
407-420-5160/ fax 407-420-5011

OSCEOLA
Little Sentinel, Legal Advertising
633 N. Orange Avenue
Orlando, FL 32801
407-420-5160/ fax 407-420-5011

PUTNAM
Palatka Daily News, Legal Advertising
P. O. Box 777
Palatka, FL 32178
386-312-5200/ fax 386-312-5209

ST. JOHNS
St. Augustine Record, Legal Advertising
P. O. Box 1630
St. Augustine, FL 32085
904-819-3436

SEMINOLE
Seminole Herald, Legal Advertising
300 North French Avenue
Sanford, FL 32771
407-323-9408

VOLUSIA
News Journal Corporation, Legal Advertising
P. O. Box 2831
Daytona Beach, FL 32120-2831
(386) 681-2322

APPENDIX C
ARMY CORP OF ENGINEERS LETTER

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
COCOA PERMITS SECTION
400 HIGH POINT DRIVE, SUITE 600
COCOA, FLORIDA 32926

October 16, 2018

REPLY TO
ATTENTION OF
Regulatory Division
North Permits Branch
Cocoa Permits Section
SAJ-2011-00444(NPR-AWP)

City of Palm Bay
Attn: Christopher Little
120 Malabar Road
Palm Bay, Florida 32907

Dear Mr. Little:

Reference is made to the application received on October 10, 2018, for a Department of the Army permit to construct the South Regional Water Reclamation Facility. The proposed project site is located at 250 Osmosis Drive, in Section 30, Township 29 South, Range 37 East, Palm Bay, Brevard County, Florida. The application has been assigned the file number SAJ-2011-00444.

The project as proposed will not require a Department of the Army permit in accordance with Section 10 of the Rivers and Harbors Act of 1899 as it is not located within the navigable waters of the United States. Furthermore, a permit will not be required in accordance with Section 404 of the Clean Water Act as it will not involve the discharge of dredged or fill material into waters of the United States. Provided the work is done in accordance with the enclosed drawings, Department of the Army authorization will not be required.

The analysis completed for the proposed action does not address nor include any consideration for geographic jurisdiction on aquatic resources and shall not be interpreted as such.

Additionally, your project site may contain species protected by the Endangered Species Act (ESA) of 1972, as amended. You should contact your local U.S. Fish and Wildlife Service (FWS) office to determine if federally listed species or their habitat are present on your project site. If it is determined that federally listed species may be affected by the proposed project, authorization for "incidental take" may be required. FWS offices can be contacted by the following telephone numbers: Jacksonville at 904-232-2580, Panama City at 850-769-0552, St. Petersburg at 727-570-5398, or Vero Beach at 772-562-3909.

This letter does not obviate the requirement to obtain any other Federal, State, or local permits that may be necessary for your project. Should you have any questions, please contact Andrew Phillips at the letterhead address or by telephone at

321-504-3771 extension 14.

Thank you for your cooperation with our permit program. The Corps Jacksonville District Regulatory Division is committed to improving service to our customers. We strive to perform our duty in a friendly and timely manner while working to preserve our environment. We invite you to take a few minutes to visit http://per2.nwp.usace.army.mil/survey.html and complete our automated Customer Service Survey. Your input is appreciated – favorable or otherwise. Please be aware this web address is case sensitive and should be entered as it appears above.

Sincerely,

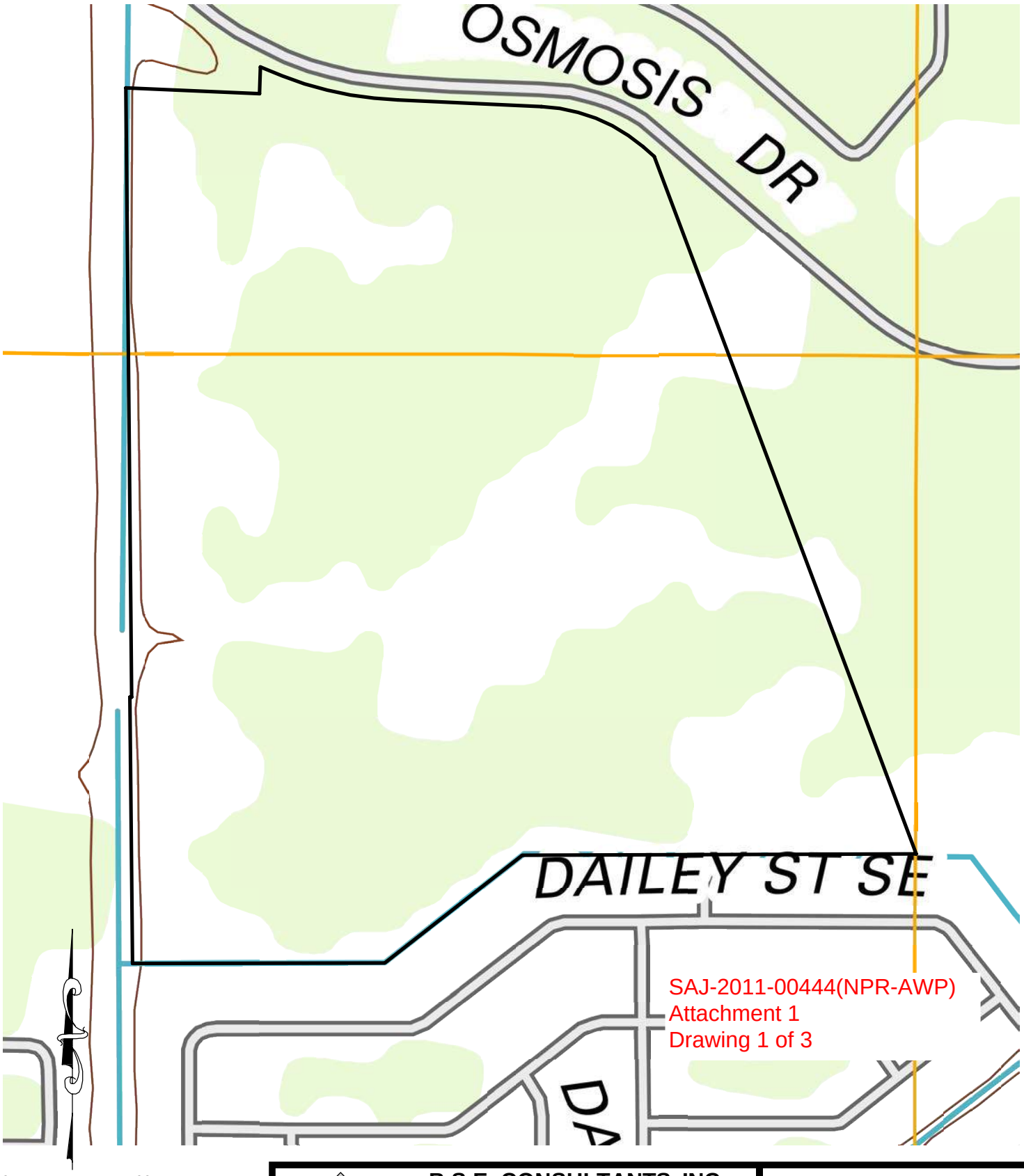
Andrew W. Phillips
Project Manager

Enclosures

cc: (electronically)

BSE; Scott Glaubitz

CITY OF PALM BAY
SOUTH REGIONAL WATER RECLAMATION FACILITY
SITE-SPECIFIC LOCATION MAP



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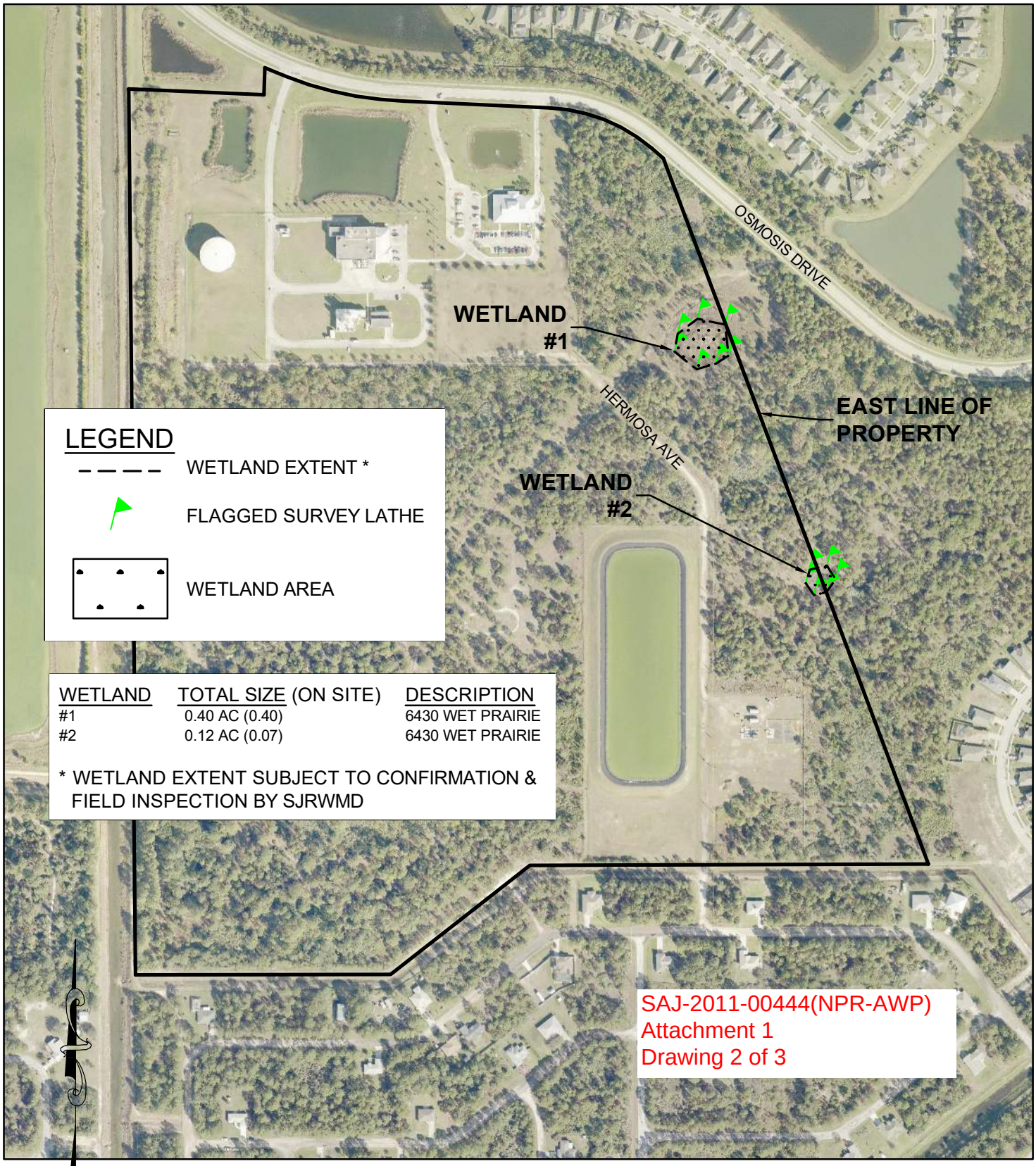
B.S.E. CONSULTANTS, INC.
CONSULTING - ENGINEERING - LAND SURVEYING
312 SOUTH HARBOR CITY BOULEVARD, SUITE 4 MELBOURNE, FL 32901
PHONE: (321) 725-3674 FAX: (321) 723-1159
CERTIFICATE OF BUSINESS AUTHORIZATION: 4905
CERTIFICATE OF LAND SURVEYING BUSINESS AUTHORIZATION: LB0004905

DATE: 10/15/17
DESIGN/DRAWN: KAL/RLR
DRAWING# 11417_200_001B
PROJECT# 11417
SHEET 1 OF 1

CITY OF PALM BAY
SOUTH REGIONAL WATER RECLAMATION FACILITY
OVERALL SITE WETLAND EXHIBIT



WETLAND	TOTAL SIZE (ON SITE)	DESCRIPTION
#1	0.40 AC (0.40)	6430 WET PRAIRIE
#2	0.12 AC (0.07)	6430 WET PRAIRIE

* WETLAND EXTENT SUBJECT TO CONFIRMATION & FIELD INSPECTION BY SJRWMD

SAJ-2011-00444(NPR-AWP)
Attachment 1
Drawing 2 of 3

0 100
(IN FEET)

B.S.E. CONSULTANTS, INC.
CONSULTING - ENGINEERING - LAND SURVEYING
312 SOUTH HARBOR CITY BOULEVARD, SUITE 4 MELBOURNE, FL 32901
PHONE: (321) 725-3674 FAX: (321) 723-1159
CERTIFICATE OF BUSINESS AUTHORIZATION: 4905
CERTIFICATE OF LAND SURVEYING BUSINESS AUTHORIZATION: LB0004905

DATE: 8/7/17
DESIGN/DRAWN: MM/RLR
DRAWING# 11417_200_002A
PROJECT# 11417
SHEET 1 OF 1

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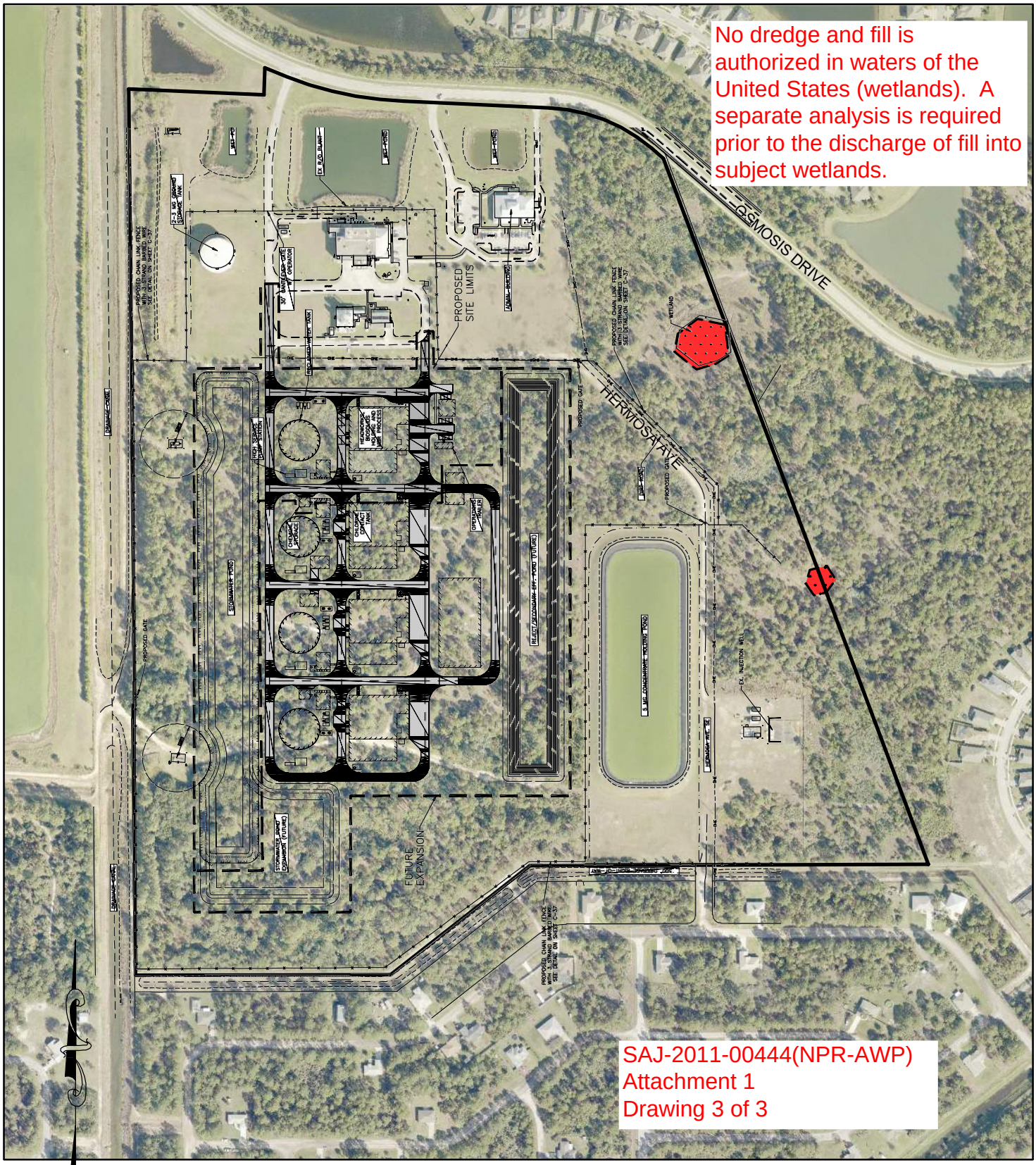
CITY OF PALM BAY
SOUTH REGIONAL WATER RECLAMATION FACILITY
AERIAL EXHIBIT FOR USACOE



0 100

(IN FEET)

B.S.E. CONSULTANTS, INC.
CONSULTING - ENGINEERING - LAND SURVEYING
312 SOUTH HARBOR CITY BOULEVARD, SUITE 4 MELBOURNE, FL 32901
PHONE: (321) 725-3674 FAX: (321) 723-1159
CERTIFICATE OF BUSINESS AUTHORIZATION: 4905
CERTIFICATE OF LAND SURVEYING BUSINESS AUTHORIZATION: LB0004905

DATE: 10/12/17
DESIGN/DRAWN: KAL/RLR
DRAWING# 11417_200_002B
PROJECT# 11417
SHEET 1 OF 1

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APPENDIX D
ENVIRONMENTAL ASSESSMENT REPORT

B.S.E. CONSULTANTS, INC.

Consulting ~ Engineering ~ Land Surveying

Scott M. Glaubitz, P.E., P.L.S.
President

Hassan Kamal, P.E.
Vice President

Memorandum:

DATE: **August 14, 2017**

TO: **Scott Glaubitz**

FROM: **Mary L. McAuliffe, Environmental Manager**

Re: ***BSE #11417 City of Palm Bay, South Regional Water Reclamation Facility***

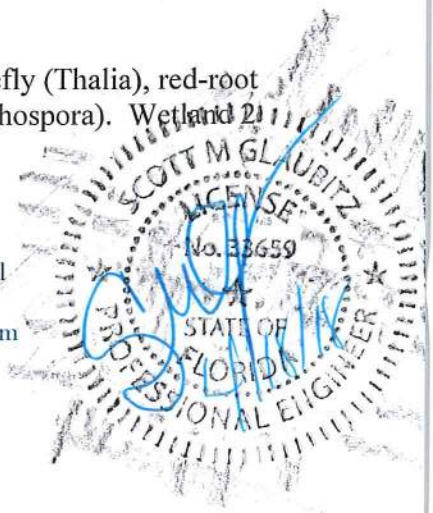
We conducted field visits at the above-referenced property to determine whether protected species occur on/at or use the site for burrowing, nesting and/or foraging. Primary species of concern included red-cockaded woodpeckers (*Picoides borealis*), gopher tortoise *(Gopherus polyphemus)* and FL Scrub jays *(Aphelocoma coerulescens)*. No red-cockaded woodpeckers or suitable nest-cavity pine trees were observed. No scrub jays or nests were observed or found. Habitat is not sufficient or suitable for scrub jays.

The 107.5 ac site is primarily pine flatwoods (FLUCCS 4110) with a canopy of slash pine and patchy shrub layer of saw palmettos. Some areas appear scrubby in nature while other areas are wetter (which is typical for flatwoods). Dirt roadways occur on the site together with mowed areas, a retention pond and maintenance building to the SE. Natural drainage has been altered by construction of berms, retention ponds and dirt roadways.

We located and set lathes in two wetland areas. Wetland 1 (0.40 ac) appears on government databases as FLUCCS 6430 with 8.02 ac on-site and another 1.05 ac off-site. Wetland 2 (0.12 ac) does not appear on the government databases for mapped land use as wetland; it is mapped at 4110 Pine Flatwoods.

All three government databases which include Brevard County Natural Resources Management, St. Johns Water Management District (SJRWMD) and the National Wetlands Inventory (NWI) show Wetland 1 as FLUCCS 6430 with 8.02 ac on-site and an additional 1.05 ac extending off-site. While the actual wetland extent of Wetland 1 may be greater or less subject to field verification by Brevard County or SJRWMD during the permitting process; wetland 2 may not be claimed by either agency.

Vegetation in wetland 1 includes pickerelweed (Pontederia), arrowhead (Sagittaria), firefly (Thalia), red-root (Lachnanthes), St. John's wort (Hypericum), sedges and rush species (Carex and Rhynchospora). Wetland 2 vegetation includes cordgrass (Spartina) and buttonbush (Cephalanthus occidentalis).



Civil ~ Agricultural ~ Transportation ~ Utility ~ Site Planning ~ Environmental
312 South Harbor City Boulevard, Suite #4, Melbourne, Florida 32901
Telephone: (321) 725-3674 ~ Fax: (321) 723-1159 ~ Email: info@bseconsult.com
Toll Free: 1-800-523-4BSE (4273)

The FLUCCS (6250) mapped areas (3.72 ac) of hydric pine flatwood reported to occur on the site, in our opinion, are not hydric; and should be considered 4110 pine flatwoods, being no more hydric in plant community structure than the remainder of the site.

The site was surveyed for gopher tortoise activity. An abandoned burrow was found on the south side of Wetland 1; gopher tortoise scat was found further south which led to the discovery of two burrows. An inactive burrow (formerly active when first found on 6-30-17) and an active burrow were located. An attached exhibit shows the location of both burrows.

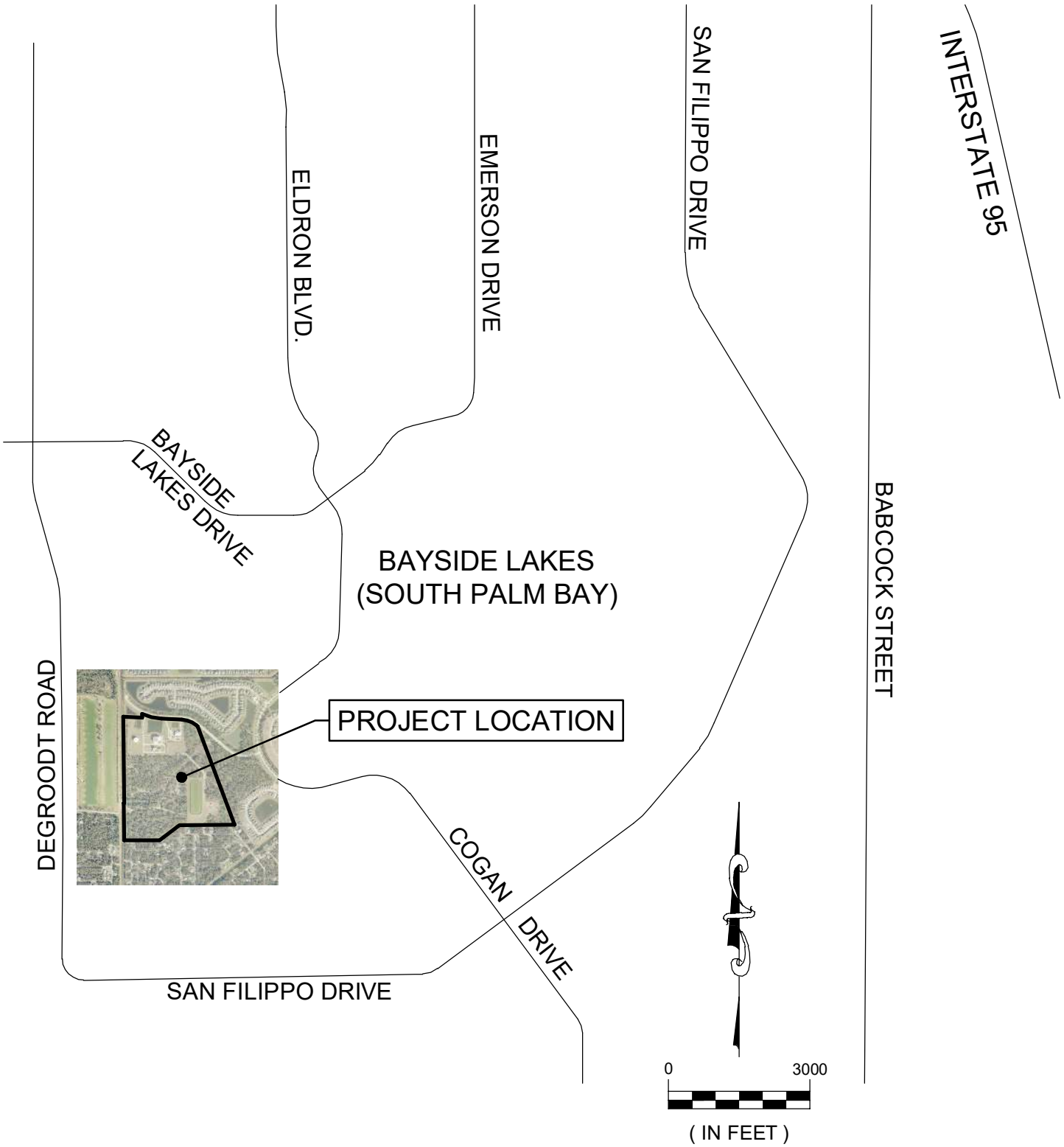
A permit from the FL Fish & Wildlife Conservation Commission (FWC) is required to excavate gopher tortoise burrows (active and inactive) and relocate any (most likely a single) gopher tortoise off-site. The permit fee (payable to FWC) is $208. Cost for long-term relocation payable to a permitted facility is $800/tortoise. Burrow excavation costs are typically $1600/day for heavy equipment and on-site supervision by a licensed gopher tortoise agent.

The attached exhibits include Location, Soils, FLUCCS (FL Land Use & Cover Classification System), Wetland (Detail), Gopher Tortoise (burrow locations) and photographs.

CITY OF PALM BAY

SOUTH REGIONAL WATER RECLAMATION FACILITY

LOCATION MAP



B.S.E. CONSULTANTS, INC.

CONSULTING - ENGINEERING - LAND SURVEYING

312 SOUTH HARBOR CITY BOULEVARD, SUITE 4 MELBOURNE, FL 32901

PHONE: (321) 725-3674 FAX: (321) 723-1159

CERTIFICATE OF BUSINESS AUTHORIZATION: 4905

CERTIFICATE OF LAND SURVEYING BUSINESS AUTHORIZATION: LB0004905

DATE: 8/7/17
DESIGN/DRAWN: MM/RLR
DRAWING# 11417_200_001
PROJECT# 11417
SHEET 1 OF 1

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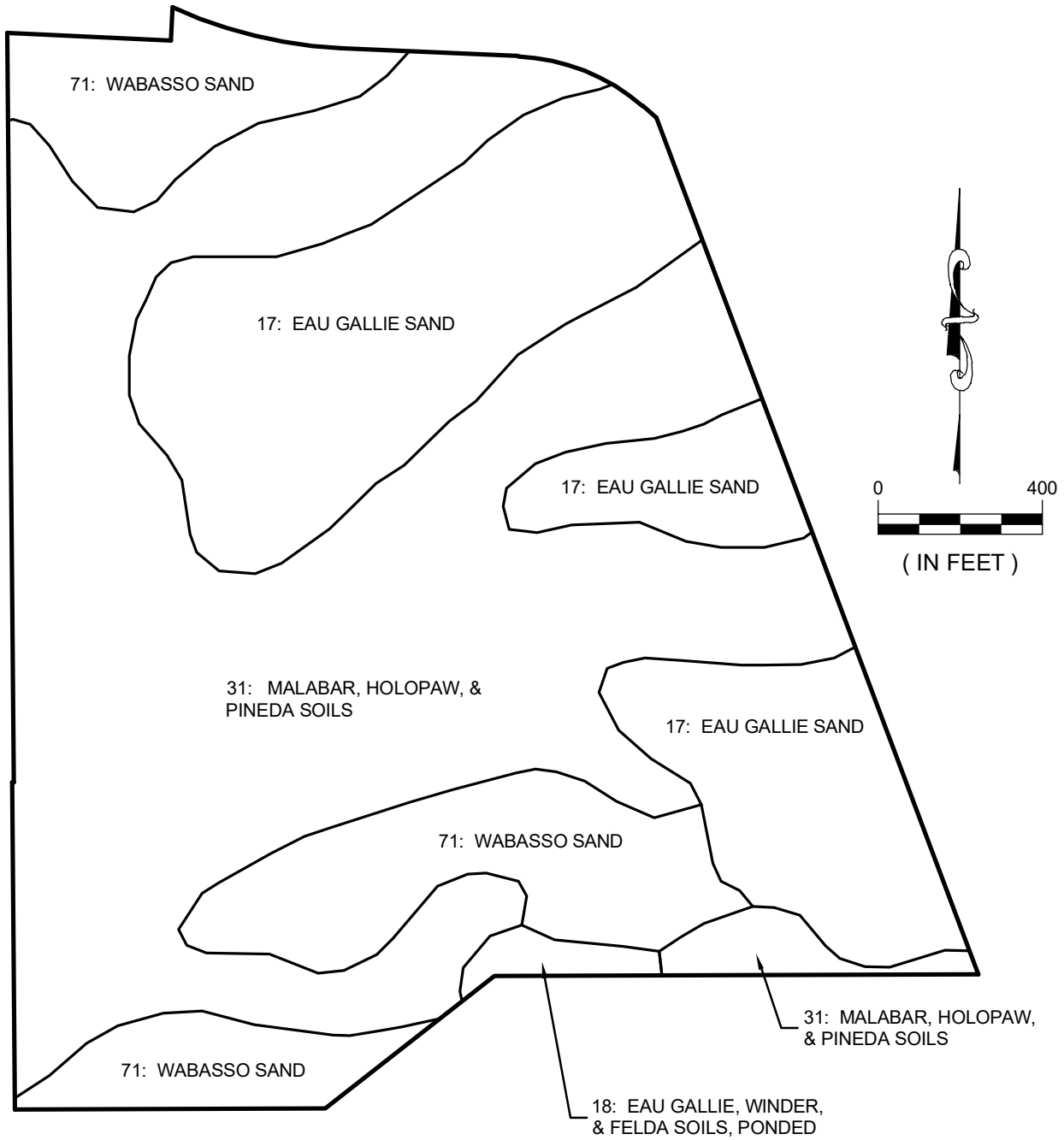
CITY OF PALM BAY
SOUTH REGIONAL WATER RECLAMATION FACILITY
SOILS EXHIBIT



SOIL DATA PROVIDED BY: SOIL SURVEY STAFF, NATURAL RESOURCES CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL SURVEY GEOGRAPHIC (SSURGO) DATABASE FOR BREVARD COUNTY, FLORIDA.

SOIL CODE	AREA (AC)
17	31.10
18	0.98
31	57.25
71	18.17

B.S.E. CONSULTANTS, INC.
CONSULTING - ENGINEERING - LAND SURVEYING
312 SOUTH HARBOR CITY BOULEVARD, SUITE 4 MELBOURNE, FL 32901
PHONE: (321) 725-3674 FAX: (321) 723-1159
CERTIFICATE OF BUSINESS AUTHORIZATION: 4905
CERTIFICATE OF LAND SURVEYING BUSINESS AUTHORIZATION: LB0004905

DATE: 8/7/17
DESIGN/DRAWN: MM/RLR
DRAWING# 11417_200_005
PROJECT# 11417
SHEET 1 OF 1

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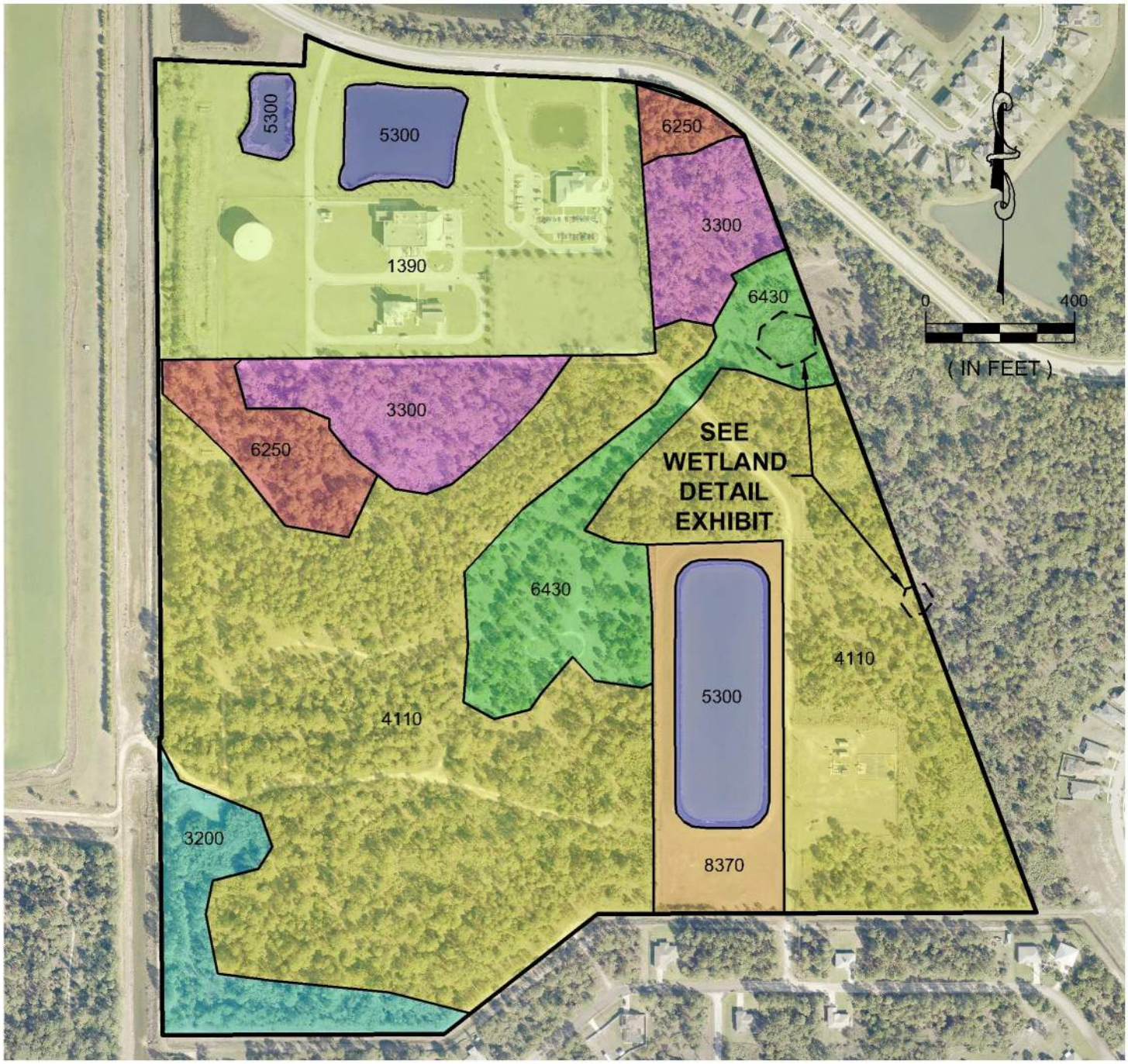
CITY OF PALM BAY

SOUTH REGIONAL WATER RECLAMATION FACILITY

FLORIDA LAND USE & COVER CLASSIFICATION SYSTEM (FLUCCS*) EXHIBIT

1390:	HIGH DENSITY, UNDER CONSTRUCTION	21.11 AC
3200:	SHRUB & BRUSHLAND	4.63 AC
3300:	MIXED UPLAND, NON-FORESTED	7.67 AC
4110:	PINE FLATWOOD	51.82 AC
5300:	RESERVOIR	6.57 AC
6250:	HYDRIC PINE FLATWOOD	3.72 AC
6430:	WET PRAIRIE	8.02 AC
8370:	SURFACE WATER COLLECTION BASINS	3.96 AC



* NOTE: FLUCCS CODES PER ST. JOHNS RIVER WATER MANAGEMENT DISTRICT, 2009

B.S.E. CONSULTANTS, INC.

CONSULTING - ENGINEERING - LAND SURVEYING

312 SOUTH HARBOR CITY BOULEVARD, SUITE 4 MELBOURNE, FL 32901

PHONE: (321) 725-3674 FAX: (321) 723-1159

CERTIFICATE OF BUSINESS AUTHORIZATION: 4905

CERTIFICATE OF LAND SURVEYING BUSINESS AUTHORIZATION: LB0004905

DATE: 8/11/17
DESIGN/DRAWN: MM/RLR
DRAWING# 11417_200_004
PROJECT# 11417
SHEET 1 OF 1

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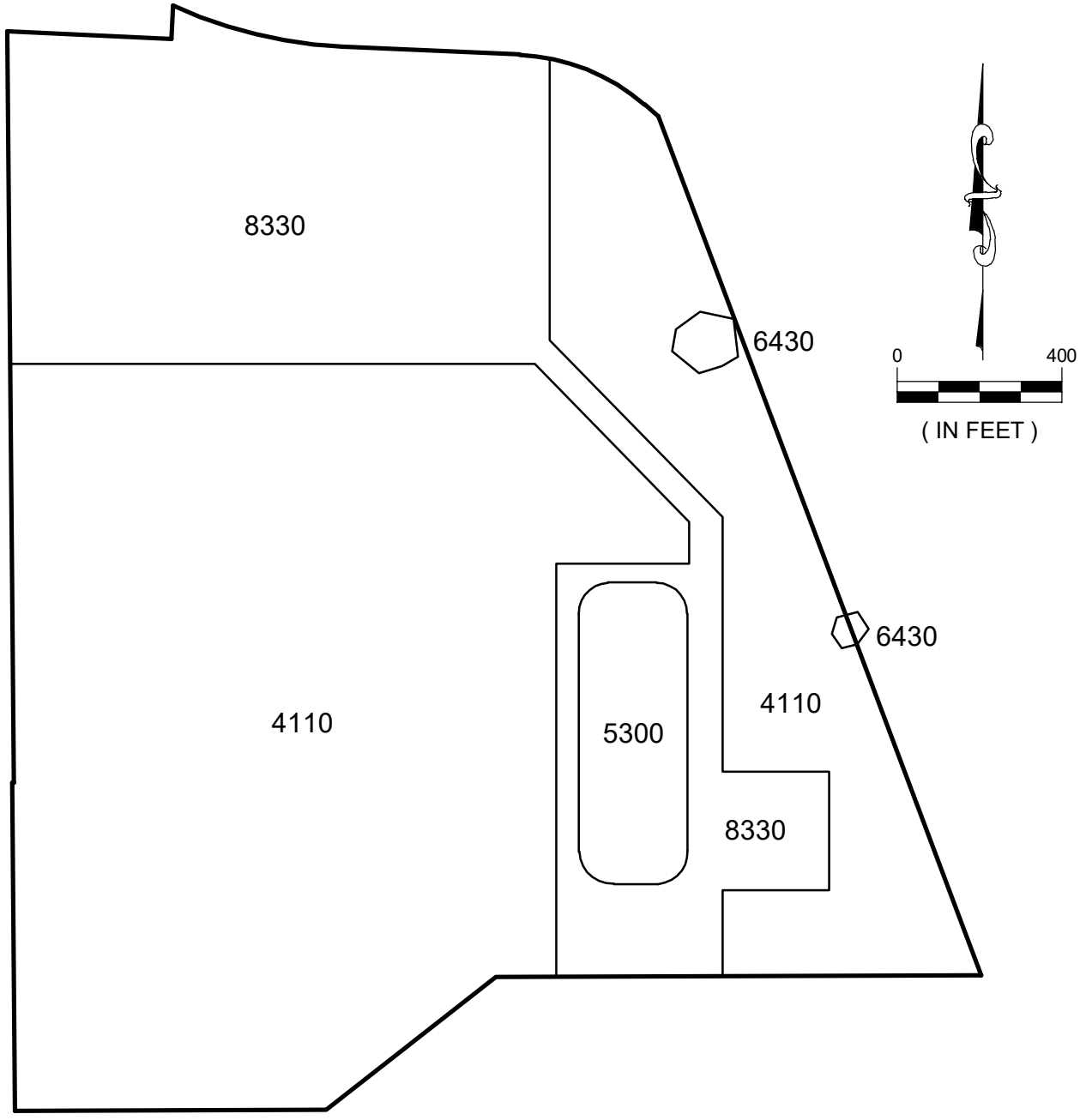
CITY OF PALM BAY
SOUTH REGIONAL WATER RECLAMATION FACILITY
FLORIDA LAND USE & COVER CLASSIFICATION SYSTEM (FLUCCS) EXHIBIT

FLUCCS CODE	DESCRIPTION	AREA (ACRES)
4110	PINE FLATWOODS	71.26
5330	RETENTION	4.33
6430	WET PRAIRIE	0.46
8330	WATER SUPPLY	31.44



* NOTE: FLUCCS BY M. MCAULIFFE, BSE CONSULTANTS.

B.S.E. CONSULTANTS, INC.
CONSULTING - ENGINEERING - LAND SURVEYING
312 SOUTH HARBOR CITY BOULEVARD, SUITE 4 MELBOURNE, FL 32901
PHONE: (321) 725-3674 FAX: (321) 723-1159
CERTIFICATE OF BUSINESS AUTHORIZATION: 4905
CERTIFICATE OF LAND SURVEYING BUSINESS AUTHORIZATION: LB0004905

DATE: 8/7/17
DESIGN/DRAWN: MM/RLR
DRAWING# 11417_200_004
PROJECT# 11417
SHEET 1 OF 1

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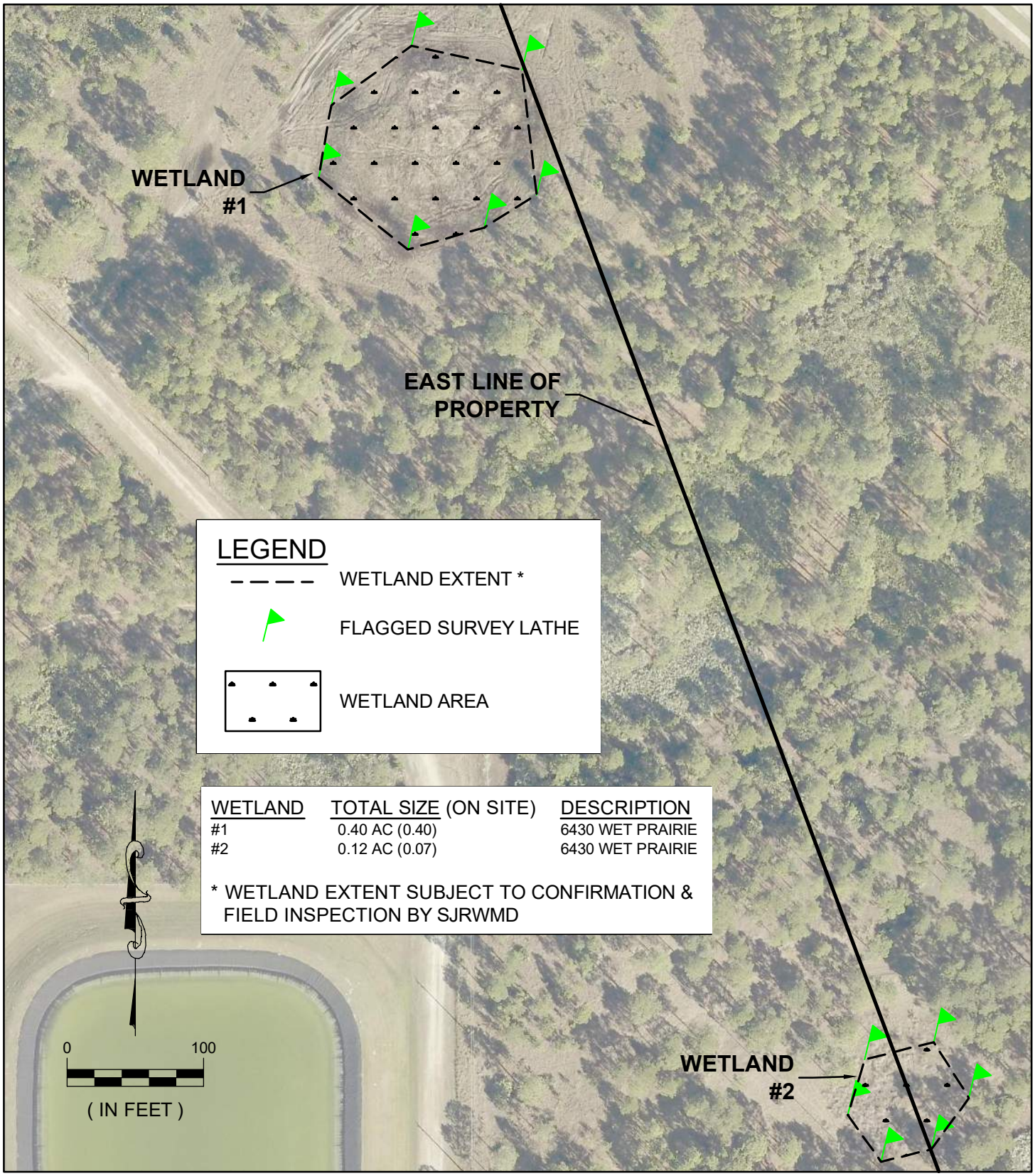
CITY OF PALM BAY
SOUTH REGIONAL WATER RECLAMATION FACILITY
WETLAND EXHIBIT



LEGEND

- WETLAND EXTENT *
- FLAGGED SURVEY LATHE
- WETLAND AREA

WETLAND	TOTAL SIZE (ON SITE)	DESCRIPTION
#1	0.40 AC (0.40)	6430 WET PRAIRIE
#2	0.12 AC (0.07)	6430 WET PRAIRIE

* WETLAND EXTENT SUBJECT TO CONFIRMATION & FIELD INSPECTION BY SJRWMD

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DATE: 8/7/17
DESIGN/DRAWN: MM/RLR
DRAWING# 11417_200_002
PROJECT# 11417
SHEET 1 OF 1

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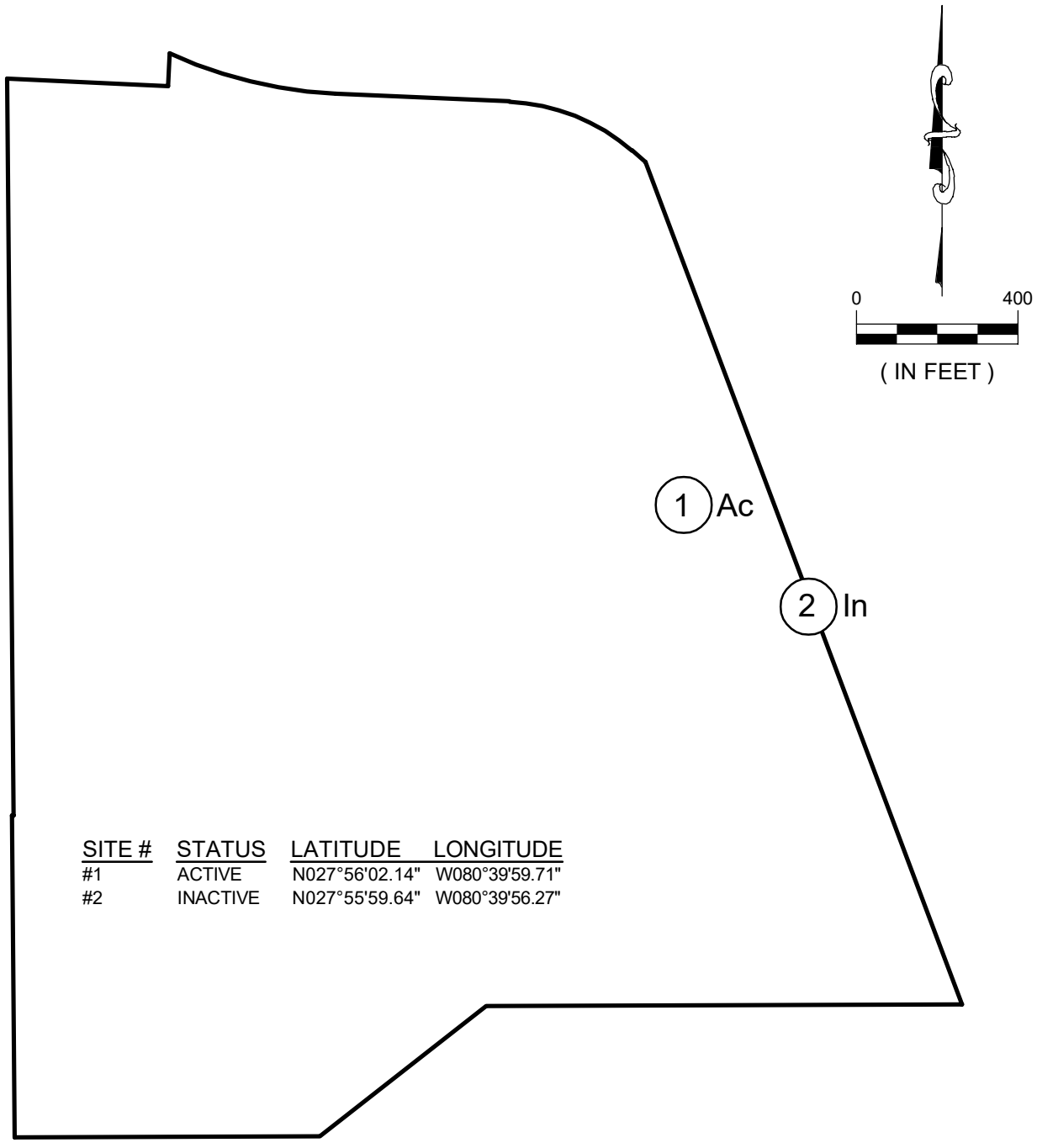
CITY OF PALM BAY
SOUTH REGIONAL WATER RECLAMATION FACILITY
GOPHER TORTOISE EXHIBIT



SITE #	STATUS	LATITUDE	LONGITUDE
#1	ACTIVE	N027°56'02.14"	W080°39'59.71"
#2	INACTIVE	N027°55'59.64"	W080°39'56.27"

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DATE: 8/7/17
DESIGN/DRAWN: MM/RLR
DRAWING# 11417_200_003
PROJECT# 11417
SHEET 1 OF 1

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City of Palm Bay
South Regional Water Reclamation Facility

Representative Habitat – Pine Flatwoods

-- PREPARED BY --
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8-2-17

City of Palm Bay
South Regional Water Reclamation Facility

Representative Habitat

-- PREPARED BY --
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8-2-17

City of Palm Bay
South Regional Water Reclamation Facility

Wetland #1

B.S.E. #11416

-- PREPARED BY --
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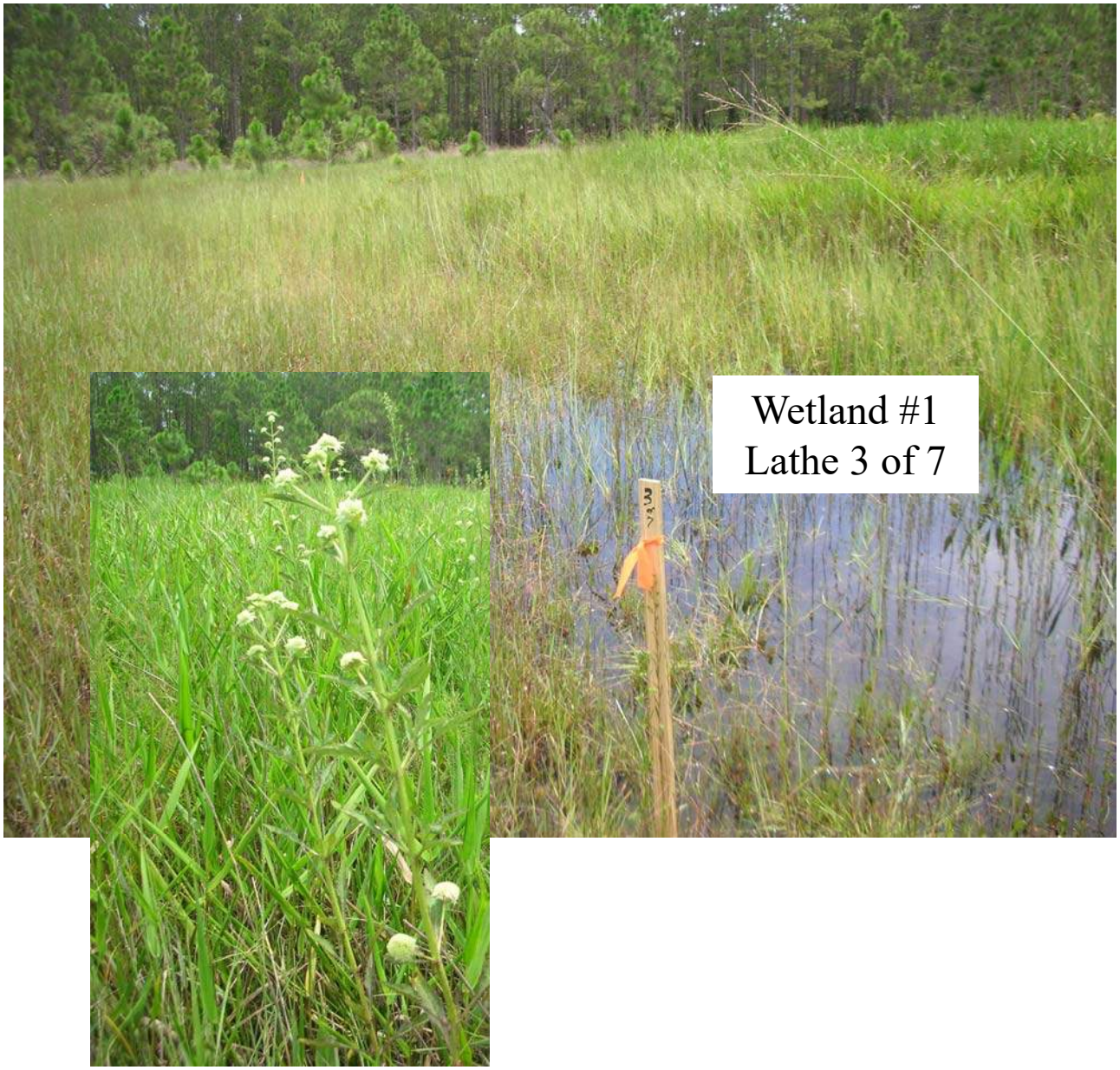
8-2-17

City of Palm Bay
South Regional Water Reclamation Facility



Wetland #1
Lathe 3 of 7

B.S.E. #11416

-- PREPARED BY --
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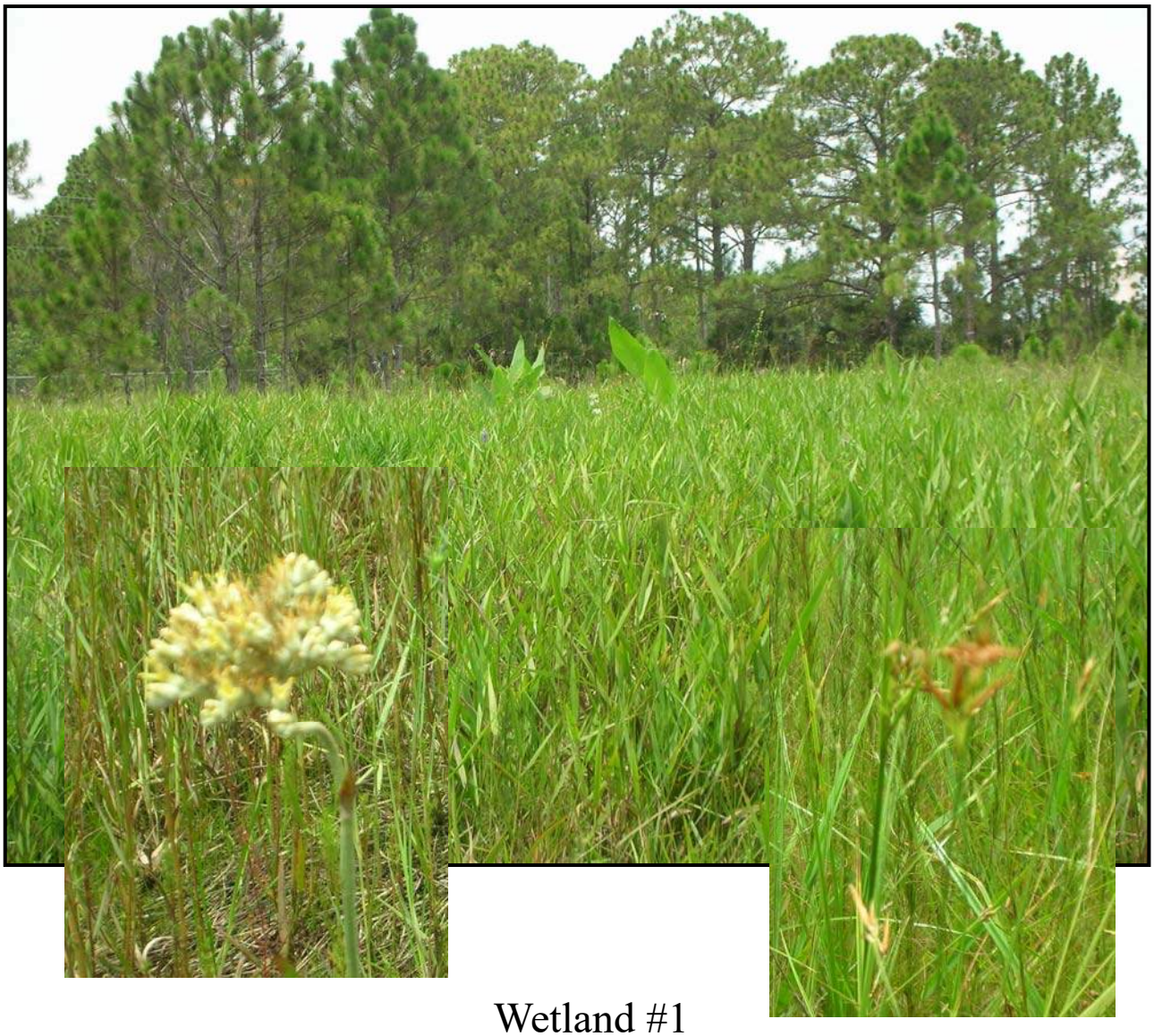
8-2-17

City of Palm Bay
South Regional Water Reclamation Facility



Wetland #1
Thalia, Pickerel Weed, Sagittaria, Rhynchospora, Carex, Hypericum & Lachnanthes

B.S.E. #11416

-- PREPARED BY --
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8-2-17

City of Palm Bay
South Regional Water Reclamation Facility

Wetland #2

-- PREPARED BY --
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B.S.E. #11416

8-2-17

City of Palm Bay
South Regional Water Reclamation Facility

Active Gopher Tortoise Burrow #1
With Lathes & Survey Tape

B.S.E. #11416

-- PREPARED BY --
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(321) 725-3674

8-2-17

City of Palm Bay
South Regional Water Reclamation Facility

Active Gopher Tortoise Burrow #1

-- PREPARED BY --
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8-2-17

City of Palm Bay
South Regional Water Reclamation Facility

B.S.E. #11416

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8-2-17

APPENDIX E
2009 GEOTECHNICAL REPORT

Information To Build On
Engineering • Consulting • Testing

Report
Geotechnical Engineering Services
South Regional Water and Wastewater Facility
Palm Bay, Brevard County, Florida
PSI Project No. 0757144

Information To Build On
Engineering • Consulting • Testing

June 25, 2009

Wade-Trim, Inc.
3790 Dixie Highway NE
Suite D
Palm Bay, Florida 32905

Attn: Mr. Eddie Fontanin, P.E.
Project Manager

RE: Report
Geotechnical Engineering Services
South Regional Water and Wastewater Facility
Palm Bay, Brevard County, Florida
PSI Project No. 0757144

Dear Mr. Fontanin:

In accordance with our proposal (PSI Proposal No. 757-9-084) and your authorization, Professional Service Industries, Inc. (PSI) has performed geotechnical engineering services for the referenced project. PSI's geotechnical services were conducted to provide design level geotechnical recommendations to guide the design and construction of the proposed water and wastewater facility improvements.

PROJECT INFORMATION

The proposed project site under consideration is a 53± acre tract of land in Palm Bay, Brevard County, Florida. The property is located on the east side of Degroodt Road SW, north of Dailey Street SE. The site currently contains existing water/wastewater infrastructure. Portions of the property are heavily vegetated with mature pine trees, with various dirt paths/roads traversing the site.

Based on information provided to PSI, we understand the initial phase of the project (2013 infrastructure plan) is to include the construction of a new control building (Element A-1), MBR tank (Element A-2), 1.0 MGAL reclaimed water storage tank (Element A-3), reclaimed water pump station (Element A-4), chlorine contact chamber (Element A-5) and chemical storage structure (Element A-6). Associated with the noted infrastructure, various elements including a future RO Supply Well (B-2), existing RO Supply Well (B-1) and proposed stormwater ponds (C-4) will be constructed.

Based on information provided to PSI, the MBR tank will have plan dimensions of 50 feet by 80 feet and be 20 feet tall. The 1.0 MGAL reclaimed water storage tank will be 30 feet in height.

Foundation loads for the proposed buildings/tanks were not available to PSI at the time of this report. However, based on past experience and the information provided to PSI, we would anticipate building loads to be relatively light to moderate (i.e. maximum column and wall foundation loads of 75 kips and 2 to 3 kips per lineal foot, respectively). We anticipate bearing pressures from the MBR tank and the reclaimed water storage tank to be on the order of 1,500 psf and 2,200 psf, respectively.

The above listed assumptions have been used for the purpose of preparing this report. Adjustments to PSI's recommendations may be necessary if the planned development differs from the noted assumptions.

SCOPE OF GEOTECHNICAL SERVICES

The purpose of this study was to obtain information on the subsurface soil and groundwater conditions at the proposed project site. The subsurface materials encountered were then evaluated with respect to the available project characteristics. In this regard, geotechnical engineering evaluations for the following issues were addressed.

1. Feasibility of utilizing shallow foundation systems for support of the proposed building/structures and tanks, with slab-on-grade floor systems.

2. Design parameters required for the foundation systems, including allowable bearing pressures, foundation levels and expected settlements.

3. Soil subgrade preparation, including stripping, grubbing and compaction. Engineering criteria for placement and compaction of approved structural fill materials.

4. Suitability and availability of materials on-site that may be moved during site grading for use as structural fill in the building/structures and tanks areas, as pavement subgrade fill, and as general backfill.

5. General location and description of potentially deleterious materials encountered in the borings which may interfere with construction progress or structure performance, including existing fills or surficial organics.

6. Identification of groundwater levels (seasonal fluctuations).

7. Input to the design of the proposed stormwater pond improvements.

The following services were provided in order to achieve the preceding objectives:

1. Reviewed readily available published geologic and topographic information. This published information was obtained from the "Fellsmere NW, Florida" quadrangle map published by the United States Geological Survey (USGS) and the "Soil Survey of Brevard County, Florida" published by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS).

2. Executed a program of subsurface sampling and field testing. As requested, PSI performed a series of Standard Penetration Test (SPT) and auger borings within the planned development areas. The following summarizes our field work.

New Control Building (A-1)	-	1 SPT Boring (20-foot depth)
MBR Tank (A-2)	-	2 SPT Borings (40-foot depth)
1.0 MGAL Tank (A-3)	-	2 SPT Borings (75-foot depth)
Reclaimed Water Pump Station (A-4)	-	1 SPT Boring (20-foot depth)
Chlorine Contact Chamber (A-5)	-	1 SPT Boring (20-foot depth)
Chemical Storage Structure (A-6)	-	1 SPT Boring (20-foot depth)
Proposed Stormwater Ponds (C-4)	-	5 Auger Borings (10-foot depth)
Existing RO Supply Well (B-1)	-	1 Auger Boring (10-foot depth)
Site Wide Borings	-	6 Auger Borings (10-foot depth)

   The boring locations were established in the field utilizing handheld GPS equipment and the project plans provided to PSI. In addition to the borings, one (1) Double Ring Infiltrometer (DRI) test was performed in the planned stormwater pond area. Five (5) laboratory falling-head permeability tests were also performed on Shelby tube soil samples obtained from borings completed within the planned stormwater pond areas.

3. Visually classified and stratified representative soil samples in the laboratory using the Unified Soil Classification System (USCS). Conducted a limited laboratory testing program. Identified soil conditions at each boring location and formed an opinion of the site soil stratigraphy.

4. Collected groundwater level measurements and estimated normal wet seasonal high groundwater levels.

5. The results of the field exploration and laboratory tests were used in the engineering analysis and in the formulation of our geotechnical recommendations for the 2013 infrastructure phase of the project. The results of the subsurface exploration, including the recommendations and the data on which they are based, are presented in this report.

REVIEW OF PUBLISHED DATA

USGS Quadrangle Map

Based on our review of the USGS quadrangle map entitled "Fellsmere NW, Florida," natural ground surface elevations in the project vicinity is on the order of +20 to +25 feet NGVD. Site-specific topographic information was not available to PSI at the time of this report.

Refer to **Figure 1** in the **Appendix** for an extract of the USGS map for the project vicinity.

SCS Soil Survey

Referencing the USDA Soil Conservation Service (SCS) "Soil Survey of Brevard County, Florida" indicates that there are four soil map units within the vicinity of the project site. The mapped soil units as depicted by the SCS are as follows.

Soil Series	Depth (inches)	Unified Classification	USDA Seasonal High Groundwater Table
			Depth (inches)
(Eg) EauGallie sand	0 to 84	SP, SP-SM, SM, SM-SC, SC	0 to 10
(Ew) EauGallie, Winder and Felda soils, ponded	0 to 84	SP, SP-SM, SM, SM-SC, SC	0 to 10
(Mb) Malabar, Holopaw and Pineda soils	0 to 65	SP, SP-SM, SM-SC, SC	0 to 10
(Wa) Wabasso sand	0 to 62	SP, SP-SM, SM, SM-SC, SC	0 to 10

An excerpt of the SCS soils map is included in the **Appendix** as **Figure 2**.

FIELD EXPLORATION

General

The approximate locations of the SPT and auger borings drilled for our field study are presented on **Sheet 1** in the **Appendix**. The soil types encountered at the specific boring locations are presented in the form of soil profiles on **Sheets 2** and **3**. Included on **Sheets 2** and **3** is a legend describing the encountered soils in USCS format and the measured groundwater levels recorded in the borings. The soil stratification presented is based on visual observation of the recovered soil samples, laboratory test results and the interpretation of field logs by a geotechnical engineer.

It should be noted that variations in the subsurface conditions are expected and may be encountered between and away from the borings. Also, whereas the individual boring logs indicate distinct strata breaks, the actual transition between the soil layers may be more gradual than shown on the soil profiles.

Soil Conditions

Based on our borings performed for the evaluation, the soils generally consisted of a varying sequence of fine sands. These sands graded relatively clean to slightly silty, silty and clayey in composition (i.e. SP, SP-SM, SM and SC materials). In addition, zones of sandy clay and clay (CL and CH materials) were encountered at various depths in a few borings. Some of the sands were noted to contain "hardpan" (partially to well-cemented soils) and coquina (sedimentary rock formed from shell and on coral).

The coquina and hardpan were generally encountered in the depth interval 5 to 10 feet below existing grade. The layers of sandy clay and clay (Stratum 3) were encountered in borings A-3-1 and A-4 within the approximate depth intervals 12 to 22 feet below existing grade, and again in boring A-3-1 at depths of about 37 to 42 feet.

Based on the SPT blow counts recorded in the SPT borings, the sands are generally in a loose to medium dense condition. However, zones of dense material were encountered in the upper 10 feet of some of the borings.

The clays are generally in a firm to stiff condition in the upper 25 feet, and in a very stiff condition at greater depths. Refer to the boring profiles on **Sheets 2** and **3** for detailed information regarding the materials encountered within the individual borings.

Groundwater Conditions

Groundwater was measured in the borings at the time of drilling (June 2009). Based on our measurements, the groundwater levels ranged from 1.8 to 5.5 feet below the existing ground surface in the soil borings.

Groundwater levels at the site will vary throughout the year as a result of variations in the magnitude and frequency of seasonal rainfall, plus changes in drainage conditions at the site. Based on the results of the borings completed for the project, a review of SCS data, site topographic information and our

past experience, we estimate the normal seasonal high groundwater for the site will occur within 1 foot of the natural ground surface. More detailed recommendations regarding seasonal groundwater levels can be provided once detailed topographic information is provided for the site.

It should be noted the estimated normal seasonal high groundwater level is not intended to define a limit or ensure that future seasonal fluctuations in groundwater levels will not exceed the estimated levels. Post-development groundwater levels could exceed the estimated levels as a result of a series of rainfall events, changed conditions at the site that alter surface water drainage characteristics, or variations in the duration, intensity, or total volume of rainfall.

Laboratory Test Results

Laboratory tests conducted on select soil samples consisted of percent fines passing the U.S. No. 200 sieve, moisture content, Atterberg Limits and permeability testing. Laboratory tests were completed in general accordance with appropriate ASTM procedures. Test results were utilized to aid in classifying the site soils and determine pertinent engineering properties/parameters. The laboratory test results are presented adjacent to the soil profiles on **Sheets 2** and **3** in the **Appendix** at the depth increment of the test specimens.

SITE SUITABILITY

Based on the results of PSI's borings, it is our opinion that subsoil conditions are generally suitable for the proposed water and wastewater facility improvements from a geotechnical engineering perspective. To adequately prepare the building/structure and tank areas, the subgrade should be proof-rolled/densified following site clearing activities, including the removal of all surface vegetation, and organic topsoil. Additionally, all fills should be placed and compacted in maximum one-foot thick lifts.

Following completion of subgrade preparation/fill compaction, shallow spread foundations can be used for building support. Such foundations can be designed for a maximum net allowable bearing pressure up to 3,000 pounds per square foot (psf). The large MBR and storage tanks can be supported on mat foundations.

More detailed discussions pertaining to site preparation, pavement construction and foundation design matters for the proposed project follow.

SITE PREPARATION CONSIDERATIONS

General

The following recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions encountered. If there is any change in the project criteria, including building/structure and tank locations on the site, a review must be made by PSI to determine if additional fieldwork and/or any modifications to our recommendations will be required.

Once final design plans and specifications are available, a general review by PSI is strongly recommended as a means to check that the evaluations made in preparation of this report are correct and that earthwork and foundation recommendations are properly interpreted and implemented.

Site Clearing

At the outset of construction, clearing and grubbing including root raking and removal of organic-laden topsoil should be completed. Clearing and grubbing is expected to extend to average depths of about 6 inches in order to remove root-laden soils. Clearing and grubbing normally includes removing the surface vegetation, stripping topsoils, grubbing major root systems, stump removal, plus removing organic soils, debris and other deleterious materials. At a minimum, it is recommended that the clearing operations extend at least ten feet beyond the proposed building/structure and tank perimeters, where possible.

Initial site clearing and preparation work should be carried out under the observation of a representative of the geotechnical engineer.

Fill Placement and Subgrade Preparation

Following the clearing operations, the exposed subgrade should be evaluated as directed by representatives of PSI to confirm that all unsuitable materials have been removed. Building/structure and tank areas should then be proof-rolled to provide a stable/unyielding subgrade prior to placing fill.

Proof rolling should consist of compaction with a large diameter, vibratory drum roller. The roller should have a drum weight of at least ten tons. Proof rolling should consist of a minimum of ten overlapping coverages of the roller in a criss-cross pattern with a maximum travel speed of 2 feet per second. Based on past experience, compaction should be completed in the static mode when within 75 feet of existing structures to reduce the transmission of vibrations that may disturb building occupants or potentially cause structural distress. Careful observations should be made during proof rolling to help identify any areas of soft/yielding soils that may require over-excavation and replacement filling.

For the building/structure and tank areas, we recommend that the natural ground, to a minimum depth of one foot below stripped grade, be compacted to at least 95 percent of the material's modified Proctor (ASTM D-1557) maximum dry density. Following satisfactory completion of initial compaction of the stripped subgrade, the proposed development areas may be brought up to finished grades as required.

Engineered Fill

Any off site fill imported for the project should consist of clean fine sand with less than 12 percent by dry weight passing the U.S. Standard No. 200 sieve and be free of rubble, organics, clay, debris and other deleterious material. Fill should be tested and approved prior to import and placement. Each lift should have a loose thickness not exceeding 12 inches. Density tests should be performed to confirm the required compaction is being achieved prior to placing the next lift.

Prior to beginning compaction, soil moisture conditioning may be required. Soil moisture contents should be controlled in order to facilitate proper compaction. A moisture content within two percentage points of the material's optimum indicated by the modified Proctor test (ASTM D-1557) is recommended prior to compaction of the natural ground and fill. All engineered fill should be compacted to at least 95 percent of the material's modified Proctor (ASTM D-1557) maximum dry density.

FOUNDATION DESIGN CONSIDERATIONS

General

Based on our evaluations and analyses, the soil conditions encountered in the borings performed for the project are considered capable of supporting the proposed buildings/structures and tanks on shallow spread foundations and mat foundations, respectively, following satisfactory completion of the subgrade preparation recommendations noted herein.

All foundation excavations should be observed by the Geotechnical Engineer or his representative to explore the extent of any fill, excessively loose, soft, or otherwise undesirable materials. If the foundation excavations appear suitable for support, the bottom of foundation excavations should be compacted after excavation. The subgrade soils should be compacted to a minimum density requirement of 95 percent of the material's modified Proctor (ASTM D-1557) maximum dry density for a minimum depth of two feet below the bottom of footings, as determined by field density compaction tests. Backfill soils placed adjacent to footings or walls should be carefully compacted with a light, walk-behind roller or vibratory plate compactor to avoid damaging in-place footings or walls.

If soft or loose materials are encountered in the footing excavations, then such materials should be removed and the subgrade re-established by backfilling. This backfilling may be done with a well-compacted, suitable fill such as clean sand (engineered fill), a lean concrete, or crushed FDOT No. 57 or FDOT No. 67 stone. Sand backfill should be compacted to at least 95 percent of the material's modified Proctor maximum dry density (ASTM D-1557), as previously described. Stone should be thoroughly compacted to a firm and unyielding condition, as confirmed by the geotechnical engineer's site representative.

Shallow Spread Foundations

Based on the anticipated construction and recommended site preparation, shallow foundations may be designed for a net allowable bearing pressure of 3,000 pounds per square foot (psf). The foundations and floor slabs should bear on properly placed and compacted cohesionless (sand) fills and/or densified native soils as discussed earlier.

All footings should be embedded so that the bottom of the foundation is a minimum of 18 inches below adjacent finished grades on all sides. Strip or wall footings should be a minimum of 18 inches wide, while column footings should be at least 30 inches square.

Provided the recommended subgrade preparation operations presented herein are properly performed, estimates show total settlement of shallow spread footings for isolated columns and wall footings should be less than one inch. Differential settlements should be approximately 50 percent of the total movements. These estimates are based on foundation loads discussed herein. The settlement of shallow foundations supported on sandy soils should occur relatively quickly after initial loading. Thus, the majority of expected settlement should occur during construction as dead loads are imposed.

Mat Foundations

We have evaluated a flexible mat foundation system for support of the proposed storage tank facilities. Mat foundation systems have been used successfully for similar tanks on other projects and thus we consider this foundation system viable for support of the proposed new MBR and reclaimed water storage tanks. Based on the loading information provided to PSI, the load stress at the base of the MBR and reclaimed water tanks is on the order 1,500 psf and 2,000 psf, respectively. We evaluated a mat in which the bottom elevation is some 2 to 3 feet below existing grade.

Mat foundation settlements below the tanks were calculated using the computer program SETTLG. A stress/settlement model was developed to simulate the mat foundation's settlement performance. The subsurface conditions/parameters were determined based on the results of PSI's borings, laboratory testing and our experience in the area. Estimated maximum theoretical total and differential settlements were computed to be 6 inches and 3 inches for the 1.0 MGAL tank and 2 inches and 1 inch for the MBR tank, respectively. The largest movements are projected to occur near the center of the tanks, decreasing at the edges. The angular distortion as a result of theoretical differential settlement across the mat foundation is estimated in the range 1 in 140 to 1 in 500. The tanks and utility connections should be designed/constructed to tolerate the projected settlement movements and distortions resulting from the same.

Foundation settlements will take place fairly rapidly after initial load application and will for the most part be complete by the end of the construction and preload/hydro-testing period. We estimate that about 20 percent of the projected settlement movement will take place after construction as consolidation settlement of the fine grained soils takes place. All of the settlement movements should have occurred within the first 3 to 4 months of the facility being built out and loaded.

For design of a mat foundation system, it is our opinion a subgrade modulus of 10 to 30 pounds per cubic inch (pci) can be used to model/represent the foundation subsoils, the modulus being less at the tank centers and higher at the edges. The mat foundation should be constructed atop stable and unyielding soils prepared by proof rolling as discussed herein. As the structural engineer works on the design of the mats, we would be pleased to review modulus parameters with him as necessary.

Lateral Load Resistance

Lateral loads that are applied to the foundations may be resisted by earth pressure mobilized on the buried vertical faces of the footings and by shearing forces acting along the footing-subgrade interface. Earth pressure resistance may be determined using an equivalent fluid density of 360 pounds per cubic foot for moist soil and 180 pounds per cubic foot for submerged soil below the water table. A friction factor of 0.4 should be used to determine base shearing resistance. A factor of safety of 1.5 should be applied to the resistance value computed in this matter. The noted values are based on the assumption that the footings are surrounded by compacted sand fill.

To develop passive resistances, the foundations must be able to tolerate some lateral movement. In order to minimize the movement required to develop resistance, the pressure values presented above can be halved. We estimate lateral movements in the range one-quarter to three-eighths of an inch. A factor of safety of at least 1.5 is recommended for design.

Earth Pressures on Walls

Below grade walls and retaining walls for the project should be designed to resist pressures exerted by the adjacent soils and hydrostatic head. For walls that are not restrained during backfilling but are free to rotate at the top, active earth pressure should be used in design. Walls that are restrained should be designed assuming at-rest pressures. Recommended soil parameters for the near-surface granular soils encountered at the site are presented in the following.

Total Unit Weight, γ_b	=	120 lb/ft^3
Angle of Internal Friction, ϕ	=	30°
Coeff. of Sliding Friction	=	0.40
Active Soil Pressure coeff., K_a	=	0.33
At-rest Soil Pressure coeff., K_o	=	0.50
Passive Soil Pressure coeff., K_p	=	3.00

The recommended parameters assume that adequate drainage is provided behind the walls to prevent the build up of excess hydrostatic pressures.

In order to avoid wall damage due to excessive compaction, hand operated mechanical tampers should be used to densify backfill soils; heavy compaction equipment should not be allowed within five feet of walls. The soils behind walls should be compacted to approximately 95 percent of the material's modified Proctor (ASTM D-1557) maximum dry density.

FLOOR SLABS

Floor slabs can be safely supported as slab-on-grade systems provided the final subgrade elevation is densified and prepared as recommended herein. We further recommend that the upper one foot of the subgrade soils within the building pads be compacted to at least 95 percent of the maximum dry density of the soil's modified Proctor (ASTM D-1557).

It is recommended that the floor slab bearing soils be covered by lapped polyethylene sheeting in order to reduce the potential for floor dampness which can affect the performance of floor coverings. This membrane should consist of a minimum six mil thick, single layer of non-corroding, non-deteriorating sheeting material placed to minimize seams and to cover all of the soil below the building floor slabs. Seams should be overlapped a minimum of 12 inches.

OTHER CONSIDERATIONS

Stormwater

Stormwater ponds for the proposed development will likely need to be designed as wet bottom systems. Ponds that are to be constructed adjacent to wetland conservation areas need to consider the hydro-period of the wetland in design, as to not negatively impact the wetland feature. We recommend the pond control elevations be set between the estimated normal seasonal high and low groundwater levels to minimize fluctuation of water levels in the ponds.

Stormwater ponds should be designed to provide stable slopes, with recommended side slopes being 4 horizontal to 1 vertical (4H:1V) or flatter from a level 2 feet below the pond's normal control level to the top of berm and 2H:1V or flatter from a level 2 feet below the normal control level to the pond bottom. The proposed stormwater systems should be designed and constructed in accordance with Water Management District requirements and meet city criteria.

PSI conducted one double ring infiltration (DRI) test and five laboratory falling-head permeability tests at depths of about 1 foot below the existing ground surface within the proposed stormwater pond areas. The results of our tests indicate vertical permeability rates of between 13 and 40 feet per day at the test locations. Based on experience, the coefficient of horizontal permeability (hydraulic conductivity) may be taken as 1.5 times the vertical rate for design purposes.

It should be noted that the coefficient of vertical permeability is not an infiltration rate. The recovery of a given stormwater system is dependent on the soil permeability as well as the groundwater table, pond bottom elevation, confining layer and water level in the pond. We recommend a commercially available computer program such as PONDS or MODRET be used by an engineer experienced in groundwater modeling to evaluate the stormwater systems. The systems should be designed and constructed in accordance with Water Management District requirements. We recommend an appropriate safety factor be applied to the permeability rate used in the stormwater pond models.

Excavations

In Federal Register, Volume 54, No. 209 (October 1989) the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better insure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, general construction excavations or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed the Owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

PSI is providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations.

Dewatering

Some form of dewatering will likely be needed for the project during construction. Shallow excavations can typically be dewatered using sumps and pumps, while deeper excavations will require a well-point or horizontal sock drain system to achieve adequate drawdown. Dewatering systems should be designed and operated in accordance with Water Management District criteria, including handling of discharge.

LIMITATIONS

Our professional services have been performed, our findings obtained, and our geotechnical recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This company is not responsible for the conclusions, opinions or recommendations made by others based on this data. No other warranties are implied or expressed.

The scope of this investigation was intended to evaluate the soil conditions within the influence of the proposed building/structure and tank foundations and does not address potential deep soil conditions such as sinkholes. The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed improvements.

The scope of our services presented herein does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our client.

PSI did not provide any service to investigate or detect the presence of moisture, mold or other biological contaminates in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence of the amplification of the same. Client acknowledges that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. Client further acknowledges that site conditions are outside of PSI's control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible for the occurrence or recurrence of mold amplification.

CLOSURE

PSI appreciates the opportunity to provide our services on this project and we look forward to working with you during the construction phase. If you have any questions regarding the contents of this report, or if we may be of further service, please contact the undersigned.

Very truly yours,

PROFESSIONAL SERVICE INDUSTRIES, INC.
Certificate of Authorization No. 3684

Jeremy A. Sewell, P.E.
Project Engineer
FL License No. 62951

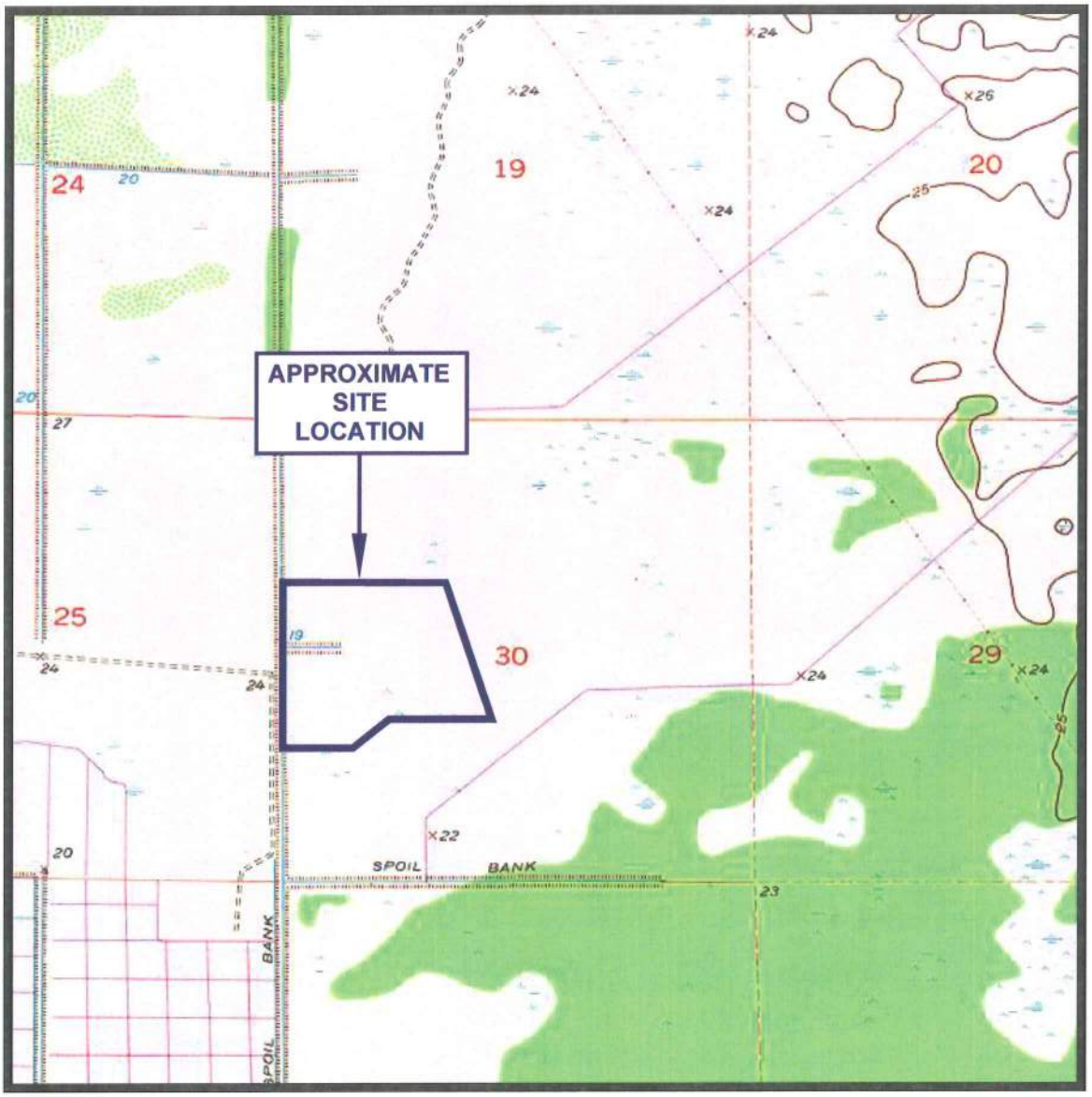
Kenneth L. Symonds 7/15/09
Kenneth L. Symonds, Jr., P.E.
Senior Project Engineer
FL License No. 59518

for Robert A. Trompke, P.E.
Geotechnical Department Manager
FL License No. 55456

RT\ 0757144 (Wastewater Facility, Palm Bay)625.doc

Appendix : Figure 1 – USGS Quadrangle Map
Figure 2 – SCS Soils Map
Sheet 1 – Boring Location Plan
Sheets 2 and 3 – Boring Profiles

APPENDIX



REFERENCE: U.S.G.S "FELLSMERE NW, FLORIDA" QUADRANGLE MAP

SECTION:	*30*	*ISSUED:*	*1970*
TOWNSHIP:	*29 SOUTH*	*PHOTOREVISED:*	*1970*
RANGE:	*37 EAST*	*SCALE:*	*1"=2000'*

VICINITY MAP

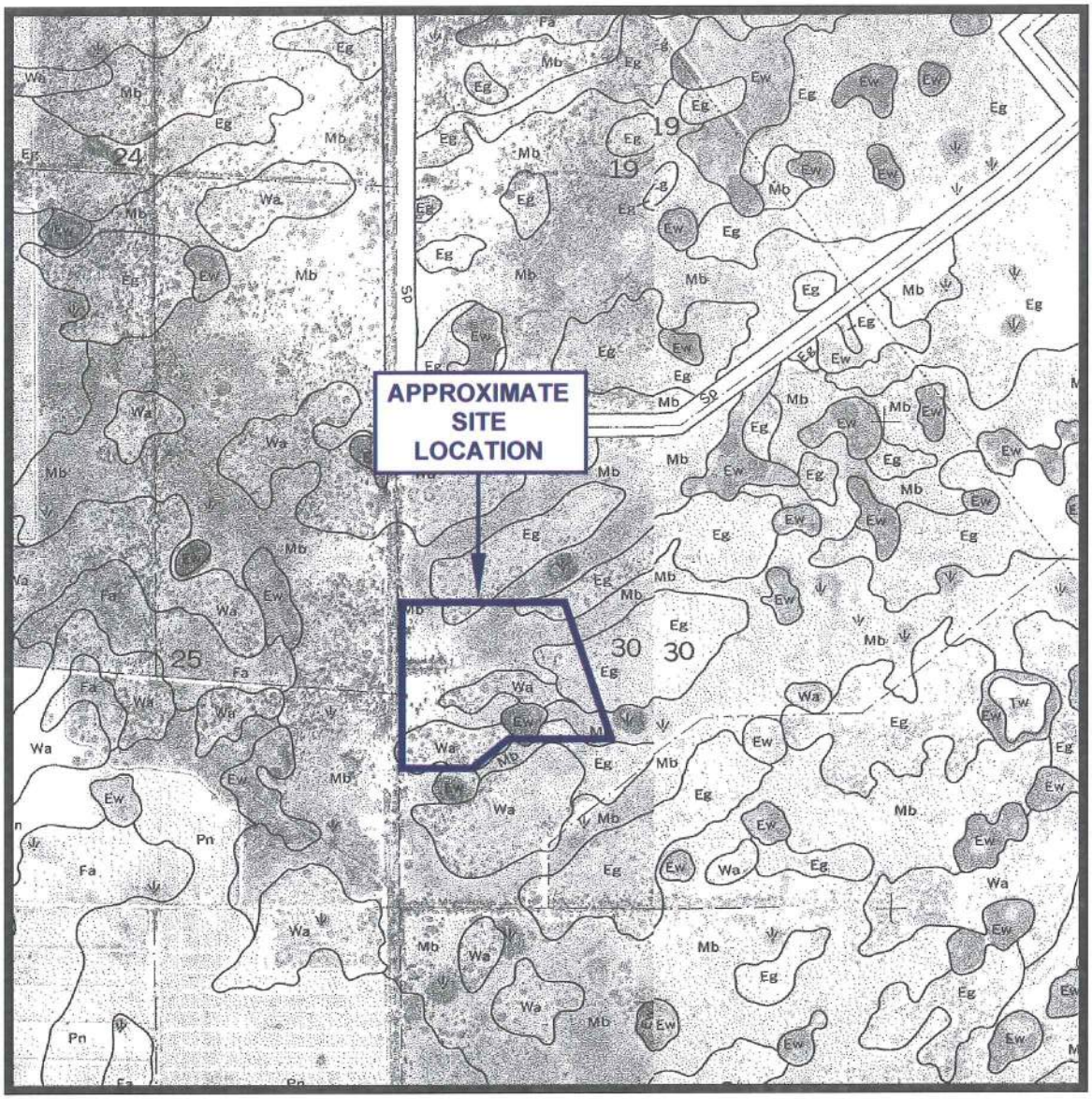
SOUTH REGIONAL WATER & WASTEWATER RECLAMATION FACILITY

PALM BAY, BREVARD COUNTY, FLORIDA

psi *Information To Build On*

Engineering • Consulting • Testing

DRAWN:	DJW	SCALE:	NOTED	PROJ. NO:	0757144
CHKD:	RT	DATE:	6-24-09	FIGURE:	1



REFERENCE: U.S.D.A.-S.C.S. "BREVARD COUNTY, FLORIDA" SOILS MAP

SECTION: 30
TOWNSHIP: 29 SOUTH
RANGE: 37 EAST

ISSUED: AUGUST 1989
SCALE: 1"=2000'

SOILS LEGEND

Wa WABASSO
Mb MALABAR
Eg EAUGALLIE SAND
Ew EAUGALLIE, WINDER, AND FELDA SOILS, PONDED

SOILS MAP

SOUTH REGIONAL WATER & WASTEWATER RECLAMATION FACILITY

PALM BAY, BREVARD COUNTY, FLORIDA

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CHKD:	RT	DATE:	6-24-09	FIGURE:	2

LOCATION PLAN

SCALE: 1"=300'

N

W E

S

LEGEND

APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

APPROXIMATE LOCATION OF AUGER BORING

APPROXIMATE LOCATION OF DOUBLE RING INFILTROMETER TEST

GEOTECHNICAL ENGINEERING SERVICES

SOUTH REGIONAL WATER & WASTEWATER RECLAMATION FACILITY

PALM BAY, BREVARD COUNTY, FLORIDA

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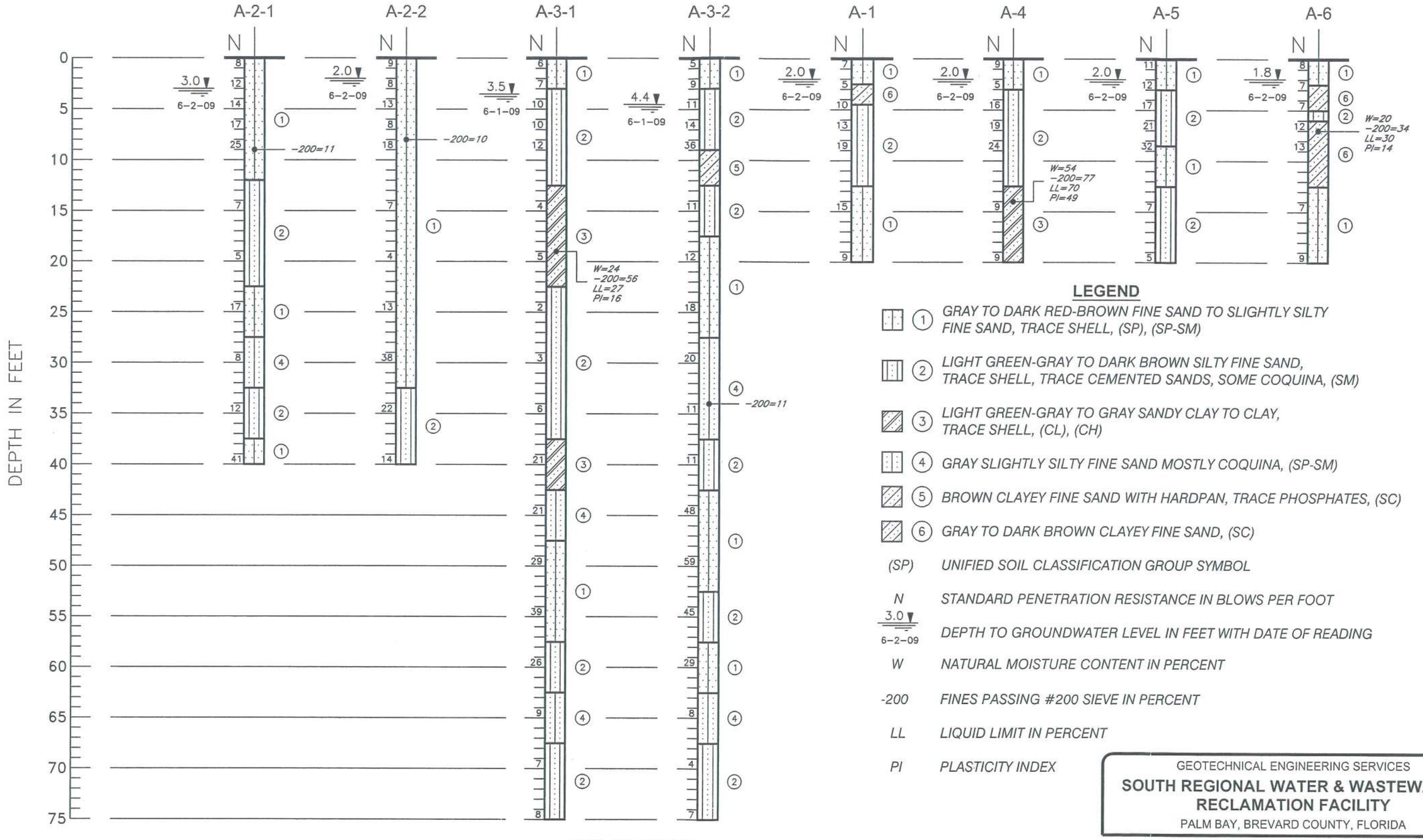
DRAWN:	DJW	SCALE:	NOTED	PROJ. NO:	0757144
CHKD:	RT	DATE:	6-12-09	SHEET:	1



SOIL PROFILES

SCALE: 1"=10'

LEGEND

(1)	*GRAY TO DARK RED-BROWN FINE SAND TO SLIGHTLY SILTY FINE SAND, TRACE SHELL, (SP), (SP-SM)*
(2)	*LIGHT GREEN-GRAY TO DARK BROWN SILTY FINE SAND, TRACE SHELL, TRACE CEMENTED SANDS, SOME COQUINA, (SM)*
(3)	*LIGHT GREEN-GRAY TO GRAY SANDY CLAY TO CLAY, TRACE SHELL, (CL), (CH)*
(4)	*GRAY SLIGHTLY SILTY FINE SAND MOSTLY COQUINA, (SP-SM)*
(5)	*BROWN CLAYEY FINE SAND WITH HARDPAN, TRACE PHOSPHATES, (SC)*
(6)	*GRAY TO DARK BROWN CLAYEY FINE SAND, (SC)*
(SP)	*UNIFIED SOIL CLASSIFICATION GROUP SYMBOL*
N	*STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT*
3.0 ▼ 6-2-09	*DEPTH TO GROUNDWATER LEVEL IN FEET WITH DATE OF READING*
W	*NATURAL MOISTURE CONTENT IN PERCENT*
-200	*FINES PASSING #200 SIEVE IN PERCENT*
LL	*LIQUID LIMIT IN PERCENT*
PI	*PLASTICITY INDEX*

GEOTECHNICAL ENGINEERING SERVICES

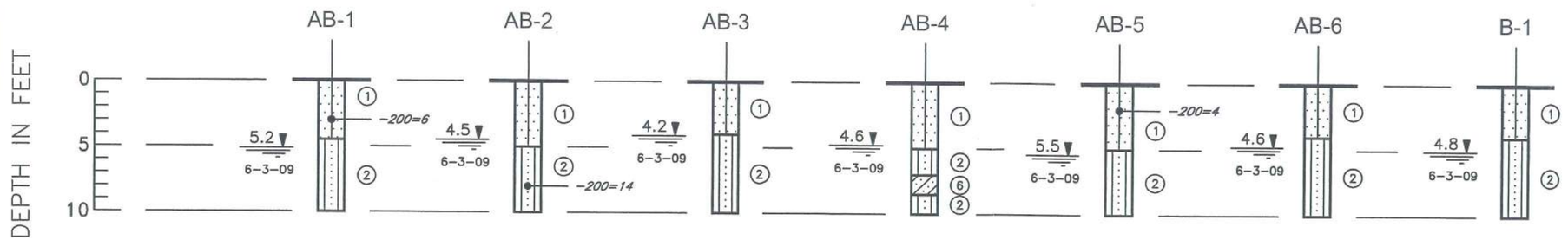
SOUTH REGIONAL WATER & WASTEWATER RECLAMATION FACILITY

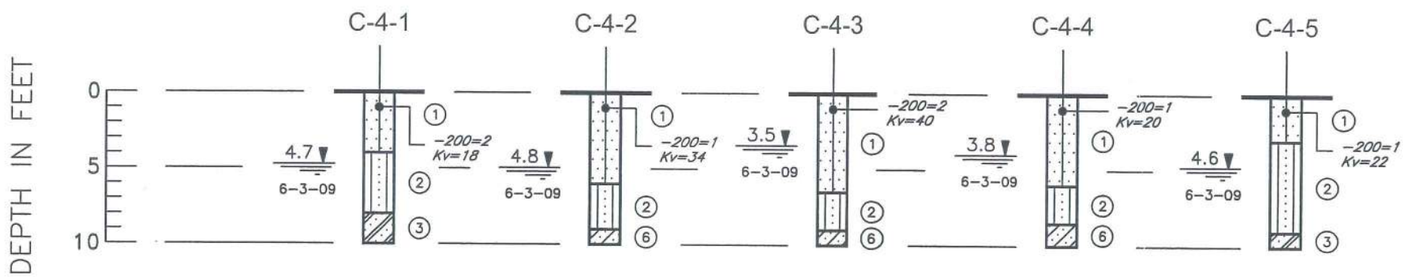
PALM BAY, BREVARD COUNTY, FLORIDA

Information To Build On

Engineering • Consulting • Testing

DRAWN:	DJW	SCALE:	NOTED	PROJ. NO:	0757144
CHKD:	RT	DATE:	6-12-09	SHEET:	2





SOIL PROFILES

SCALE: 1"=10'

LEGEND

1. *GRAY TO DARK RED-BROWN FINE SAND TO SLIGHTLY SILTY FINE SAND, TRACE SHELL, (SP), (SP-SM)*
2. *LIGHT GREEN-GRAY TO DARK BROWN SILTY FINE SAND, TRACE SHELL, TRACE CEMENTED SANDS, (SM)*
3. *LIGHT GREEN-GRAY TO GRAY SANDY CLAY TO CLAY, TRACE SHELL, (CL), (CH)*
4. *GRAY SLIGHTLY SILTY FINE SAND MOSTLY COQUINA, (SP-SM)*
5. *BROWN CLAYEY FINE SAND WITH HARDPAN, TRACE PHOSPHATES, (SC)*
6. *GRAY TO DARK BROWN CLAYEY FINE SAND, (SC)*

(SP) — *UNIFIED SOIL CLASSIFICATION GROUP SYMBOL*

3.0 ▼ / 6-2-09 — *DEPTH TO GROUNDWATER LEVEL IN FEET WITH DATE OF READING*

-200 — *FINES PASSING #200 SIEVE IN PERCENT*

Kv — *COEFFICIENT OF VERTICAL PERMEABILITY IN FEET PER DAY*

GEOTECHNICAL ENGINEERING SERVICES

SOUTH REGIONAL WATER & WASTEWATER RECLAMATION FACILITY

PALM BAY, BREVARD COUNTY, FLORIDA

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CHKD:	RT	DATE:	6-12-09	SHEET:	3

APPENDIX F
2018 GEOTECHNICAL REPORT

Report
Geotechnical Engineering Services
City of Palm Bay
South Regional Water Reclamation Facility – Phase 1A
Osmosis Drive SE
Palm Bay, Florida
PSI Project No. 07571924

Project Number: 07571924
April 10, 2018

Professional Service Industries, Inc.
1748 33rd Street, Orlando, FL 32839
Phone: (407) 304-5560
Fax: (407) 304-5561

Mr. Oscar Duarte, P.E.
Wade-Trim, Inc.
3790 Old Dixie Highway, NE
Palm Bay, Florida 32905

RE: Report
Geotechnical Engineering Services
City of Palm Bay
South Regional Water Reclamation Facility – Phase 1A
Osmosis Drive SE
Palm Bay, Florida

Dear Mr. Duarte:

In accordance with PSI Proposal No. 0757-233730 dated January 29, 2018 and your authorization, Professional Service Industries, Inc. (PSI) has completed a geotechnical evaluation at the site of the referenced project. The subsurface exploration was conducted to provide geotechnical engineering recommendations to guide design and construction of the proposed improvements to the existing water reclamation facility.

PROJECT INFORMATION

The project site is located at the existing City of Palm Bay South Regional Water Reclamation Facility (SRWRF) in Palm Bay, Brevard County, Florida. The SRWRF is being expanded to meet the current and future needs of the City of Palm Bay. The expansion of the plant is planned in four phases. The planned phases will occur on the south side of the existing plant, with each successive phase developed south of the previous.

This project concerns the improvements for Phase 1 A, adjacent to the south side of the existing plant. Based on the plan provide to PSI from Wade Trim, Phase 1 includes a reclaimed water storage tank, chlorine contact chamber, Membrane Bioreactor (MBR) process tank, headworks and lift station. This phase will also include roads A, B, C, G and H as shown on the provided plan. The following information regarding the proposed structures was provided to PSI by Wade-Trim:

- Reclaimed Storage Tank - diameter of 125 feet and height of 36 feet. The maximum water level is 35.5 feet. The preferred foundation for the tank is a monolithic slab with thickened edges.

- Chlorine Contact Tank - Plan dimensions of 50 feet by 50 feet with a contact pressure of 1,650 psf.

- Membrane Bioreactor (MBR) Process Tank - Plan dimensions of 150 feet by 175 feet with a wall height of approximately 20 feet. Based on plans provided to PSI, the preferred foundation is a 2-foot thick flexible mat. The MBR will have a contact pressure of 1,650 psf.

- Lift Station – assumed to be 20 feet below the existing grade.

Included in the improvements will be new roadways. The roadway sections may be either flexible or rigid pavement. Based on the plans provided to PSI by Wade-Trim, no new stormwater facilities are planned.

PSI performed a preliminary geotechnical study at the facility in 2009. The borings were performed generally across the proposed expansion phases. The data from the 2009 PSI geotechnical study has been included in this report (see **Appendix B**).

The noted information/assumptions have been used for the purpose of preparing this report. If any of the stated information/assumptions are incorrect or have been changed, PSI should be notified so appropriate changes to our recommendations can be incorporated in this report.

REVIEW OF PUBLISHED DATA

USGS Topographic Map

The topographic survey map published by the USGS entitled "Fellsmere NW, Florida" was reviewed for ground surface features in the area of the proposed development. Based on this review, the natural ground surface elevation is on the order of +20 to +25 feet National Geodetic Vertical Datum (NGVD) of 1929. No site-specific topographic data was provided to PSI for our review.

Figure 1 of the **Appendix A** contains an excerpt of the USGS map for the site.

NRCS Soil Survey

The "Soil Survey of Brevard County, Florida," published by the USDA NRCS, was reviewed for general near-surface soil information within the general project vicinity. This information indicates the majority of the planned Phase 1A site is covered by EauGallie sand (Soil Series 17). Portions of Road A, Road C and Road H are covered by Malabar, Holopaw, and Pineda soils (Soil Series 31). The general information provided by the NRCS for the two mapped soil units is summarized in the following table.

Soil Series	Depth (inches)	Unified Classification	USDA Seasonal High Groundwater Table
			Depth (inches)
(17) EauGallie sand	0 to 84	SP, SP-SM, SM, SM-SC, SC	0 to 18
(31) Malabar, Holopaw, and Pineda soils	0 to 65	SP, SP-SM, SM-SC, SC	0 to 10

Figure 2 of the **Appendix A** contains an excerpt of the USDA NRCS Soils map for the site.

FIELD EXPLORATION

General

To evaluate subsurface conditions at the site, PSI drilled a total of nine (9) Standard Penetration Test (SPT) borings at the locations requested by Wade-Trim. The borings were located in the field using handheld GPS equipment and the borings were performed using an All-Terrain Vehicle (ATV) mounted drill rig. The approximate boring locations are presented on **Sheet 1** in the **Appendix A**. The SPT borings were drilled using rotary wash procedures and sampled following ASTM D-1586. An automatic hammer was used to obtain the SPT samples. The upper 4 feet of the SPT borings were drilled using a manual hand auger to confirm utility clearance. SPT samples were then recovered at intervals of 5, 7 and 9 feet below the existing grade, and sampled at 5-foot intervals thereafter to the boring termination depth of 55 feet below the existing ground surface. Representative samples recovered from the borings were stored in air-tight jars and were transported to our Orlando laboratory for lab testing and to verify field stratification.

PSI also obtained one (1) relatively undisturbed Shelby tube sample of clay soils from boring SB-5 at depth of approximately 15 to 17 feet below the existing grade. The Shelby tube sample was transported to PSI's Orlando laboratory for consolidation testing. The results of the consolidation test are included in **Appendix C**.

The soil types encountered at the specific boring locations are presented in the form of soil profiles on **Sheets 2** and **3** in the **Appendix A**. The 2009 soil boring profiles from PSI's preliminary geotechnical study are included in **Appendix B**. Included with the boring profiles is a legend describing the encountered soils in USCS format, measured groundwater levels and results of PSI's laboratory testing.

The stratification presented is based on visual observation of the recovered soil samples, laboratory testing and interpretation of field logs by a geotechnical engineer. It should be noted that variations in the subsurface conditions are expected and may be encountered between and away from PSI's borings. Also, whereas the individual boring logs indicate distinct strata breaks, the actual transition between the soil layers may be more gradual than shown on the soil profiles.

Soil Conditions

Based on the borings PSI completed for the project, subsurface conditions are relatively consistent across the site. In general, the borings revealed a series of fine sands grading relatively clean to slightly silty, silty and clayey in composition (i.e. SP, SP-SM, SM and SC materials) interbedded by a zone of sandy clay and clay (CL and CH materials). Some of the sands were noted to contain hardpan (partially to well cemented silty sands) and coquina (sedimentary rock formed from shell and coral). Beneath the sandy clay to clay layer, the soil generally consisted of clean to silty fine sand (SP, SP-SM and SM materials) to the boring termination depth.

Based on the SPT blow counts recorded during our field exploration, the sands generally grade in a loose to medium dense condition with zones that grade very loose, dense and very dense. The sandy clay and clay layers encountered were found to be generally in a soft to firm condition with occasional zones that graded stiff to very stiff.

The soils encountered in the borings were found to be generally consistent with our previous field exploration in 2009. We did not encounter any dense material in the upper 10 feet of exploration in our recent borings. However, as noted, variations in the subsurface conditions are expected and may be encountered between and away from PSI's borings.

A detailed description of the individual borings is shown on the soil profiles on **Sheets 2** and **3** in the **Appendix A**.

Groundwater Conditions

At the time of our fieldwork (February 23, 2018 to February 28, 2018), groundwater was observed in the borings at depths of 2.1 to 4 feet below the existing ground surface. The current measured groundwater levels are similar to the those observed in PSI's 2009 geotechnical study of the property. Groundwater levels between 1.8 to 5.5 feet below the existing grade were observed by PSI in 2009. The 2009 study was completed later in the dry season. The estimated normal seasonal high groundwater levels presented herein are based on the observed soil stratigraphy, conditions observed in the borings, USDA Soil Survey information, and our past experience in the project vicinity. In this regard, we estimate the normal seasonal high groundwater table will occur within 1 foot of the existing ground surface. More detailed groundwater information can be provided once detailed site specific topographic information is provided to us.

In general, the estimated normal seasonal high groundwater level is not intended to define a limit or ensure that future seasonal fluctuations in groundwater levels will not exceed the estimated levels. Groundwater conditions will vary with environmental changes and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences, such as swales, ponds, drainage systems, underdrains and areas of covered soil (buildings, paved parking lots, sidewalks, etc.).

The encountered groundwater levels are shown adjacent to the individual soil boring profiles on **Sheets 2** and **3** of **Appendix A** and **Sheets 2** and **3** in **Appendix B** (2009 soil borings).

SITE SUITABILITY

Based on the results of PSI's borings, it is our opinion that subsurface conditions are generally suitable for the proposed water treatment facility expansion from a geotechnical engineering perspective. Following completion of site preparation as recommended herein, shallow foundation systems appear suitable for support of the proposed structures. Dewatering should be anticipated during construction of the below grade components of the proposed lift station foundation and subsurface utilities.

Provided adequate separation is maintained between the normal seasonal high groundwater table and the bottom of the pavement base, pavements can be constructed using conventional asphalt or concrete sections. More detailed discussions pertaining to site preparation and our design recommendations follow.

SITE PREPARATION CONSIDERATIONS

General

The following recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions encountered. If there is any change in the project criteria, including the location or orientation of the structures or pavement areas, a review must be made by PSI to determine if additional fieldwork and/or any modifications to our recommendations will be required.

Once final design plans and specifications are available, a general review by PSI is strongly recommended as a means to check that the evaluations made in preparation of this report are correct and that earthwork and foundation recommendations are properly interpreted and implemented.

Site Clearing/Stripping

At the outset of construction, clearing and grubbing including root raking and removal of any organic-laden topsoil that remains on the site should be completed. This normally includes removing the surface vegetation, stripping topsoil, grubbing major root systems, and removing any miscellaneous debris and/or deleterious materials. At a minimum, it is recommended that the clearing/stripping operations extend at least ten feet beyond the proposed structures and pavement areas wherever practical. Material generated during stripping operations should be disposed of off-site in a proper manner as directed by the Owner.

Initial site clearing and preparation work should be carried out under the observation of a representative of the geotechnical engineer. After the site has been stripped and cleared, the site should be inspected by a representative of the geotechnical engineer to verify adequate topsoil and vegetation removal.

Fill Placement and Subgrade Preparation

Following the clearing/stripping operations, the exposed subgrade should be evaluated as directed by the geotechnical engineer or his representative to confirm that all unsuitable materials have been removed. The structure and pavement areas should then be proof-rolled to provide a stable/unyielding subgrade prior to placing fill. Proof rolling should consist of compaction with a large diameter, vibratory drum roller. A minimum of ten overlapping passes of the roller in each of the two perpendicular directions with a maximum travel speed of 2 feet per second is recommended.

The purposes of the proof rolling will be to detect unsuitable soils that yield when subjected to compaction and to densify near-surface loose sands for support of shallow foundations, soil supported floor slabs and new pavements. Material that yields excessively during proof rolling should be replaced with fill selected and compacted as described in the “Engineering Fill” section of this report. If the soil subgrade is saturated, or the fill moisture content is over “optimum”, instability may occur and the contractor will be required to implement remedial measures to successfully place and compact fill.

Compaction can be completed in the vibratory or static mode in order to meet the minimum density requirements stated below. Based on past experience, we recommend compaction equipment be operated in the static mode

within 75 feet of existing structures to reduce vibrations that could cause structural distress or disturb building occupants. Careful observations should be made during proof rolling to help identify any areas of soft/yielding soils that may indicate the presence of unsuitable soils that require over-excavation and replacement filling.

It is recommended that the subgrade, to a minimum depth of 24 inches below stripped grade, be compacted to at least 95 percent of the soil's modified Proctor (ASTM D-1557) maximum dry density within the proposed structure locations. Pavement areas should be compacted to at least 95 percent of the soil's modified Proctor (ASTM D-1557) maximum dry density for a minimum depth of 12 inches below the stripped grade. Following satisfactory completion of initial compaction of the stripped subgrade, the proposed development area may be brought up to finished grades as required.

Engineered Fill

Any off-site fill imported for the project should consist of clean fine sand with less than 12 percent fines by dry weight passing the U.S. Standard No. 200 sieve and be free of rubble, organics, clay, debris and other deleterious material. Fill should be tested and approved prior to import and placement. Each lift should have a loose thickness not exceeding 12 inches. Density tests should be performed to confirm the required compaction is being achieved before placing the next lift.

Before beginning compaction, soil moisture conditioning may be required. Soil moisture contents should be controlled to facilitate proper compaction. A moisture content within two percentage points of the material's optimum indicated by the modified Proctor test (ASTM D-1557) is recommended prior to compaction of the natural ground and fill. All engineered fill should be compacted to at least 95 percent of the material's modified Proctor (ASTM D-1557) maximum dry density.

On-Site Soil Suitability

Materials to be used for backfill or compacted fill for construction should be evaluated and, if necessary, tested by PSI prior to placement to determine if they are suitable for the intended use. In general, based on the borings results and laboratory testing, the on-site, relatively clean sandy soil (Stratum 1) appears to be suitable to be used as engineered fill, provided the material is free of debris, rubble, clay, roots and organics. Stratum 2 material in its in-situ state is not suitable for use as engineered fill. However, if Stratum 2 is blended with Stratum 1 or similar low fines soils, Stratum 2 can be used as engineered fill provided it meets the requirements under the Engineered Fill section of this report. Laboratory testing should be performed on the blended soil before it is used as backfill to verify that it meets the requirements of Engineered Fill.

DESIGN RECOMMENDATIONS

Shallow Foundations – Storage Tank & Chlorine Contact Tank

Based on the anticipated construction and recommended site preparation, shallow foundations may be designed for a net allowable bearing pressure of 2,500 pounds per square foot (psf). The foundations and floor slabs should bear on properly placed and compacted cohesionless (sand) fill and/or densified native soil as discussed earlier. All footings should be embedded so that the bottom of the foundation is a minimum of 18 inches below adjacent finished grades on all sides.

Strip foundations and thickened edges of monolithic slabs should be a minimum of 18 inches wide, while column footings should be at least 36 inches square. All foundations should be designed and constructed to meet minimum Building Code criteria and requirements.

The subgrade soils should be compacted to a minimum density requirement of 95 percent of the material's modified Proctor (ASTM D-1557) maximum dry density for a minimum depth of 24 inches below the bottom of footings, as determined by field density compaction tests. Backfill soils placed adjacent to footings or walls should be carefully compacted with a light walk behind roller or vibratory plate compactor to avoid damaging in-place footings or walls.

All foundation excavations should be observed by the Geotechnical Engineer or his representative to explore the extent of any fill, excessively loose, soft, or otherwise undesirable materials.

If soft or loose materials are encountered in the footing excavations, then such materials should be removed and the subgrade re-established by backfilling. This backfilling may be done with a well-compacted, suitable fill such as clean sand as described in the "Engineered Fill" section of this report. Sand backfill should be compacted to at least 95 percent of the material's modified Proctor maximum dry density (ASTM D-1557), as previously described.

Immediately prior to placement of reinforcing steel, it is suggested that the bearing surfaces of all footing and floor slab areas be compacted using hand operated mechanical tampers. In this manner, any localized areas that have been loosened by excavation operations would be adequately recompacted.

Settlement

Settlement values were estimated for the storage tank and chlorine contact chamber foundations. The estimated settlement values were calculated using the computer program Settle3D by RocScience. A contact pressure of 1,650 psf was provided for the chlorine contact chamber. The contact pressure of the water storage tank was estimated based on a maximum water height of 35.5 feet and maximum tank height of 36 feet provided by Wade-Trim and assuming an additional 250 psf load to account for the tank and foundation. A total contact pressure of 2,500 psf was used to estimate the storage tank settlement. The foundations for both structures were assumed to have 2 feet of confinement below the finished grades. The soil parameters were determined based on the results of PSI's borings, laboratory testing and our experience in the area.

Structure	Estimated Contact Pressure (psf)	Estimated Total Theoretical Settlement (inches)	Estimated Theoretical Primary (short-term) Settlement (inches)	Estimated Theoretical Secondary (long-term) Settlement (inches)	Estimated Total Theoretical Differential Settlement (inches)
Storage Tank	2,500	5	1.2 to 3	1.1 to 2.4	2.5*
Chlorine Contact Chamber	1,650	2.2	0.5 to 1.6	0.2 to 0.6	1*

*Differential settlement estimated from the center to the outside edge of the structure.

In general, the estimated total settlements for the storage tank and chlorine contact chamber should occur relatively uniformly. The largest settlement should occur near the center of the structures and decrease towards the edges. However, due to variations in the soil profile, a differential settlement of approximately 0.5 inches could occur at any point between short-term and long-term settlement within each structure footprint.

Refer to the Settle3D computer printouts in **Appendix C** for detailed settlement information for each structure.

Mat Foundation – MBR Process Tank

It is PSI's understanding the MBR process tank will be supported on a mat foundation approximately 2 feet thick. Based on the updated foundation load information provided to PSI, the maximum foundation pressure for the proposed MBR tank is on the order 1,650 psf. Plans provided show the bottom elevation of the MBR process tanks varies from +18 to +22.5 feet NAVD. We have modeled the mat foundation based on these elevations and a finished grade of +24.5 feet NAVD.

The estimated settlement values were calculated using the computer program Settle3D. A stress/settlement model was developed to simulate the mat foundation's settlement performance. The soil parameters were determined based on the results of PSI's borings, laboratory testing and our experience in the area.

A maximum total settlement of approximately 3 inches is estimated at the center of the MBR tank with the settlement decreasing to approximately 1 to 1.5 inches at the edges. The largest settlement should occur near the center of the structure and decrease towards the edges. Primary or short term settlement is estimated to range from approximately 0.5 inches to 1.5 inches. Due to variations in the soil layers, the maximum estimated short term settlement appears to occur at the southeast corner of the MBR tank. Primary differential settlement values on the order of 0.5 inches are anticipated. Short term settlement will take place fairly rapidly after initial load application and will for the most part be complete by the end of the construction and preload/hydro-testing period. Secondary or long term settlement is estimated to range from 1 to 1.8 inches within the MBR tank footprint with the highest magnitude occurring in the northeast corner of the structure. Secondary differential settlement values on the order of 0.5 inches or less are anticipated. Secondary or long term settlement of the clay soils will take place after construction. Below grade connections should be designed to tolerate the estimated settlement. Refer to the **Settle3D computer printouts** in **Appendix C** for detailed settlement information for each structure.

For design of the mat foundation, it is our opinion that a subgrade modulus of 10 to 30 pounds per cubic inch (pci) can be used for design of the mat. The mat foundation should be constructed on soils prepared by proofrolling as discussed herein. As the structural engineer works on the design of the mat, we would be pleased to review the modulus parameters as needed.

Hydro-testing

PSI recommends the storage tank, chlorine contact chamber and the MBR process tank undergo an initial tank filling (hydrotest). The hydro-test should be performed to the maximum design water height. Final pipe connections to the structures should not be made until after the hydro-test is completed. We also recommend the use of flexible piping connections to allow for post-construction long-term settlement.

Floor Slabs

Floor slabs can be safely supported as slab-on-grade systems provided the final subgrade elevation is densified and prepared as recommended herein. We further recommend that the upper one foot of the subgrade soils within the floor slab areas be compacted to at least 95 percent of the maximum dry density of the soil's modified Proctor (ASTM D-1557). We recommend a subgrade modulus of 150 pounds per cubic inch (pci) for slab design provided the subgrade is prepared as noted herein.

Lift Station

Based on our evaluations and analyses, the soil conditions encountered in the borings performed for the project are considered capable of supporting the proposed lift station structure on a shallow foundation system following satisfactory completion of the subgrade preparation recommendations noted herein, provided any unsuitable materials (i.e. organic, roots, debris, etc.) are removed from foundation areas.

Based on the anticipated construction and recommended site preparation, the lift station foundation may be designed for a net allowable bearing pressure of 1,500 pounds per square foot (psf). The foundation should bear on properly placed and compacted cohesionless (sand) fills and/or densified native sandy soils. Based on the lift station depth of 20 feet below the existing grade, it appears the bottom of the lift station may be in cohesive soils. Once the excavation reaches the proposed bottom elevation of the lift station, the exposed soils should be inspected to determine if they are cohesive. If cohesive soil is present, the bottom of the lift station should be over-excavated for a minimum depth of 2 feet and backfilled with engineered fill.

If soft, loose or cohesive materials are encountered at the foundation bearing elevation, then such materials should be removed and the subgrade re-established by backfilling. This backfilling may be done with a well-compacted, suitable fill such as engineered fill, a lean concrete, or crushed FDOT No. 57 or FDOT No. 67 stone. Sand backfill should be compacted to at least 95 percent of the material's modified Proctor maximum dry density (ASTM D-1557), as previously described. Crushed stone should be blended with clean sand (50:50 blend) and compacted to a firm and unyielding condition to be confirmed by the geotechnical engineer's representative.

All foundation excavations should be observed by the Geotechnical Engineer or his representative to explore the extent of any fill, excessively loose, soft, or otherwise undesirable materials. If the foundation excavation appears suitable for support, the bottom of the foundation excavation should be compacted after excavation. The subgrade soils should be compacted to a minimum density requirement of 95 percent of the material's modified Proctor (ASTM D-1557) maximum dry density for a minimum depth of two feet below the bottom of foundation, as determined by field density compaction tests.

The foundation should be designed to resist hydrostatic uplift forces. This can be achieved using protruding edges on the foundation and deadweight of the soils above the foundation, foundation deadweight, or a combination of these techniques.

Lateral Resistance

Lateral loads that are applied to the foundations may be resisted by earth pressure mobilized on the buried vertical faces of the footings and by shearing forces acting along the footing-subgrade interface. Earth pressure resistance may be determined using an equivalent fluid density of 360 pounds per cubic foot (pcf) for moist soil and 180 pcf for submerged soil. A friction factor of 0.4 should be used to determine base shearing resistance.

The above values presume that the foundations are surrounded by well-compacted sand backfill and can withstand horizontal movements on the order of one-quarter to three-eighths inches. Horizontal restraint determined in accordance with the recommended values should be considered resistance that is available rather than allowable. Therefore, the design should incorporate a minimum factor of safety of 1.5.

Retaining Walls

Below grade walls and retaining walls for the project should be designed to resist pressures exerted by the adjacent soils and hydrostatic head. For walls that are not restrained during backfilling but are free to rotate at the top, active earth pressure should be used in design. Walls that are restrained should be designed assuming at-rest pressures. Recommended soil parameters for the near-surface granular soils encountered at the site are presented in the following.

Total Unit Weight, γ_b	=	120 lb/ft^3
Angle of Internal Friction,ϕ	=	30°
Coeff. of Sliding Friction	=	0.40
Active Soil Pressure coeff., K_a	=	0.33
At-rest Soil Pressure coeff., K_o	=	0.50
Passive Soil Pressure coeff., K_p	=	3.00

The recommended parameters assume that adequate drainage is provided behind the walls to prevent the buildup of excess hydrostatic pressures. In order to avoid wall damage due to excessive compaction, hand operated mechanical tampers should be used to densify backfill soils; heavy compaction equipment should not be allowed within five feet of walls. The soils behind walls should be compacted to approximately 95 percent of the material's modified Proctor (ASTM D-1557) maximum dry density. Where retaining structures will lie below the groundwater table, effective unit weights of soil should be used were appropriate.

Pavement Support

Pavements for the project will include new roadways (Roads A, B, C, G and H) surrounding the planned improvements. Provided that pavements are designed to provide at least 18 inches of clearance between the bottom of the base material and the estimated normal seasonal high groundwater table, the basecourse for asphalt sections can comprise limerock, shell or crushed concrete. Recommendations for pavement sections for light-duty, medium-duty and heavy-duty are included in the following.

Light-Duty

1.5 inches	Type SP Asphaltic Concrete
6.0 inches	Limerock/crushed concrete/shell basecourse (LBR = 100)
12.0 inches	Stabilized subgrade (LBR = 40)

Medium-Duty

2.0 inches	Type SP Asphaltic Concrete
8.0 inches	Limerock/crushed concrete/shell basecourse (LBR = 100)
12.0 inches	Stabilized subgrade (LBR = 40)

Heavy-Duty

2.5 inches	Type SP Asphaltic Concrete
10.0 inches	Limerock/crushed concrete/shell basecourse (LBR = 100)
12.0 inches	Stabilized subgrade (LBR = 40)

For heavy-duty uses, such as areas that are anticipated to receive heavy truck traffic or where frequent turning movement occur, we recommend the following minimum pavement section.

Heavy-Duty (Rigid Pavement)

7.0 inches	Portland cement concrete, minimum 28 day compressive strength of 4000 psi.
12.0 inches	Well-draining granular subgrade, compacted to 98 percent of the material's AASHTO T-180 maximum dry density.

Pavement joints and reinforcing for concrete pavement should be in accordance with American Concrete Institute (ACI) standards. The recommended pavement sections are based on past experience with similar projects and the encountered subsurface conditions at the site. All pavement materials and construction should meet the more stringent of the Florida Department of Transportation (FDOT) and local city/county requirements. The noted pavement sections should be considered recommended minimums based on anticipated traffic loadings and our past experience.

OTHER CONSIDERATIONS

Utility Construction

All utility excavations should be made in accordance with recommendations outlined by the Occupational Safety and Health Administration Document *Construction Standards for Excavations (29CFR Part 1926.650-.652 Subpart P)*. Shoring should be designed in accordance with OSHA 2226, taking into consideration loads resulting from equipment, existing construction and/or fill stockpiles.

Difficulty may arise during construction when trying to compact materials containing higher percentages of fines. If those soils become unstable during compaction operations due to moisture related conditions, we recommend those soils be undercut at least 12 inches below pipe inverts and drainage structures and the resultant excavation be infilled with compacted clean fine sand with less than 10 percent by dry weight passing the No. 200 sieve and gravel bedding of Florida Department of Transportation (FDOT) crushed stone (No. 57 stone). Utility bedding material should be an equal mixture of No. 57 stone and clean sand. Gravel/sand backfill should be compacted such that it is firm and unyielding. Unsuitable soils should be removed for the full width of the trench and to the depth required to reach suitable utility foundation material.

Site Dewatering

Depending on the time of the year and prevailing weather conditions at the time of construction, dewatering will likely be required for lift station, utility and foundation excavations and to facilitate subgrade preparation and foundation construction.
Excavations that are only a few feet below the water table can likely be dewatered with a sump pump. Deeper excavations will most likely require well-pointing or sock drains to achieve adequate drawdown. In either case, the dewatering system should be designed and operated to lower the groundwater table to a depth at least 2 feet below the bottom of surfaces to be compacted in any given area. The design and discharge of the dewatering system should be in accordance with current regulatory criteria.

Excavations

In Federal Register, Volume 54, No. 209 (October 1989) the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its “Construction Standards for Excavations, 29 CFR, part 1926, Subpart P”. This document was issued to insure better the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, general construction excavations or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed the Owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor’s “responsible person”, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor’s safety procedures. In no case should slope height, inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

PSI is providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations.

LIMITATIONS

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This company is not responsible for the conclusions, opinions or recommendations made by others based on these data.

The scope of our exploration was intended to evaluate soil conditions within the influence of the proposed structures and pavement areas and does not include an evaluation of potential deep soil problems such as sinkholes. The analysis and recommendations submitted in this report are based on the data obtained from the soil borings performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed development.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our client.

CLOSURE

PSI appreciates the opportunity to provide our services to you on this project. If you have any questions regarding the information provided in this report, or if we may be of further service, please contact the undersigned.

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.
Certificate of Authorization No. 3684

Venkata Prashanth Muppana, E.I.
Staff Engineer

Eric W. Nagowski, E.I.
Project Engineer

Robert A. Trompke, P.E.
Principal Consultant/Department Manager
Florida License No. 55456

Appendix A

- Figure 1 – USGS Quadrangle Map
- Figure 2 –USDA SCS Soil Survey Map
- Sheet 1 – Boring Location Plan
- Sheets 2 and 3 – Boring Profiles

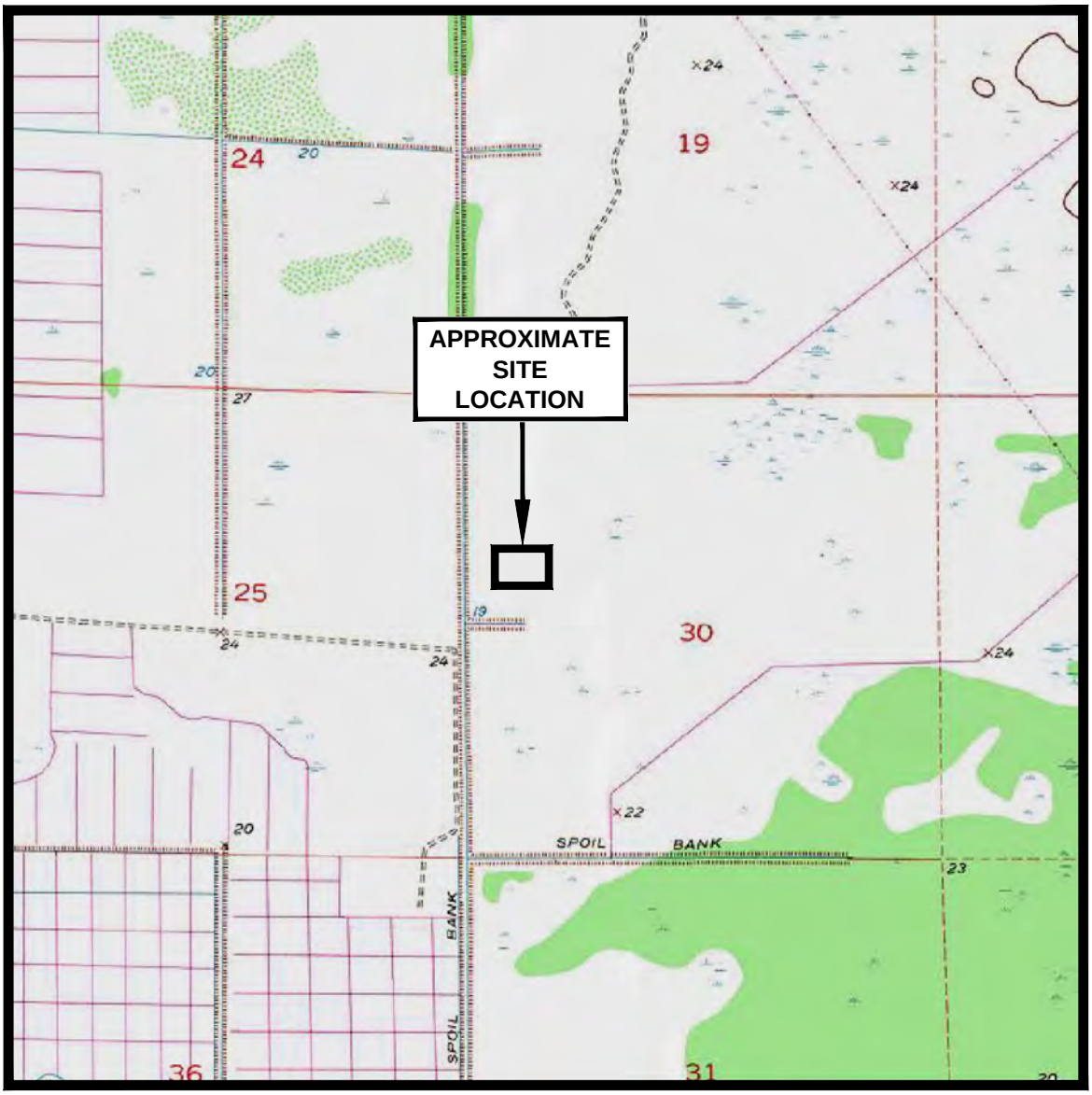
Appendix B

- PSI 2009 Geotechnical Boring Plan and Soil Profiles

Appendix C

- Settle3D Estimated Settlement Results
    - Water Storage Tank
    - Chlorine Contact Chamber
    - MBR process Tank

APPENDIX A



REFERENCE: U.S.G.S. "FELLSMERE NW, FLORIDA" QUADRANGLE MAP

SECTION: *30*
TOWNSHIP: *29 SOUTH*
RANGE: *36 EAST*

ISSUED: *1970*
PHOTOREVISED: *1970*
SCALE: *1"=2000'*

VICINITY MAP

CITY OF PALM BAY
SOUTH REGIONAL WATER RECLAMATION FACILITY-PHASE 1A

PALM BAY, FLORIDA

intertek psi

DRAWN:	DJW	SCALE:	NOTED	PROJ. NO:	07571924
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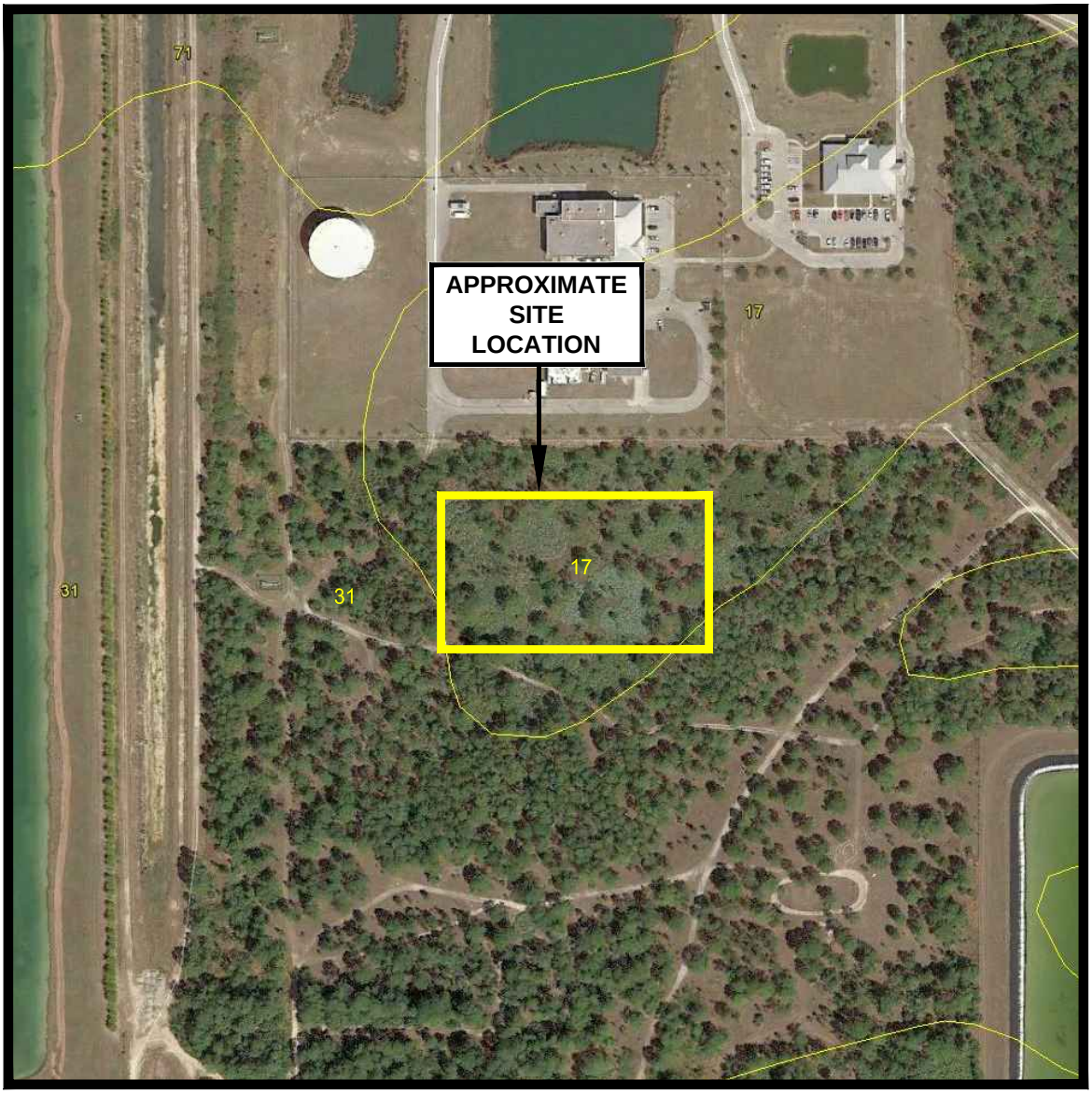

REFERENCE: U.S.D.A.-S.C.S. "BREVARD COUNTY, FLORIDA" SOILS MAP

SECTION:	*30*	*ISSUED:*	*N/A*
TOWNSHIP:	*29 SOUTH*	*SCALE:*	*1"=300'*
RANGE:	*36 EAST*		

SOILS LEGEND

17	EAUGALLIE SAND
31	MALABAR, HOLOPAW AND PINEDA SOILS

SOILS MAP

CITY OF PALM BAY
SOUTH REGIONAL WATER RECLAMATION FACILITY-PHASE 1A

PALM BAY, FLORIDA

intertek psi

DRAWN:	DJW	SCALE:	NOTED	PROJ. NO:	07571924
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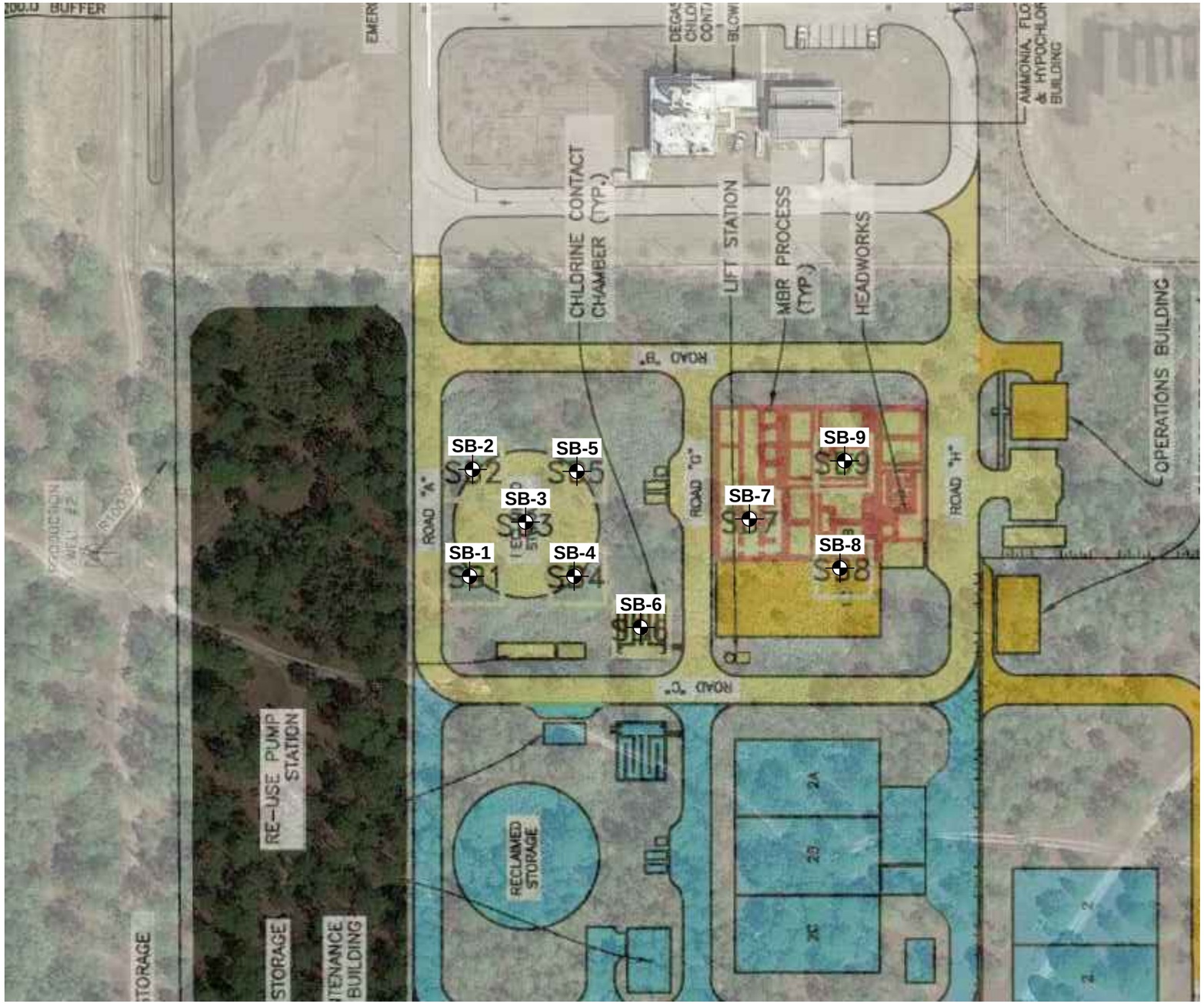

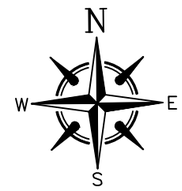

LEGEND

APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

LOCATION PLAN

SCALE: 1" = 100'

GEOTECHNICAL ENGINEERING SERVICES

CITY OF PALM BAY
SOUTH REGIONAL WATER RECLAMATION FACILITY-PHASE 1A

PALM BAY, FLORIDA

intertek psi

DRAWN:	DJW	SCALE:	NOTED	PROJ. NO:	07571924
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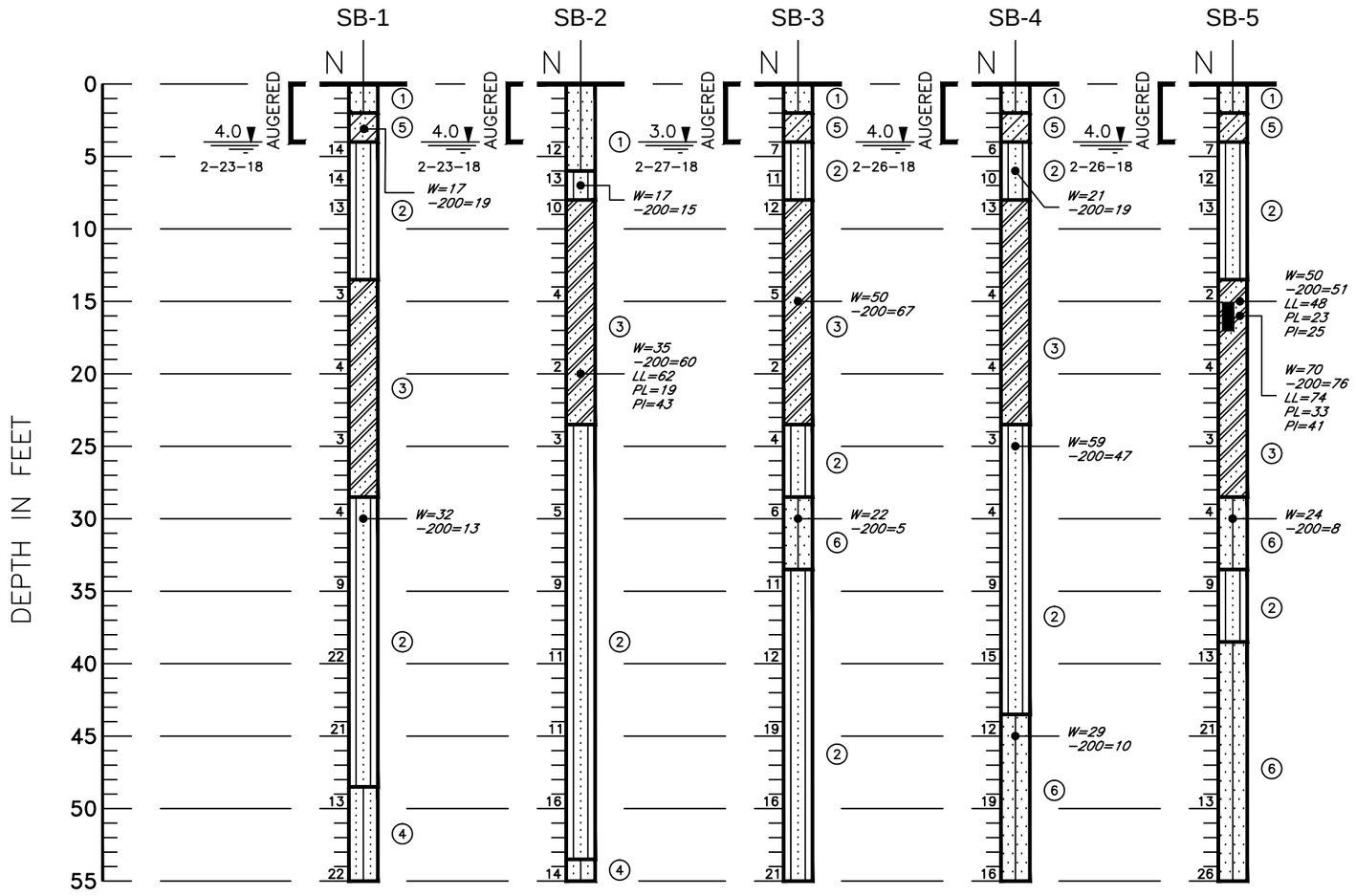

SOIL PROFILES

SCALE: 1"=10'

LEGEND

①	*GRAY TO DARK RED-BROWN FINE SAND TO SLIGHTLY SILTY FINE SAND, TRACE SHELL, (SP), (SP-SM)*
②	*LIGHT GREEN-GRAY TO DARK BROWN SILTY FINE SAND, TRACE SHELL, TRACE CEMENTED SANDS, (SM)*
③	*LIGHT GREEN-GRAY TO GRAY SANDY CLAY TO CLAY, TRACE SHELL, (CL), (CH)*
④	*GRAY SLIGHTLY SILTY FINE SAND MOSTLY COQUINA, (SP-SM)*
⑤	*BROWN CLAYEY FINE SAND, TRACE ROOTS, (SC)*
⑥	*GREEN-GRAY TO BROWN FINE SAND TO SLIGHTLY SILTY FINE SAND, TRACE SHELL, TRACE PHOSPHATES, (SP), (SP-SM)*
⑦	*GRAY TO BROWN FINE SAND TO SLIGHTLY SILTY FINE SAND, MOSTLY SMALL SHELL FRAGMENTS, (SP), (SP-SM)*
(SP)	*UNIFIED SOIL CLASSIFICATION GROUP SYMBOL*
N	*STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT USING AN AUTOMATIC HAMMER*
4.0 ▼ 2-23-18	*DEPTH TO GROUNDWATER LEVEL IN FEET WITH DATE OF READING*
▮	*SHELBY TUBE LOCATION*
W	*NATURAL MOISTURE CONTENT IN PERCENT*
-200	*FINES PASSING #200 SIEVE IN PERCENT*
LL	*LIQUID LIMIT IN PERCENT*
PL	*PLASTIC LIMIT IN PERCENT*
PI	*PLASTICITY INDEX*

GEOTECHNICAL ENGINEERING SERVICES

CITY OF PALM BAY

SOUTH REGIONAL WATER RECLAMATION FACILITY-PHASE 1A

PALM BAY, FLORIDA

intertek psi

DRAWN:	DJW	SCALE:	NOTED	PROJ. NO:	07571924
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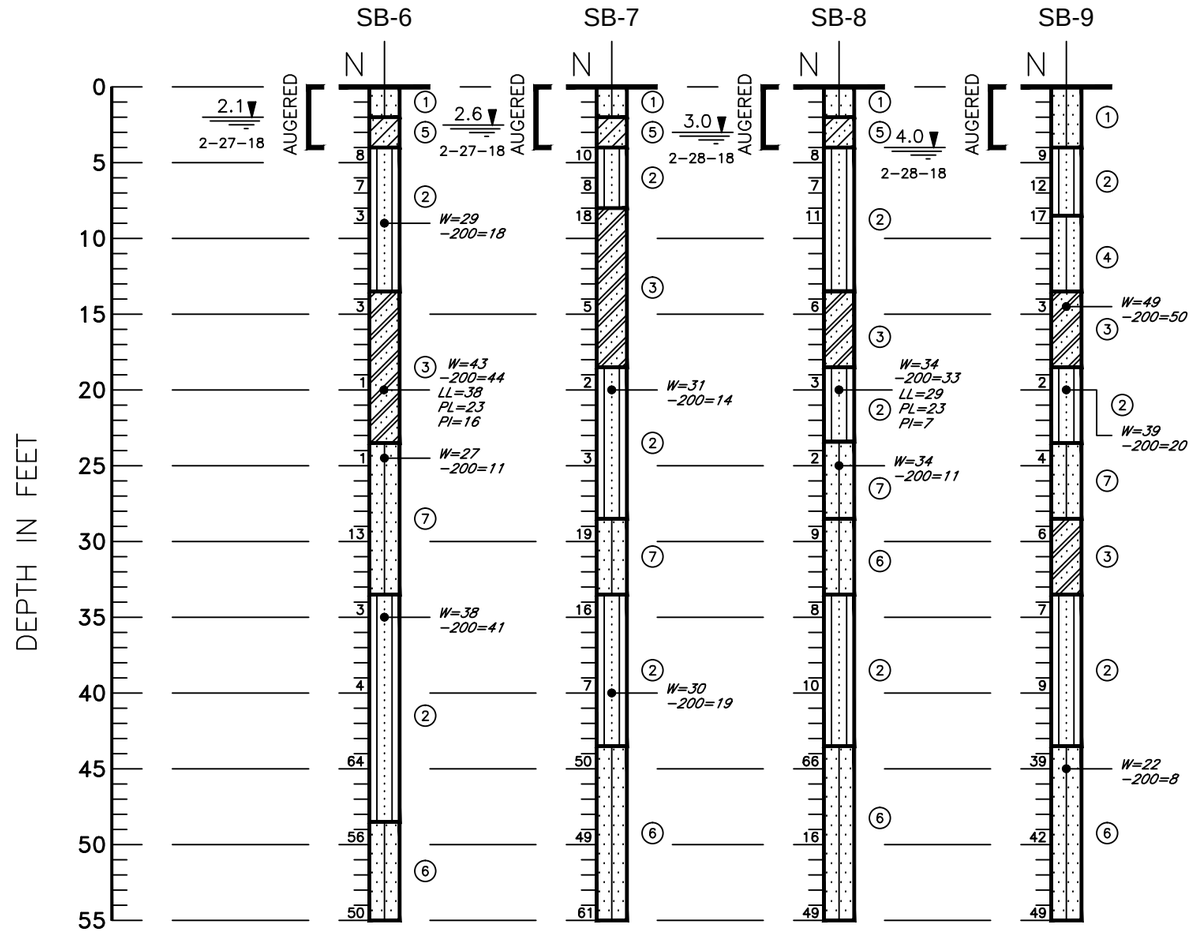

SOIL PROFILES

SCALE: 1"=10'

LEGEND

①	*GRAY TO DARK RED-BROWN FINE SAND TO SLIGHTLY SILTY FINE SAND, TRACE SHELL, (SP), (SP-SM)*
②	*LIGHT GREEN-GRAY TO DARK BROWN SILTY FINE SAND, TRACE SHELL, TRACE CEMENTED SANDS, (SM)*
③	*LIGHT GREEN-GRAY TO GRAY SANDY CLAY TO CLAY, TRACE SHELL, (CL), (CH)*
④	*GRAY SLIGHTLY SILTY FINE SAND MOSTLY COQUINA, (SP-SM)*
⑤	*BROWN CLAYEY FINE SAND, TRACE ROOTS, (SC)*
⑥	*GREEN-GRAY TO BROWN FINE SAND TO SLIGHTLY SILTY FINE SAND, TRACE SHELL, TRACE PHOSPHATES, (SP), (SP-SM)*
⑦	*GRAY TO BROWN FINE SAND TO SLIGHTLY SILTY FINE SAND, MOSTLY SMALL SHELL FRAGMENTS, (SP), (SP-SM)*
(SP)	*UNIFIED SOIL CLASSIFICATION GROUP SYMBOL*
N	*STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT USING AN AUTOMATIC HAMMER*
4.0 ▼ 2-23-18	*DEPTH TO GROUNDWATER LEVEL IN FEET WITH DATE OF READING*
W	*NATURAL MOISTURE CONTENT IN PERCENT*
-200	*FINES PASSING #200 SIEVE IN PERCENT*
LL	*LIQUID LIMIT IN PERCENT*
PL	*PLASTICITY INDEX*

GEOTECHNICAL ENGINEERING SERVICES

CITY OF PALM BAY
SOUTH REGIONAL WATER RECLAMATION FACILITY-PHASE 1A

PALM BAY, FLORIDA

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DRAWN:	DJW	SCALE:	NOTED	PROJ. NO:	07571924
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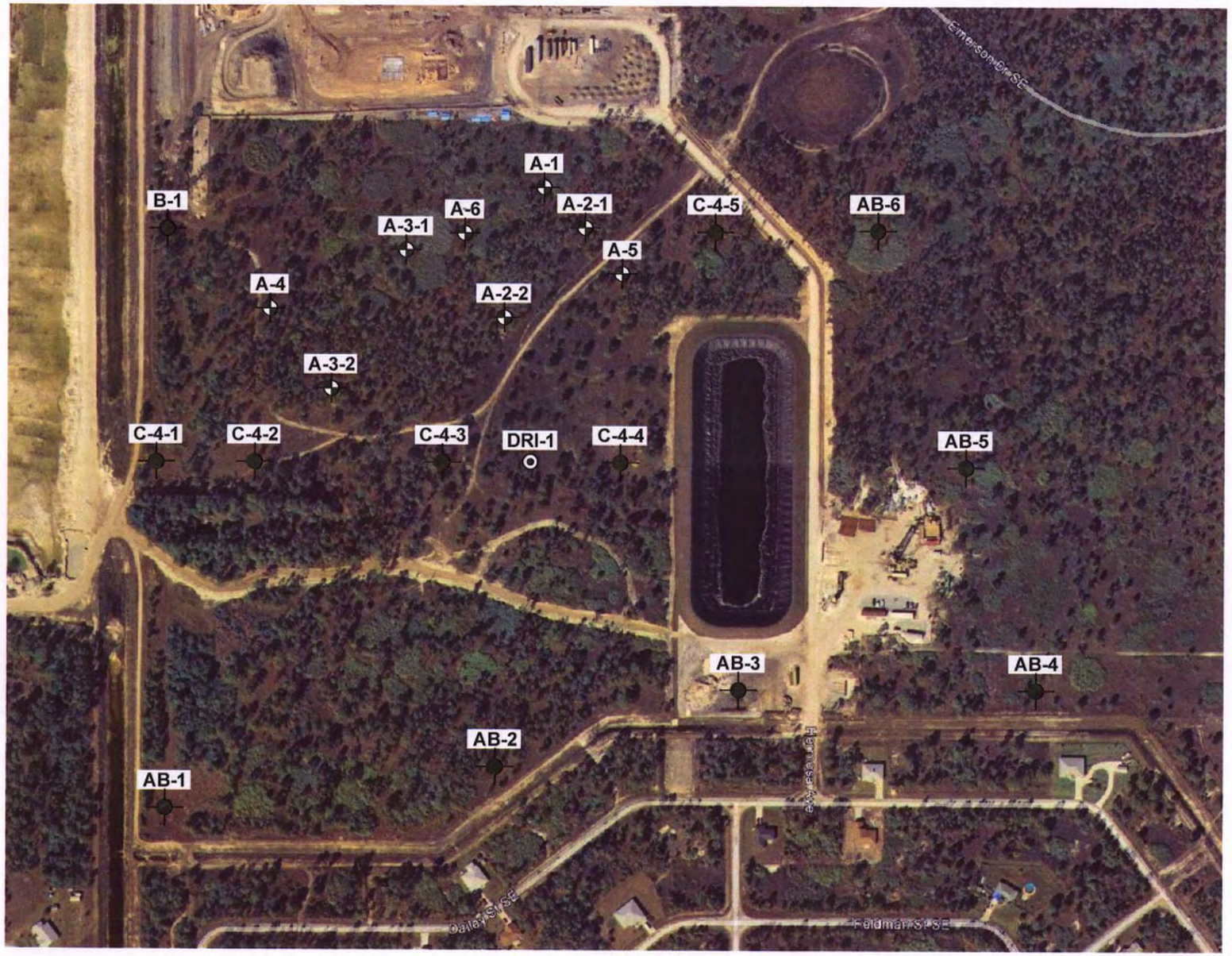
APPENDIX B



LOCATION PLAN

SCALE: 1"=300'

N

W E

S

LEGEND

APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

APPROXIMATE LOCATION OF AUGER BORING

APPROXIMATE LOCATION OF DOUBLE RING INFILTROMETER TEST

GEOTECHNICAL ENGINEERING SERVICES

SOUTH REGIONAL WATER & WASTEWATER RECLAMATION FACILITY

PALM BAY, BREVARD COUNTY, FLORIDA

psi *Information To Build On*

Engineering • Consulting • Testing

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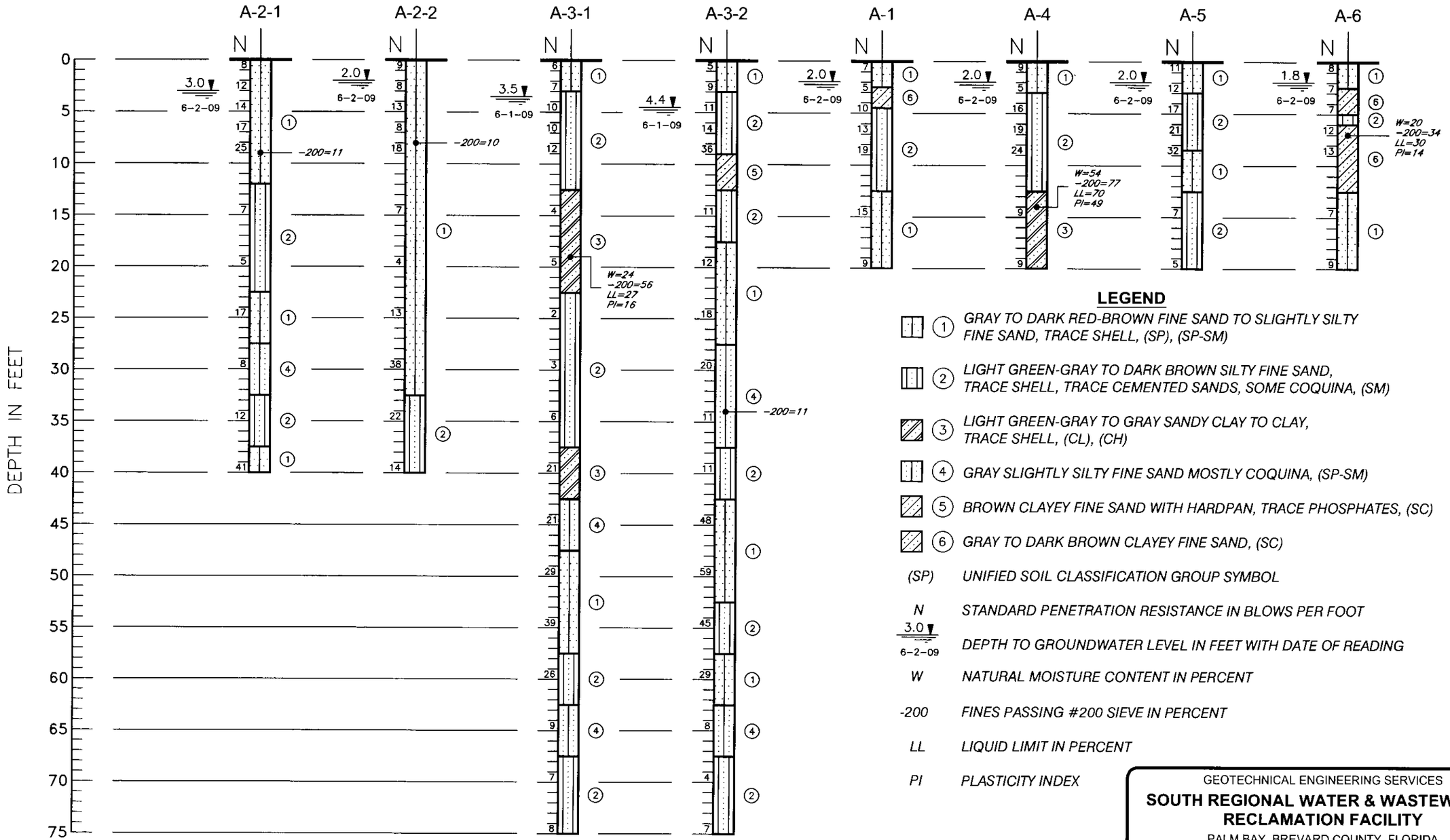


SOIL PROFILES

SCALE: 1"=10'

LEGEND

(1)	*GRAY TO DARK RED-BROWN FINE SAND TO SLIGHTLY SILTY FINE SAND, TRACE SHELL, (SP), (SP-SM)*
(2)	*LIGHT GREEN-GRAY TO DARK BROWN SILTY FINE SAND, TRACE SHELL, TRACE CEMENTED SANDS, SOME COQUINA, (SM)*
(3)	*LIGHT GREEN-GRAY TO GRAY SANDY CLAY TO CLAY, TRACE SHELL, (CL), (CH)*
(4)	*GRAY SLIGHTLY SILTY FINE SAND MOSTLY COQUINA, (SP-SM)*
(5)	*BROWN CLAYEY FINE SAND WITH HARDPAN, TRACE PHOSPHATES, (SC)*
(6)	*GRAY TO DARK BROWN CLAYEY FINE SAND, (SC)*
(SP)	*UNIFIED SOIL CLASSIFICATION GROUP SYMBOL*
N	*STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT*
3.0 / 6-2-09	*DEPTH TO GROUNDWATER LEVEL IN FEET WITH DATE OF READING*
W	*NATURAL MOISTURE CONTENT IN PERCENT*
-200	*FINES PASSING #200 SIEVE IN PERCENT*
LL	*LIQUID LIMIT IN PERCENT*
PI	*PLASTICITY INDEX*

GEOTECHNICAL ENGINEERING SERVICES

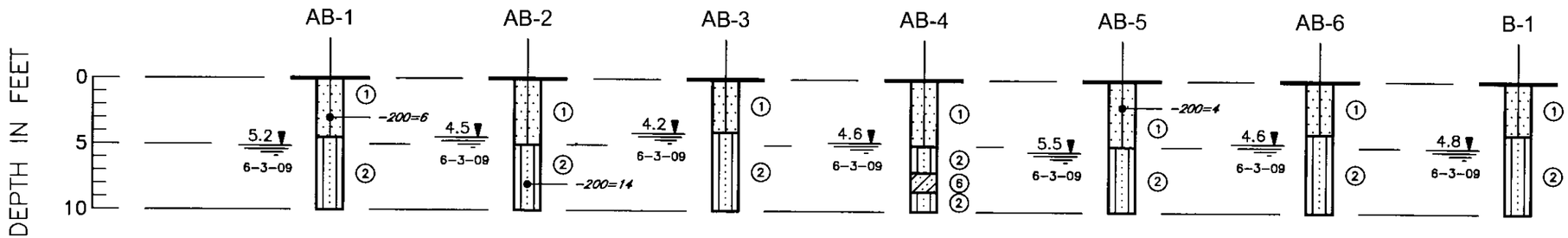
SOUTH REGIONAL WATER & WASTEWATER RECLAMATION FACILITY

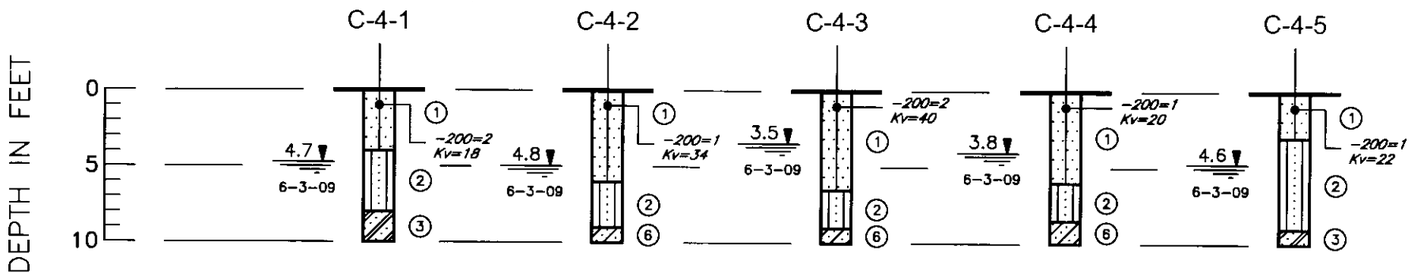
PALM BAY, BREVARD COUNTY, FLORIDA

Information To Build On

Engineering • Consulting • Testing

DRAWN:	DJW	SCALE:	NOTED	PROJ. NO:	0757144
CHKD:	RT	DATE:	6-12-09	SHEET:	2





SOIL PROFILES

SCALE: 1"=10'

LEGEND

1. *GRAY TO DARK RED-BROWN FINE SAND TO SLIGHTLY SILTY FINE SAND, TRACE SHELL, (SP), (SP-SM)*
2. *LIGHT GREEN-GRAY TO DARK BROWN SILTY FINE SAND, TRACE SHELL, TRACE CEMENTED SANDS, (SM)*
3. *LIGHT GREEN-GRAY TO GRAY SANDY CLAY TO CLAY, TRACE SHELL, (CL), (CH)*
4. *GRAY SLIGHTLY SILTY FINE SAND MOSTLY COQUINA, (SP-SM)*
5. *BROWN CLAYEY FINE SAND WITH HARDPAN, TRACE PHOSPHATES, (SC)*
6. *GRAY TO DARK BROWN CLAYEY FINE SAND, (SC)*

(SP) — *UNIFIED SOIL CLASSIFICATION GROUP SYMBOL*

3.0 / 6-2-09 — *DEPTH TO GROUNDWATER LEVEL IN FEET WITH DATE OF READING*

-200 — *FINES PASSING #200 SIEVE IN PERCENT*

Kv — *COEFFICIENT OF VERTICAL PERMEABILITY IN FEET PER DAY*

GEOTECHNICAL ENGINEERING SERVICES

SOUTH REGIONAL WATER & WASTEWATER RECLAMATION FACILITY

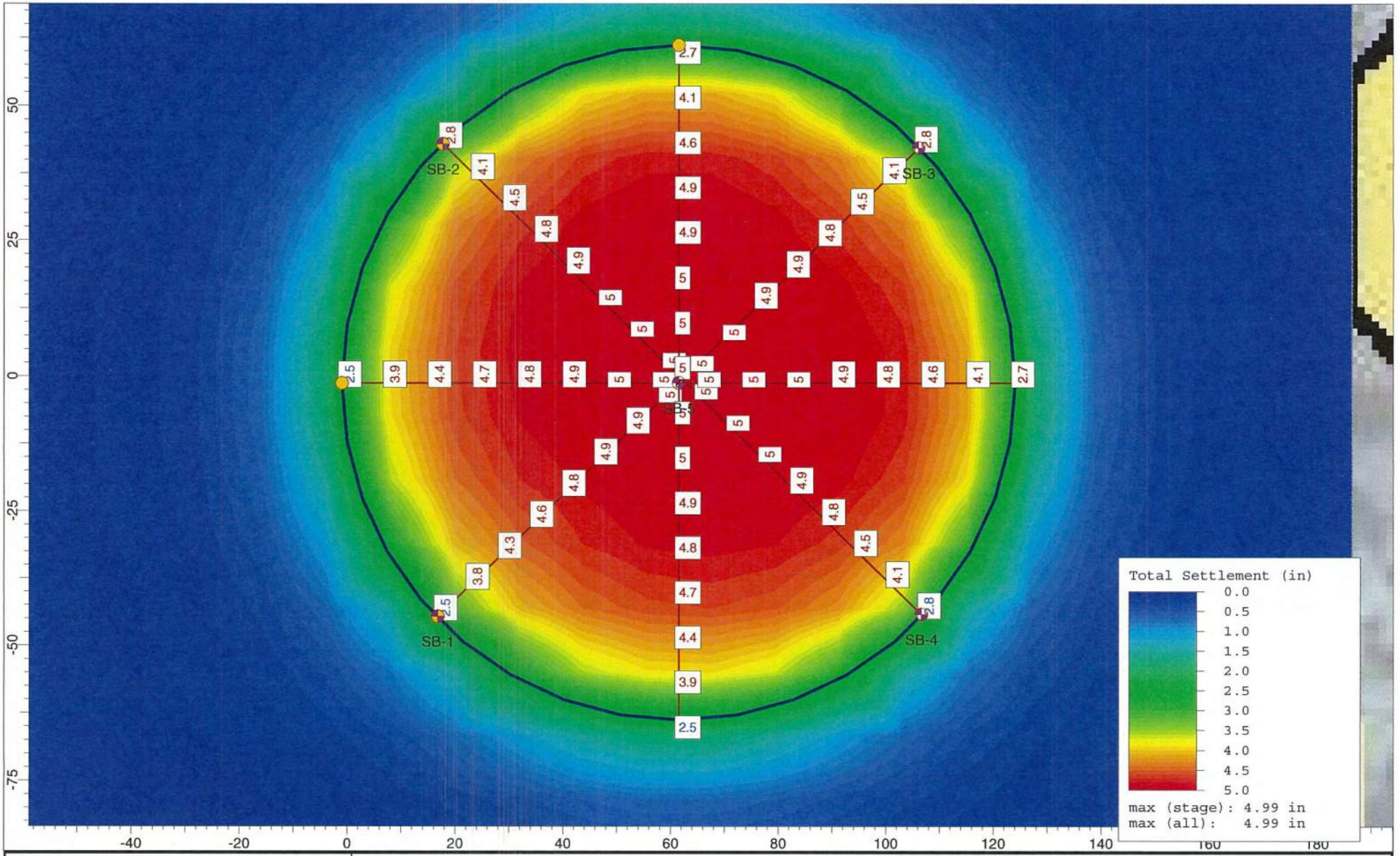
PALM BAY, BREVARD COUNTY, FLORIDA

psi *Information To Build On*

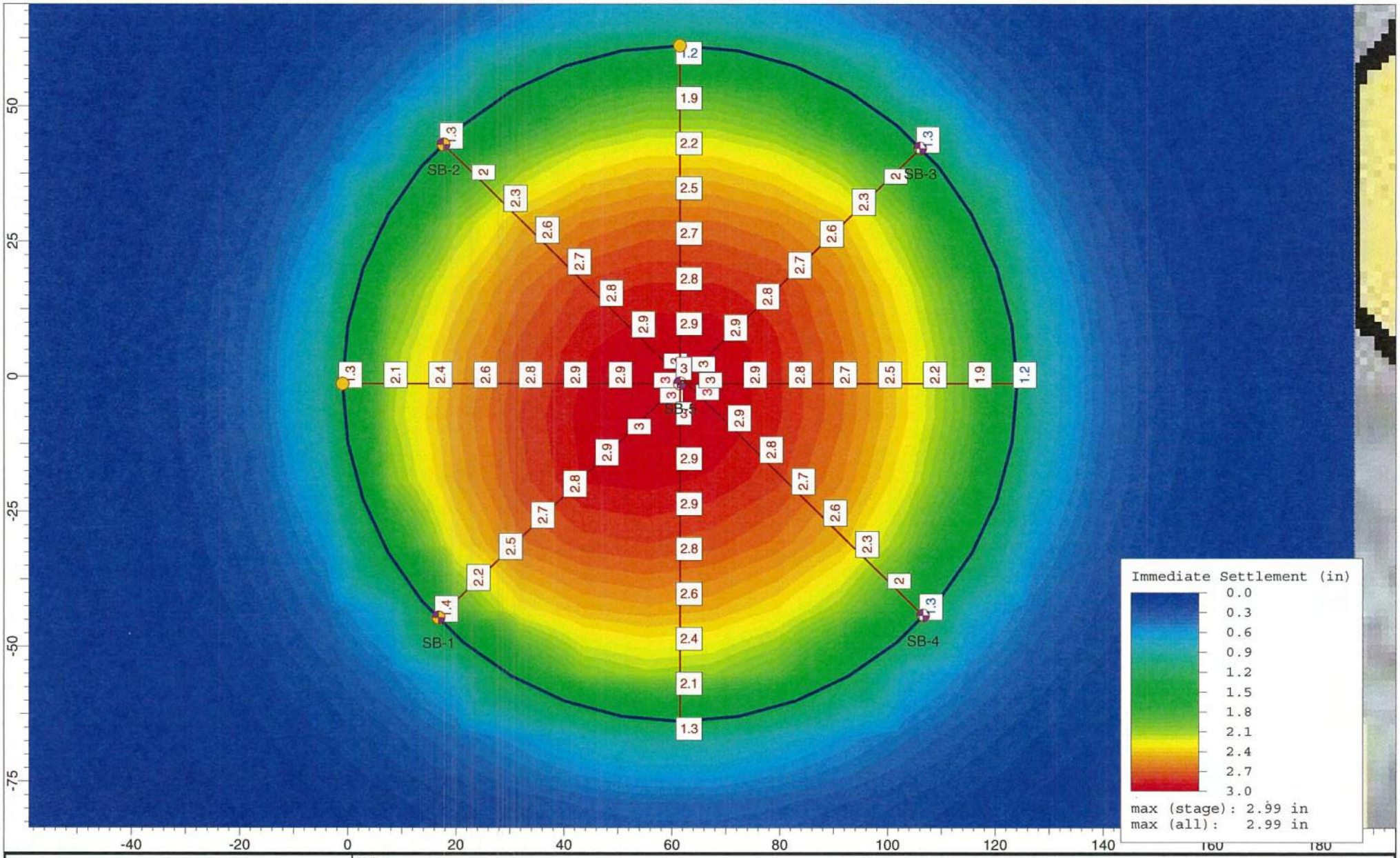
Engineering • Consulting • Testing

DRAWN:	DJW	SCALE:	NOTED	PROJ. NO:	0757144
CHKD:	RT	DATE:	6-12-09	SHEET:	3

APPENDIX C

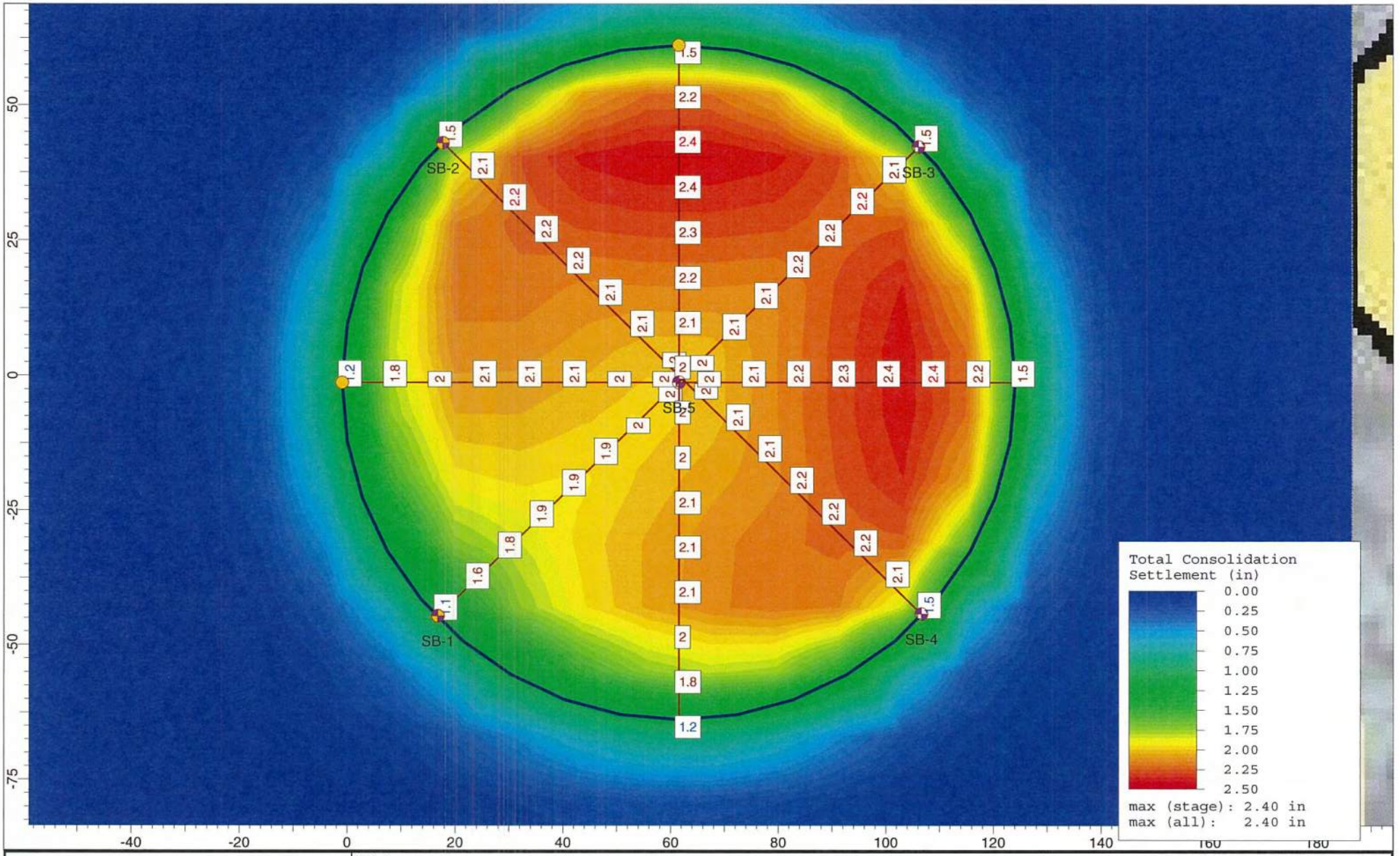


	Project	City of Palm Bay Reclaimed Water Storage Tank	
	Analysis Description	Tank with 2,500 psf load	
	Drawn By	ewn/rt	Company: PSI-Intertek
SETTLE3D 4.015	Date	4/4/2018, 3:54:19 PM	File Name: GST All Borings.s3z



rocscience	Project	City of Palm Bay Reclaimed Water Storage Tank	
	Analysis Description	Tank with 2,500 psf load	
	Drawn By	ewn/rt	Company PSI-Intertek
	Date	4/4/2018, 3:54:19 PM	File Name GST All Borings.s3z

SETTLE3D 4.015



Project	City of Palm Bay Reclaimed Water Storage Tank		
Analysis Description	Tank with 2,500 psf load		
Drawn By	ewn/rt	Company	PSI-Intertek
Date	4/4/2018, 3:54:19 PM	File Name	GST All Borings.s3z

SETTLE3D 4.015

Settle3D Analysis Information
City of Palm Bay Reclaimed Water Storage Tank

Project Settings

Document Name	GST All Borings.s3z
Project Title	City of Palm Bay Reclaimed Water Storage Tank
Analysis	Tank with 2,500 psf load
Author	ewn/rt
Company	PSI-Intertek
Date Created	4/4/2018, 3:54:19 PM
Stress Computation Method	Boussinesq

Include buoyancy effect when material settles below water table

Include vertical stress reduction due to settlement above a point

Use average properties to calculate layered stresses

Improve consolidation accuracy

Ignore negative effective stresses in settlement calculations

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0.286921 seconds

Total Settlement [in]

Stage	Minimum	Maximum
Stage 1	0	4.98355

Total Consolidation Settlement [in]

Stage	Minimum	Maximum
Stage 1	0	2.4024

Immediate Settlement [in]

Stage	Minimum	Maximum
Stage 1	0	2.99182

Loads

1. Circular Load: "Circular Load 1"

Radius	62.5 ft
Center	(61.547, -1.383)
Load Type	Flexible
Area of Load	12209.6 ft^2
Load	2.5 ksf
Depth	2 ft
Installation Stage	Stage 1

Soil Layers

SB-5: (61.547, -1.383)

Layer #	Type	Thickness [ft]	Depth [ft]
1	prepared sand layer	4	0
2	loose sand layer	9.5	4
3	Clay	15	13.5
4	loose sand layer	10	28.5
5	med dense sand	16.5	38.5

SB-1: (16.7902, -44.6782)

Layer #	Type	Thickness [ft]	Depth [ft]
1	prepared sand layer	4	0
2	loose sand layer	9.5	4
3	Clay	15	13.5
4	loose sand layer	10	28.5
5	med dense sand	16.5	38.5

SB-2: (17.7286, 42.8506)

Layer #	Type	Thickness [ft]	Depth [ft]
1	prepared sand layer	4	0
2	loose sand layer	4	4
3	Clay	15.5	8
4	loose sand layer	11.5	23.5
5	med dense sand	20	35

SB-3: (106.11, 42.106)

Layer #	Type	Thickness [ft]	Depth [ft]
1	prepared sand layer	4	0
2	loose sand layer	4	4
3	Clay	15.5	8
4	loose sand layer	11.5	23.5
5	med dense sand	20	35

SB-4: (106.668, -44.314)

Layer #	Type	Thickness [ft]	Depth [ft]
1	prepared sand layer	4	0
2	loose sand layer	4	4
3	Clay	15.5	8
4	loose sand layer	11.5	23.5
5	med dense sand	20	35

Soil Properties

Property	prepared sand layer	loose sand layer	Clay	med dense sand
Color				
Unit Weight [kips/ft^3]	0.11	0.105	0.115	0.11
Saturated Unit Weight [kips/ft^3]	0.115	0.11	0.115	0.115
K0	1	1	1	1
Immediate Settlement	Enabled	Enabled	Disabled	Enabled
Es [ksf]	770	260	-	510
Esur [ksf]	770	260	-	510
Primary Consolidation	Disabled	Disabled	Enabled	Disabled
Material Type			Non-Linear	
Cc	-	-	0.91	-
Cr	-	-	0.091	-
e0	-	-	1.67	-
Pc [ksf]	-	-	5.4	-
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0

Groundwater

Groundwater method	Piezometric Lines
Water Unit Weight	0.0624 kips/ft^3
Generating excess pore pressure above water table	

Query Lines

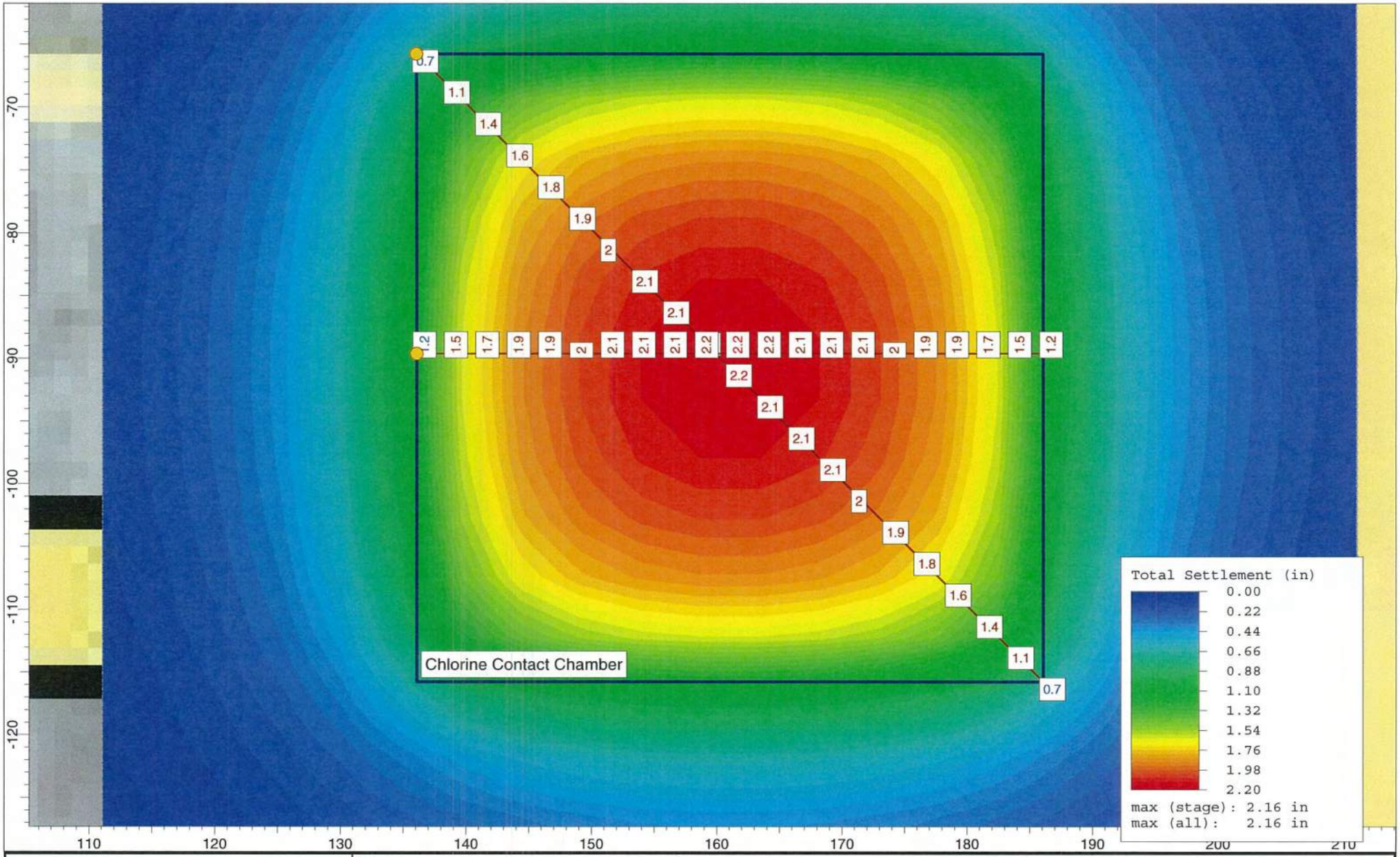
Line #	Query Line Name	Start Location	End Location	Horizontal Divisions	Vertical Divisions
1	Query Line 1	16.7902, -44.6782	106.11, 42.106	15	Auto: 69
2	Query Line 2	17.7286, 42.8506	106.668, -44.314	15	Auto: 73

Field Point Grid

Number of points 560
Expansion Factor 2

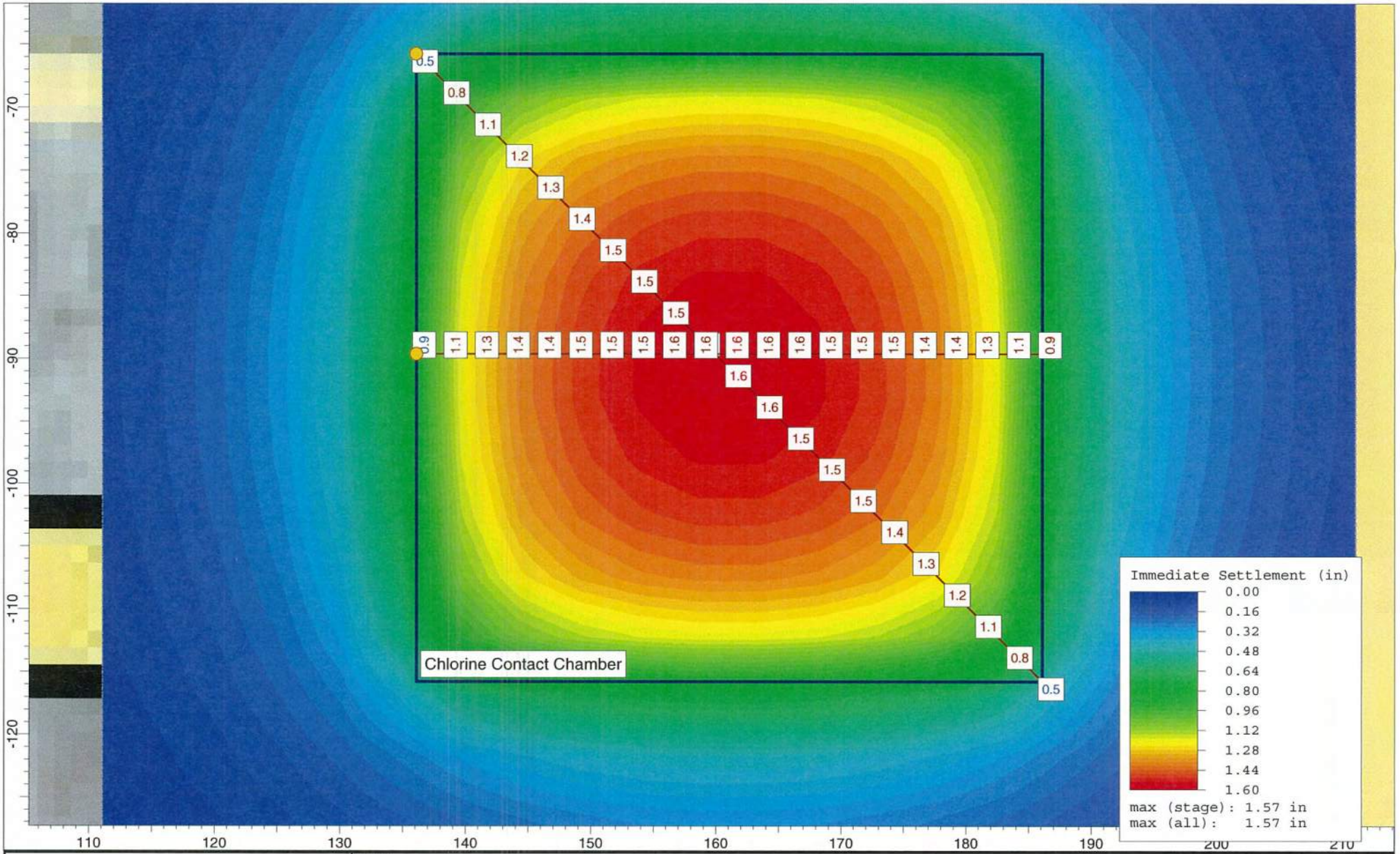
Grid Coordinates

X [ft]	Y [ft]
186.547	123.617
186.547	-126.383
-63.453	-126.383
-63.453	123.617



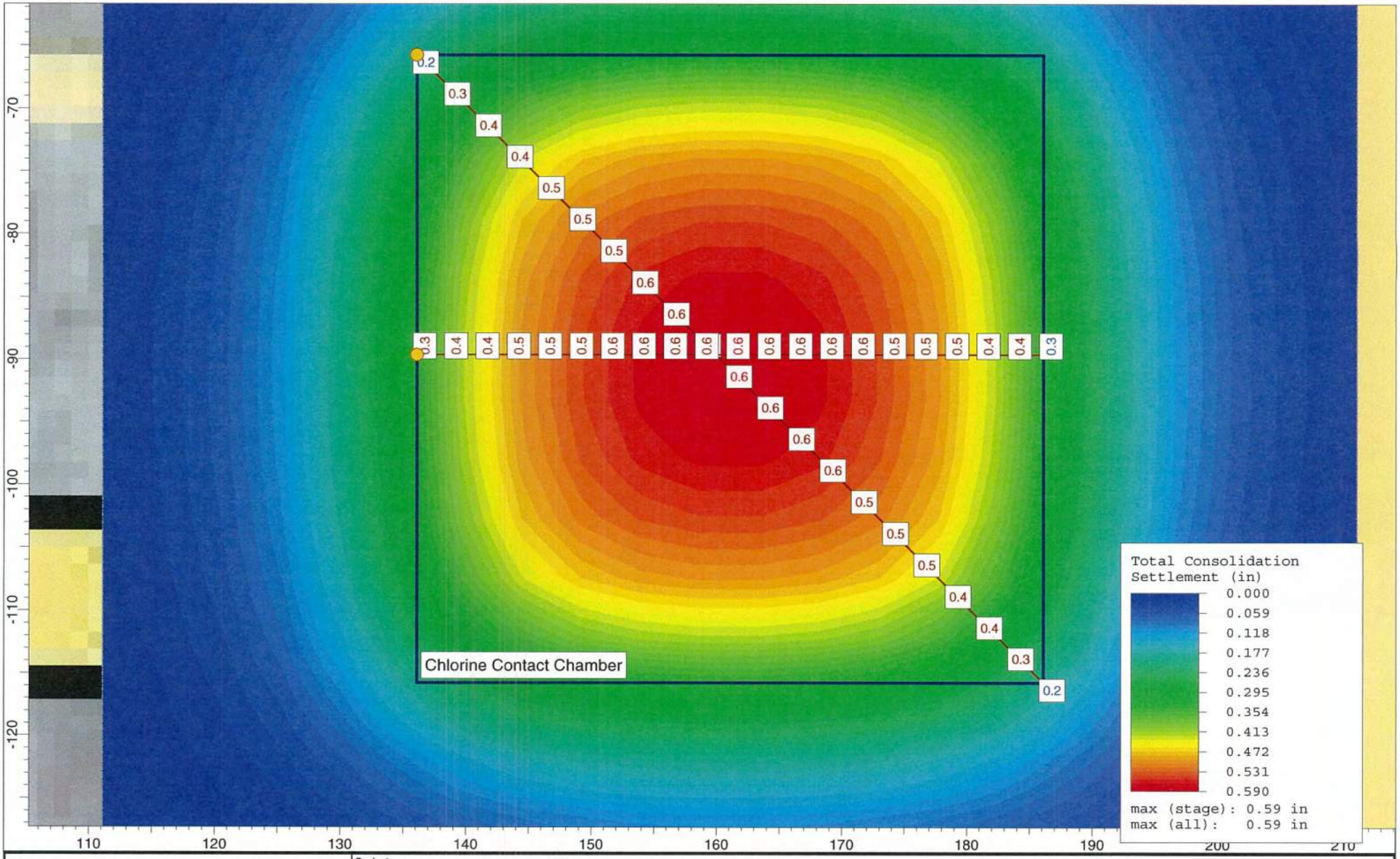
rocscience	Project	City of Palm Bay Chlorine Contact Tank	
	Analysis Description	Boring SB-6 with 1,650 psf load	
	Drawn By	ewn/rt	Company PSI-Intertek
	Date	4/4/2018, 3:54:19 PM	File Name Chlorine Contact Tank.s3z

SETTLE3D 4.015



	Project	City of Palm Bay Chlorine Contact Tank	
	Analysis Description	Boring SB-6 with 1,650 psf load	
	Drawn By	ewn/rt	Company: PSI-Intertek
	Date	4/4/2018, 3:54:19 PM	File Name: Chlorine Contact Tank.s3z

SETTLE3D 4.015



Project	City of Palm Bay Chlorine Contact Tank		
Analysis Description	Boring SB-6 with 1,650 psf load		
Drawn By	ewn/rt	Company	PSI-Intertek
Date	4/4/2018, 3:54:19 PM	File Name	Chlorine Contact Tank.s3z

SETTLE3D 4.015

Settle3D Analysis Information
City of Palm Bay Chlorine Contact Tank

Project Settings

Document Name	Chlorine Contact Tank.s3z
Project Title	City of Palm Bay Chlorine Contact Tank
Analysis	Boring SB-6 with 1,650 psf load
Author	ewn/rt
Company	PSI-Intertek
Date Created	4/4/2018, 3:54:19 PM
Stress Computation Method	Boussinesq

Include buoyancy effect when material settles below water table

Include vertical stress reduction due to settlement above a point

Use average properties to calculate layered stresses

Improve consolidation accuracy

Ignore negative effective stresses in settlement calculations

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0.448365 seconds

Total Settlement [in]

Stage	Minimum	Maximum
Stage 1	0	2.16035

Total Consolidation Settlement [in]

Stage	Minimum	Maximum
Stage 1	0	0.585387

Immediate Settlement [in]

Stage	Minimum	Maximum
Stage 1	0	1.57496

Loads

1. Rectangular Load: "Chlorine Contact Chamber"

Length	50 ft
Width	50 ft
Rotation angle	0 degrees
Load Type	Flexible
Area of Load	2500 ft^2
Load	1.65 ksf
Depth	2 ft
Installation Stage	Stage 1

Coordinates

X [ft]	Y [ft]
136.082	-115.787
186.082	-115.787
186.082	-65.787
136.082	-65.787

Soil Layers

Layer #	Type	Thickness [ft]	Depth [ft]
1	prepared sand layer	4	0
2	loose sand layer	9.5	4
3	Clay	10	13.5
4	loose sand	5	23.5
5	med dense sand	5	28.5
6	loose sand layer	10	33.5
7	Very Dense Sand	11.5	43.5

Soil Properties

Property	prepared sand layer	loose sand layer	Clay	loose sand
Color				
Unit Weight [kips/ft^3]	0.11	0.105	0.115	0.11
Saturated Unit Weight [kips/ft^3]	0.115	0.11	0.115	0.115
K0	1	1	1	1
Immediate Settlement	Enabled	Enabled	Disabled	Enabled
Es [ksf]	770	260	-	300
Esur [ksf]	770	260	-	300
Primary Consolidation	Disabled	Disabled	Enabled	Disabled
Material Type			Non-Linear	
Cc	-	-	0.43	-
Cr	-	-	0.043	-
e0	-	-	1.13	-
OCR	-	-	2	-
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0

Property	med dense sand	Very Dense Sand
Color		
Unit Weight [kips/ft^3]	0.11	0.12
Saturated Unit Weight [kips/ft^3]	0.115	0.125
K0	1	1
Immediate Settlement	Enabled	Enabled
Es [ksf]	510	1180
Esur [ksf]	510	1180
Undrained Su A [kips/ft2]	0	0
Undrained Su S	0.2	0.2
Undrained Su m	0.8	0.8
Piezo Line ID	0	0

Groundwater

Groundwater method	Piezometric Lines
Water Unit Weight	0.0624 kips/ft^3

Generating excess pore pressure above water table

Query Lines

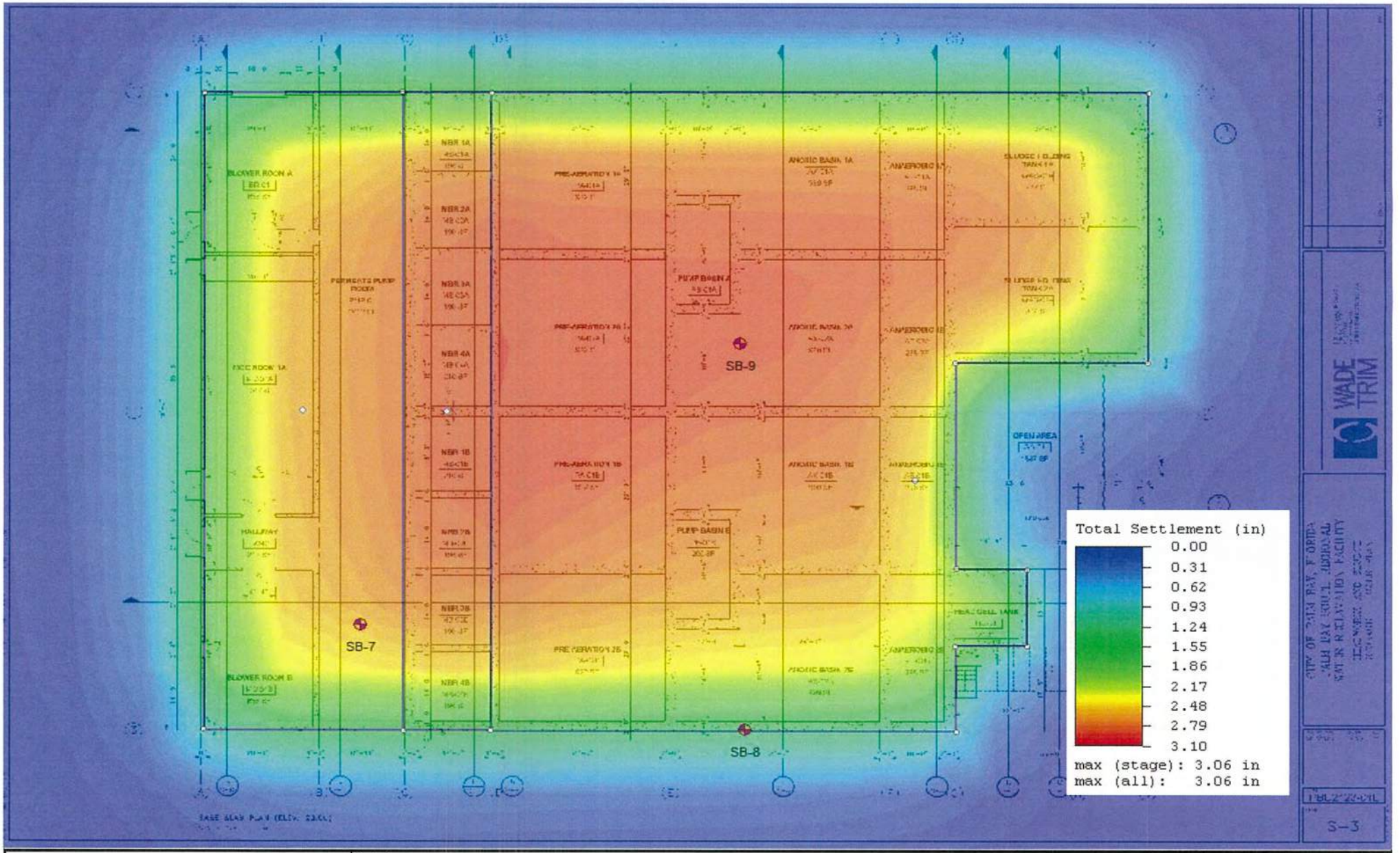
Line #	Query Line Name	Start Location	End Location	Horizontal Divisions	Vertical Divisions
1	Query Line 1	136.082, -65.787	186.082, -115.787	20	Auto: 73
2	Query Line 2	136.082, -89.6219	186.082, -89.6219	20	Auto: 73

Field Point Grid

Number of points 528
Expansion Factor 2

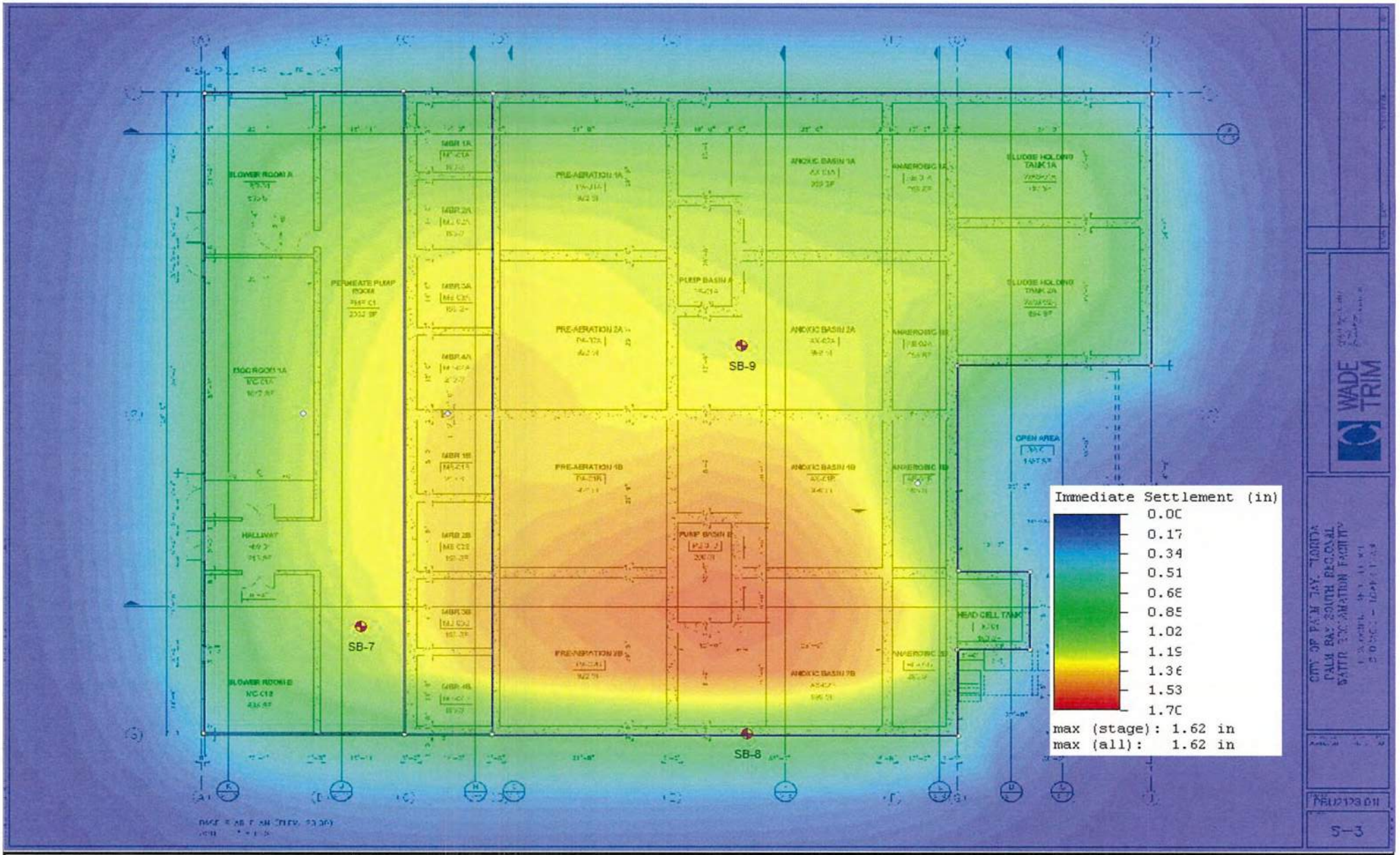
Grid Coordinates

X [ft]	Y [ft]
211.082	-40.787
211.082	-140.787
111.082	-140.787
111.082	-40.787

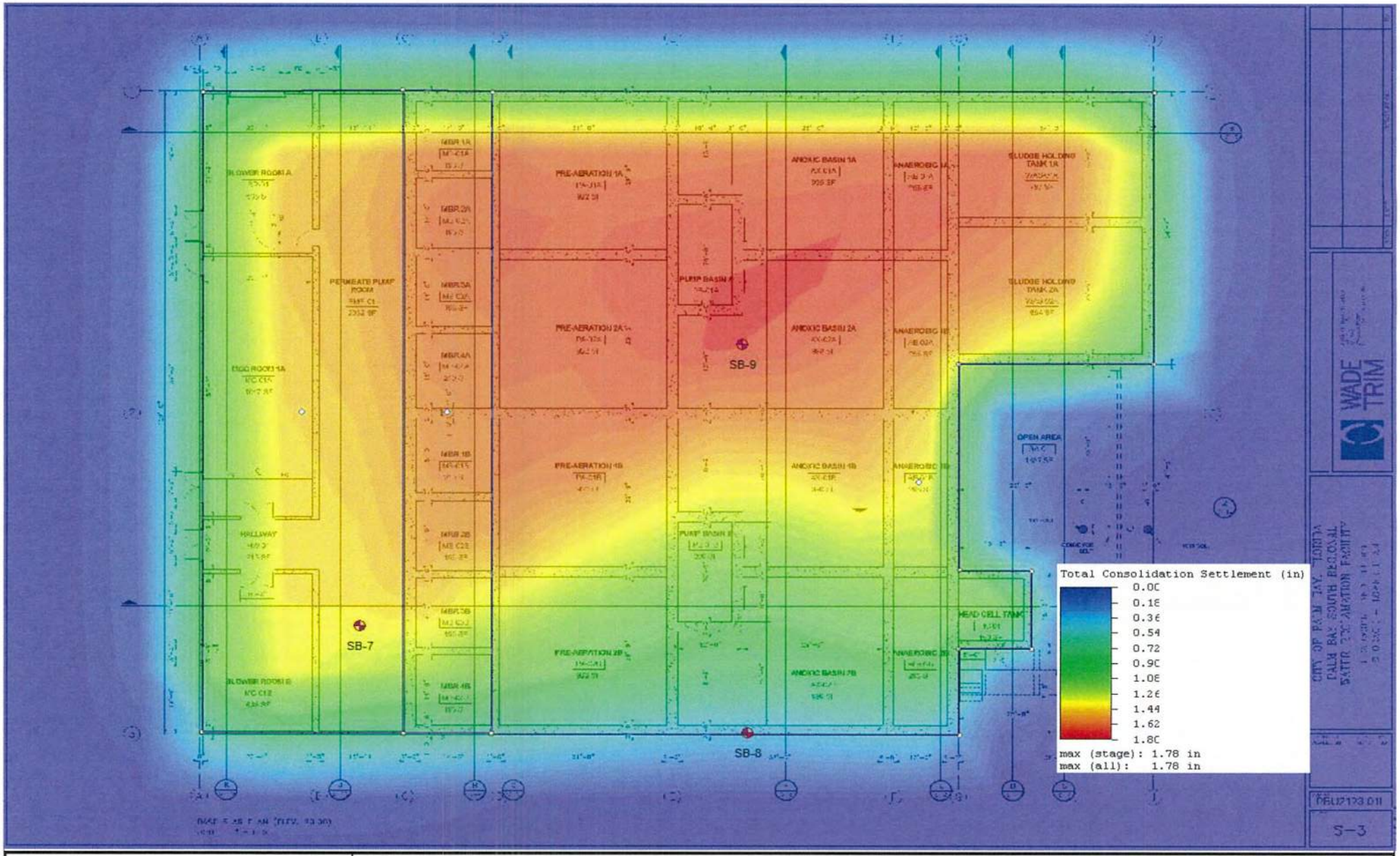


Project	City of Palm Bay MBR Process tank		
Analysis Description	MBR Tank, 1,650 psf load		
Drawn By	ewn/rt	Company	PSI-Intertek
Date	4/4/2018, 3:54:19 PM	File Name	MBR Tank Multiple Borings.s3z

SETTLE3D 4.015

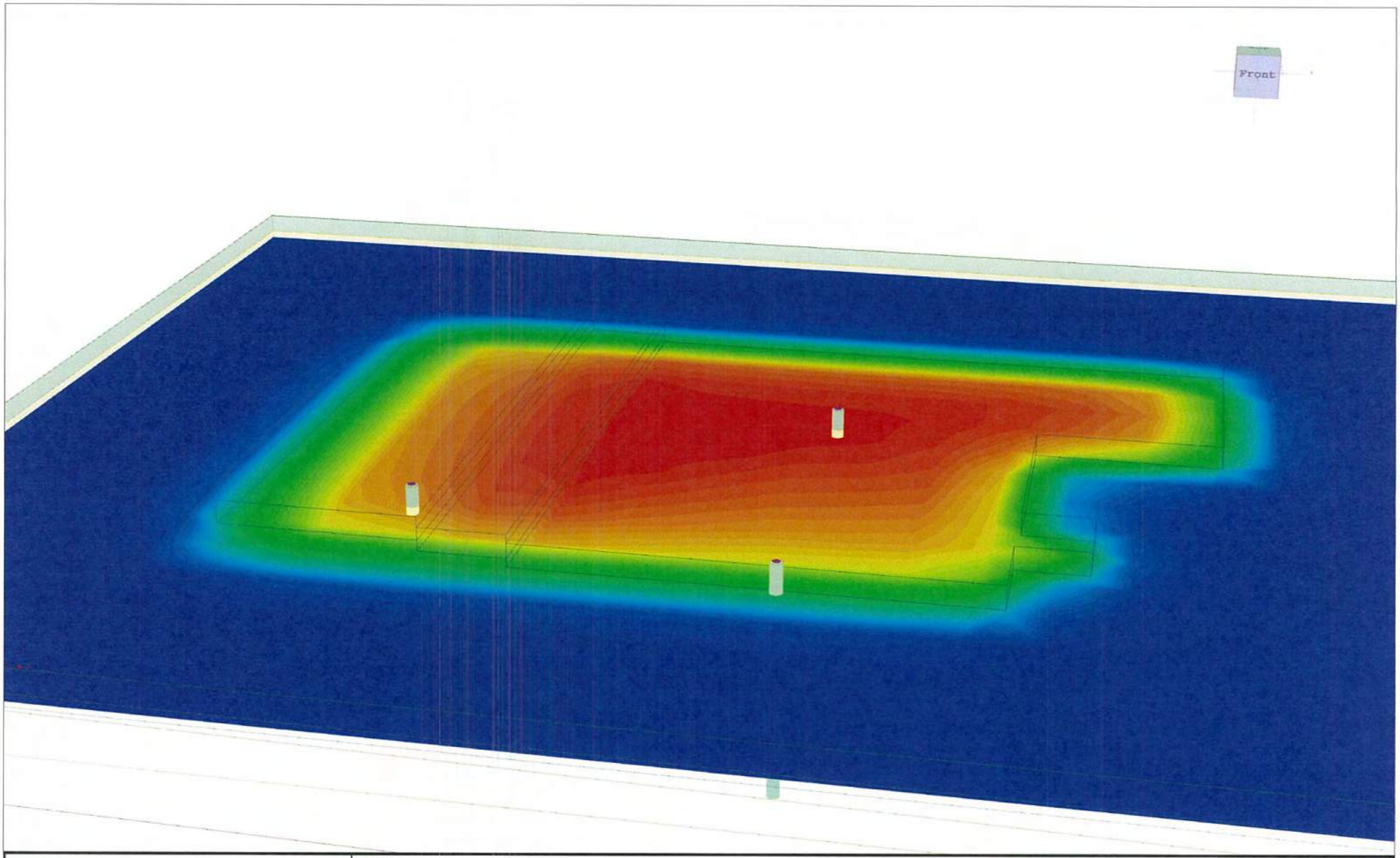


SETTLE3D 4.015	Project	City of Palm Bay MBR Process tank	
	Analysis Description	MBR Tank, 1,650 psf load	
	Drawn By	ewn/rt	Company PSI-Intertek
	Date	4/4/2018, 3:54:19 PM	File Name MBR Tank Multiple Borings.s3z



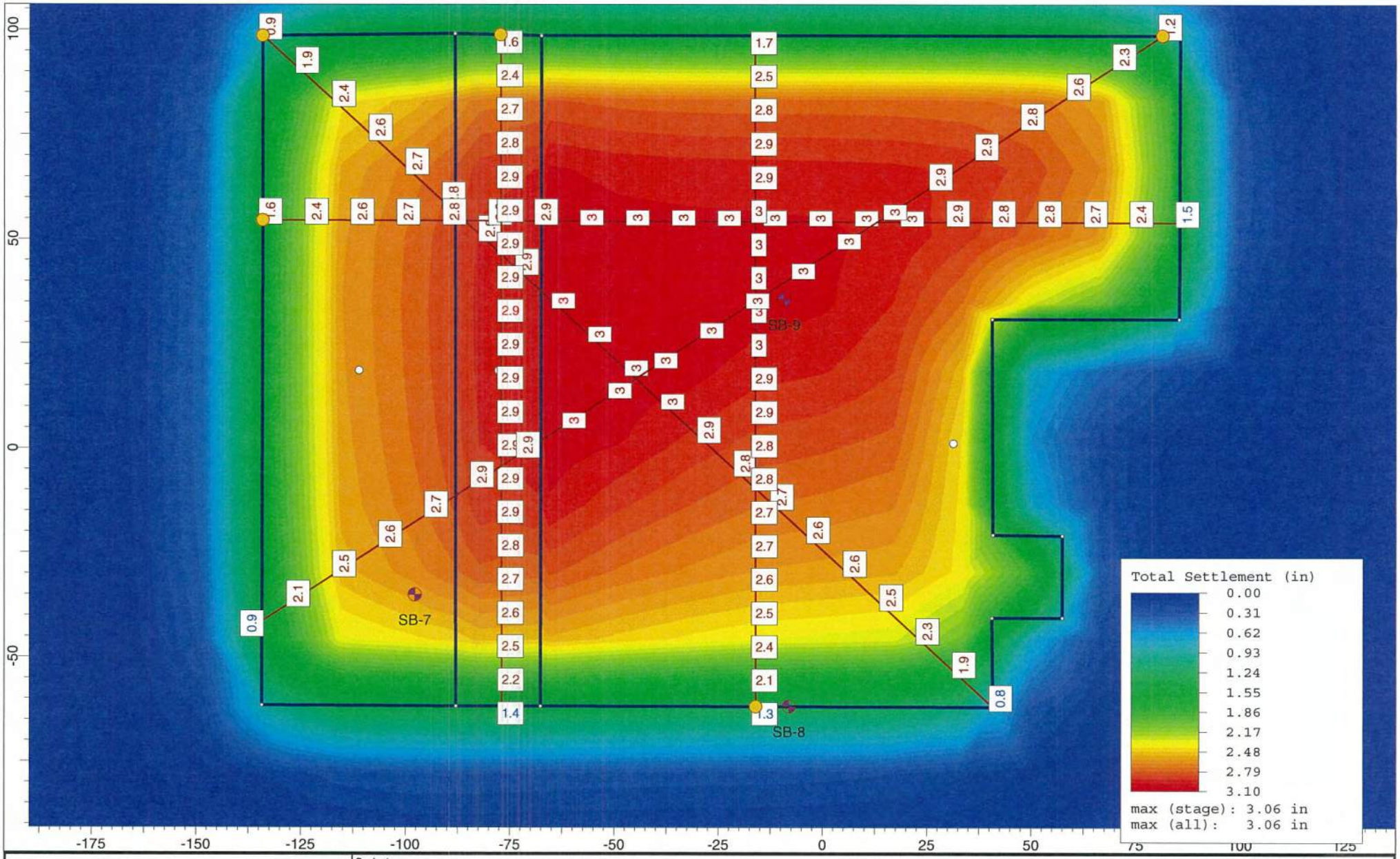
rocscience	Project	City of Palm Bay MBR Process tank	
	Analysis Description	MBR Tank, 1,650 psf load	
	Drawn By	ewn/rt	Company PSI-Intertek
	Date	4/4/2018, 3:54:19 PM	File Name MBR Tank Multiple Borings.s3z

SETTLE3D 4.015



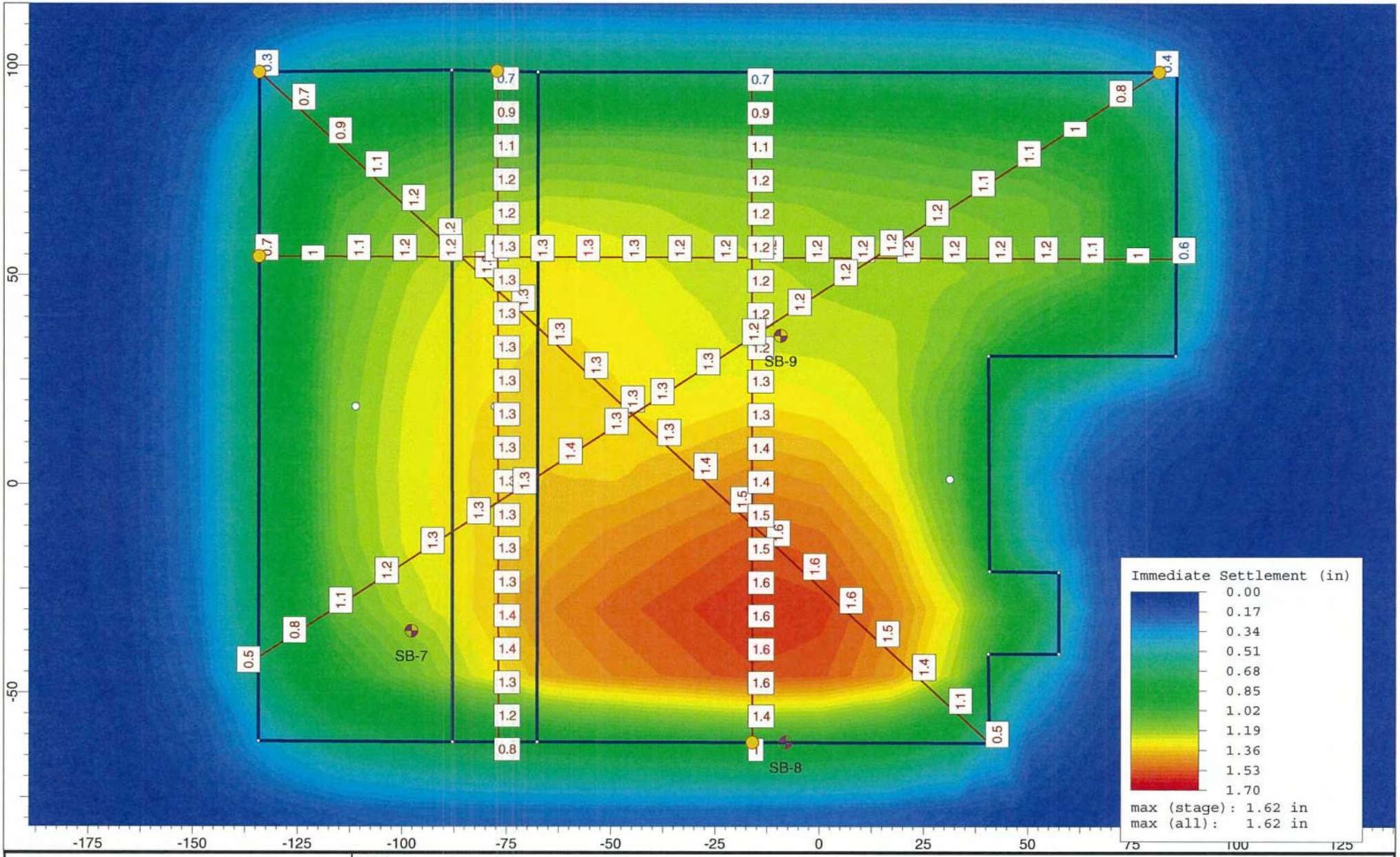
rocscience	*Project*	City of Palm Bay MBR Process tank	
	Analysis Description	MBR Tank, 1,650 psf load	
	Drawn By	ewn/rt	*Company* PSI-Intertek
	Date	4/4/2018, 3:54:19 PM	*File Name* MBR Tank Multiple Borings.s3z

SETTLE3D 4.015



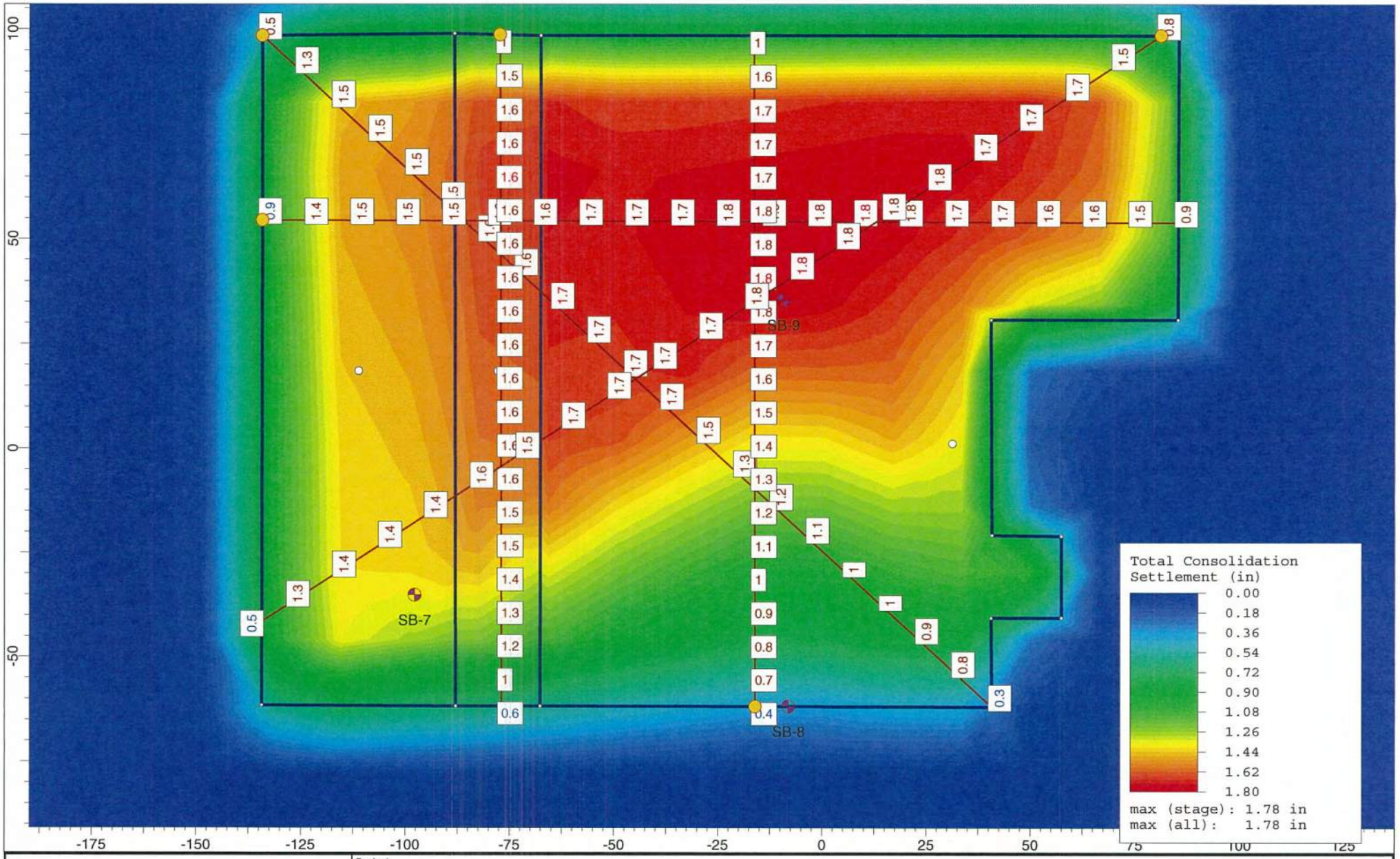
rocscience	*Project*	City of Palm Bay MBR Process tank	
	Analysis Description	MBR Tank, 1,650 psf load	
	Drawn By	ewn/rt	*Company* PSI-Intertek
	Date	4/4/2018, 3:54:19 PM	*File Name* MBR Tank Multiple Borings.s3z

SETTLE3D 4.015



	Project	City of Palm Bay MBR Process tank	
	Analysis Description	MBR Tank, 1,650 psf load	
	Drawn By	ewn/rt	Company PSI-Intertek
	Date	4/4/2018, 3:54:19 PM	File Name MBR Tank Multiple Borings.s3z

SETTLE3D 4.015



SETTLE3D 4.015	Project	City of Palm Bay MBR Process tank	
	Analysis Description	MBR Tank, 1,650 psf load	
	Drawn By	ewn/rt	Company: PSI-Intertek
	Date	4/4/2018, 3:54:19 PM	File Name: MBR Tank Multiple Borings.s3z

Settle3D Analysis Information
City of Palm Bay MBR Process tank

Project Settings

Document Name	MBR Tank Multiple Borings.s3z
Project Title	City of Palm Bay MBR Process tank
Analysis	MBR Tank, 1,650 psf load
Author	ewn/rt
Company	PSI-Intertek
Date Created	4/4/2018, 3:54:19 PM
Stress Computation Method	Boussinesq

Include buoyancy effect when material settles below water table

Include vertical stress reduction due to settlement above a point

Use average properties to calculate layered stresses

Improve consolidation accuracy

Ignore negative effective stresses in settlement calculations

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0.0857918 seconds

Total Settlement [in]

Stage	Minimum	Maximum
Stage 1	0	3.06011

Total Consolidation Settlement [in]

Stage	Minimum	Maximum
Stage 1	0	1.7755

Immediate Settlement [in]

Stage	Minimum	Maximum
Stage 1	0	1.61693

Loads

1. Polygonal Load: "Polygonal Load 1"

Label	Polygonal Load 1
Load Type	Flexible
Area of Load	7407.03 ft^2
Load	1.65 ksf
Depth	2 ft
Installation Stage	Stage 1

Coordinates

X [ft]	Y [ft]
-134.069	98.532
-134.297	-61.571
-87.903	-61.798
-88.131	98.986

2. Polygonal Load: "Polygonal Load 2"

Label	Polygonal Load 2
Load Type	Flexible
Area of Load	3286.2 ft^2
Load	1.65 ksf
Depth	4.5 ft
Installation Stage	Stage 1

Coordinates

X [ft]	Y [ft]
-88.131	98.986
-87.903	-61.798
-67.663	-61.798
-67.436	98.532

3. Polygonal Load: "Polygonal Load 3"

Label	Polygonal Load 3
Load Type	Flexible
Area of Load	20733.3 ft^2
Load	1.65 ksf
Depth	6.5 ft
Installation Stage	Stage 1

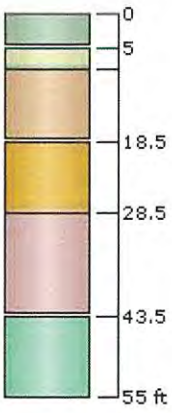
Coordinates

X [ft]	Y [ft]
-67.436	98.532
-67.663	-61.798
40.815	-62.026
40.588	-40.648
57.417	-40.648
57.417	-21.09
40.815	-20.863
40.588	30.761
85.389	30.761
85.617	98.532

Soil Layers

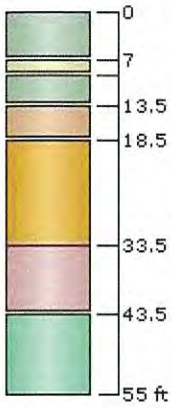
SB-7: (-97.682, -35.19)

Layer #	Type	Thickness [ft]	Depth [ft]
1	loose sand layer	5	0
2	prepared sand layer	3	5
3	loose sand layer	0	8
4	Clay	10.5	8
5	loose sand	10	18.5
6	Clay	0	28.5
7	med dense sand	15	28.5
8	Very Dense Sand	11.5	43.5



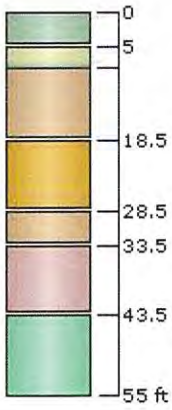
SB-8: (-8.05714, -61.9233)

Layer #	Type	Thickness [ft]	Depth [ft]
1	loose sand layer	7	0
2	prepared sand layer	2	7
3	loose sand layer	4.5	9
4	Clay	5	13.5
5	loose sand	15	18.5
6	Clay	0	33.5
7	med dense sand	10	33.5
8	Very Dense Sand	11.5	43.5



SB-9: (-9.25, 35.471)

Layer #	Type	Thickness [ft]	Depth [ft]
1	loose sand layer	5	0
2	prepared sand layer	3	5
3	loose sand layer	0	8
4	Clay	10.5	8
5	loose sand	10	18.5
6	Clay	5	28.5
7	med dense sand	10	33.5
8	Very Dense Sand	11.5	43.5



Soil Properties

Property	prepared sand layer	loose sand layer	Clay	loose sand
Color				
Unit Weight [kips/ft^3]	0.11	0.105	0.115	0.11
Saturated Unit Weight [kips/ft^3]	0.115	0.11	0.115	0.115
K0	1	1	1	1
Immediate Settlement	Enabled	Enabled	Disabled	Enabled
Es [ksf]	770	260	-	300
Esur [ksf]	770	260	-	300
Primary Consolidation	Disabled	Disabled	Enabled	Disabled
Material Type			Non-Linear	
Cc	-	-	0.91	-
Cr	-	-	0.091	-
e0	-	-	1.67	-
Pc [ksf]	-	-	5.4	-
Undrained Su A [kips/ft2]	0	0	0	0
Undrained Su S	0.2	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8	0.8
Piezo Line ID	0	0	0	0

Property	med dense sand	Very Dense Sand
Color		
Unit Weight [kips/ft^3]	0.11	0.12
Saturated Unit Weight [kips/ft^3]	0.115	0.125
K0	1	1
Immediate Settlement	Enabled	Enabled
Es [ksf]	510	1180
Esur [ksf]	510	1180
Undrained Su A [kips/ft2]	0	0
Undrained Su S	0.2	0.2
Undrained Su m	0.8	0.8
Piezo Line ID	0	0

Groundwater

Groundwater method	Piezometric Lines
Water Unit Weight	0.0624 kips/ft^3

Generating excess pore pressure above water table

Field Point Grid

Number of points 589
Expansion Factor 2

Grid Coordinates

X [ft]	Y [ft]
166.009	179.378
166.009	-142.418
-214.689	-142.418
-214.689	179.378