



**Orange County
Porter Transfer Station
Site Improvements**

**CIP NO. 4410-038-1061-6310
SEQ NO. 91566**

Technical Specifications

Prepared for:

Orange County Utilities



5901 Young Pine Road
Orlando, Florida 32829

Presented by:

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This item has been electronically signed and sealed by David Beben, PE on March 21, 2018 using a SHA authentication code.

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DIVISION 0

Bidding And Contract Documents

DIVISION 1
General Requirements

SECTION 01000

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE AND INTENT

A. Work Included:

1. The Work to be done consists of furnishing all labor, material, equipment and the performance of all Work included in this Contract. The Summary of Work is presented in Section 01010. The Contractor shall furnish all supervision, labor, materials, power, light, heat, fuel, water, tools, appliances, equipment, supplies, and means of construction necessary for proper performance and completion of the work. Contractor shall obtain and pay for all required permits. Contractor shall perform and complete the Work in the manner best estimated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Owner, and in strict accordance with the Contract Documents. The Contractor shall clean up the Work and maintain it during and after construction, until accepted, and shall do all work and pay all costs incidental thereto. Contractor shall repair or restore all structures and property that may be damaged or disturbed during performance of the Work.
2. The cost of incidental Work described in these General Requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the Work and shall be included in the prices for the various Contract Items. No additional payment will be made therefore.
3. The Contractor shall provide and maintain such modern materials, tools, and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the Work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy of his workmanship, materials and equipment, prior acceptance of the Engineer notwithstanding.

B. Public Utility Installations and Structures:

1. The Contract Documents may contain data relative to existing public utility installations and structures above and below the ground surface. This data is not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make investigations to fully understand the character, condition and extent of all such installations and

structures as may be encountered and as may affect the construction operations.

2. Public utility installations or structures owned or controlled by the Owner or other governmental body which are shown on the Drawings to be removed, relocated, replaced or rebuilt by the Contractor shall be considered as a part of the general cost of doing the Work and shall be included in the prices bid for the various Contract items. No separate payment shall be made therefor.
3. Where public utility installations or structures owned or controlled by the Owner or other governmental body are encountered during the course of the Work, and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the Engineer, removal, relocation, replacement or rebuilding is necessary to complete the Work under this Contract, such work shall be accomplished by the utility having jurisdiction, or such work may be ordered, in writing by the Engineer, for the Contractor to accomplish. If such work is accomplished by the utility having jurisdiction it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required. If such work is accomplished by the Contractor, it will be paid for as extra work as provided in the Agreement.
4. The Contractor shall, at all times in performance of the Work, employ accepted methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage or destruction of public utility installations and structures; and shall, at all times in the performance of the Work, avoid unnecessary interference with, or interruption of, public utility services, and shall cooperate fully with the owners thereof to that end.
5. The Contractor shall give written notice to Owner, other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight (48) hours in advance of breaking ground in any area or on any unit of the Work.
6. The maintenance, repair, removal, relocation or rebuilding of public utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the owners of such utilities.
7. The Contractor shall make provisions to avoid impacting existing facilities operation or maintenance activities. If an impact is anticipated, the Contractor shall propose a means to maintain existing activities, subject to

approval by the Owner. The Owner will not be responsible for any costs associated with such proposed modification.

1.02 DRAWINGS AND PROJECT MANUAL

- A. Drawings: When obtaining data and information from the Drawings, figures shall be used in preference to scaled dimensions, and large scale drawings in preference to small scale drawings.

- B. Copies Furnished to Contractor:
 - 1. After the Contract has been executed, the Contractor will be furnished two (2) sets of plans (24 inches by 36 inches), one (1) electronic copy of the plans, and one (1) copy of the Project Manual (Contract Requirements and Specifications) and all addenda.
 - 2. The Contractor shall furnish each of the subcontractors, manufacturers, and material suppliers such copies of the Contract Documents as may be required for their work. All copies of the Contract Documents shall be printed from the reproducible sets furnished to the Contractor. All costs of reproduction and printing shall be borne by the Contractor.

- C. Supplementary Drawings:
 - 1. When, in the opinion of the Engineer, it becomes necessary to explain more fully the Work to be done or to illustrate the Work further or to show any changes which may be required, drawings known as Supplementary Drawings, with specifications pertaining thereto, will be prepared by the Engineer and the Contractor will be furnished five (5) sets of plans and one (1) copy of the Project Manual (Contract Requirements and Specifications) and all addenda.
 - 2. The Supplementary Drawings shall be binding upon the Contractor with the same force as the Drawings. Where such Supplementary Drawings require either less or more than the estimated quantities of Work, credit to the Owner or compensation therefor to the Contractor shall be subject to the terms of the Agreement.

- D. Contractor to Check Drawings and Data:
 - 1. The Contractor shall verify all dimensions, quantities and details shown on the Drawings, Supplementary Drawings, schedules, Specifications or other data received from the Engineer, and shall notify him of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory Work, faulty construction or improper operation resulting therefrom nor from rectifying such conditions

at no additional expense to Owner or Engineer. Contractor will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the Engineer, should such errors or omissions be discovered.

2. All schedules are given for the convenience of the Owner and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in Work to be done under the Contract and additional Work claimed by Contractor.
- E. Specifications: The Technical Specifications consist of three parts: General, Products, and Execution. The General Section contains General Requirements which govern the Work. Products and Execution modify and supplement these by detailed requirements for the Work and shall always govern whenever there appears to be a conflict.
- F. Intent:
1. All Work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Drawings or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described.
 2. The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.

1.03 MATERIALS AND EQUIPMENT

- A. Manufacturer:
1. The names of proposed manufacturers, material suppliers, and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings shall be submitted to the Engineer for acceptance, prior to construction, to afford proper investigation and checking. No manufacturer will be accepted for any materials to be furnished under this Contract unless he shall be of good reputation and have a plant of ample capacity. Contractor shall, upon the request of the Engineer, be required to submit evidence that he has manufactured a similar product to the one specified and that it has

been previously used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.

2. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the Engineer, that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract and will not impose any liability on the Owner or Engineer.
3. Any two or more pieces of material or equipment of the same kind, type or classification, and being used for identical types of service, shall be made by the same manufacturer.

B. Delivery:

1. The Contractor shall deliver materials to the site in ample quantities to insure the most speedy and uninterrupted progress of the Work so as to complete the Work within the scheduled time. However, the Contractor shall not store materials on-site for more than thirty (30) days before installation. This will not supersede more stringent requirements noted in Division 2.
2. The Contractor shall also coordinate deliveries in order to avoid delay in, or impede, the progress of the Work of any related Contractor.
3. All materials and equipment shall be properly stored on site in accordance with these specifications and the manufacturer's recommendations.

C. Tools and Accessories:

1. The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind or size of equipment, one complete set of suitably marked high grade special tools and appliances which may be needed to adjust, operate, maintain or repair the equipment. Such tools and appliances shall be furnished in accepted painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.
2. Spare parts shall be furnished as specified in the specifications.
3. Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight and principal rate data.

D. Service of Manufacturer's Engineer:

1. The Contract prices for equipment shall include the cost of furnishing a competent and experienced engineer or superintendent who shall represent the manufacturer and shall assist the Contractor, when required, to install, adjust, test and place in operation, the equipment in conformity with the Contract Documents.
2. Prior to the equipment being placed in permanent operation by the Owner, such Engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the Owner in the proper operation and maintenance of such equipment.

1.04 INSPECTION AND TESTING

A. General:

1. Inspection and testing of materials will be provided by the Contractor unless otherwise specified.
2. For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Two (2) originally executed and five (5) copies of the reports shall be submitted and authoritative certification thereof shall be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.
3. If, in the performing of any test of any material or equipment, it is ascertained by the Engineer that the material or equipment does not comply with the Contract Documents, the Contractor will be notified thereof and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the Work and replace it with acceptable material, without cost to the Owner or Engineer.
4. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.
5. The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner executes final acceptance of the Work.

B. Costs:

1. The cost of preliminary shop and field tests of equipment and certain other tests specifically called for in the Contract Documents shall be borne by the Contractor and such costs shall be deemed to be included in the Contract price.
2. Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested for compliance. The Contractor is responsible for providing sufficient information to allow Engineer to determine that the item of material or equipment proposed is equivalent to that specifically named and an acceptable substitute therefor. If in the sole discretion of the Engineer, tests of the proposed substitute items are necessary for Engineer's review, the substitute items will be tested by the Contractor at no additional cost to the Owner.

C. Inspection of Materials:

1. The Contractor shall give notice in writing to the Engineer, sufficiently in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, the Engineer will arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials or Engineer will notify the Contractor that the inspection will be made at a point other than the point of manufacture.
2. The Contractor must comply with these provisions before shipping any material. Such inspection shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

D. Certificate of Manufacture:

1. The Contractor shall furnish to Engineer authoritative evidence in the form of Certificate of Manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents.
2. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product to be provided by the manufacturer. Two (2) original and five (5) copies are to be provided to the Engineer.

E. Shop Tests:

1. Testing for pressure, duty, capacity, rating, efficiency, performance, function or special requirements which are specified shall be tested in the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents.
2. No such equipment or materials shall be shipped to the Work site until the Engineer notifies the Contractor, in writing, that the results of such tests are acceptable.
3. Two (2) signed original and five (5) copies of the manufacturer's actual test data and interpreted results thereof, accompanied by two (2) signed original and five (5) copies of a certificate of authenticity sworn to by a responsible official of the manufacturing company and/or independent laboratory, shall be forwarded to the Engineer for acceptance.
4. The cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.
5. Failure of Tests:
 - a. Any defects in the materials or their failure to meet the tests, guarantees or requirements of the Contract Documents shall be promptly corrected by the Contractor at no additional cost to Owner. The decision for the Owner as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive.
 - b. If the Contractor fails to make these corrections or if the improved materials, when tested, shall again fail to meet the guarantees or specified requirements, the Owner, notwithstanding its partial payment for Work, and materials, may reject the materials and may order the Contractor to remove them from the site at the Contractor's own expense.
 - c. In case the Owner rejects any materials, then the Contractor shall replace the rejected materials within a reasonable time. If the Contractor fails to do so, the Owner may, after the expiration of a period of thirty (30) calendar days after giving notice in writing, proceed to replace such rejected materials and the cost thereof shall be deducted from any compensation due or which may become due to the Contractor under the Contract.

F. Substantial Inspection: During such the substantial completion inspection, the Work shall be clean and functional. In no case will the final estimate be prepared until the Contractor has complied with all requirements set forth and the Engineer

and Owner have made their final inspection of the entire Work and are satisfied that the entire Work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents.

1.05 TEMPORARY STRUCTURES

- A. Temporary Fences: If, during the course of the Work, it is necessary to remove or disturb any fence or part thereof, the Contractor shall coordinate with the Engineer and provide a suitable temporary fence at no additional cost to Owner. The Engineer shall be solely responsible for the determination of the necessity for approving a temporary fence and the type of temporary fence to be used.
- B. Temporary Roadway: If, during the course of the Work, it is necessary to disturb the normal traffic flow, the Contractor shall coordinate with the Engineer and Owner to install temporary roadways which can maintain typical facility operations at no additional cost to Owner. The Engineer or Owner shall be responsible for determining the appropriateness of the temporary roadways.
- C. Responsibility for Temporary Structures: In executing the Contract, the Contractor assumes full responsibility for the sufficiency and safety of all temporary structures or Work and for any damage which may result from their failure or their improper construction, maintenance or operation and will indemnify and hold harmless the Owner and Engineer from all claims, suits or actions and damages or costs of every description arising by reason of failure to comply with the above provisions.

1.06 ACCIDENT PREVENTION

- A. Precautions shall be exercised at all times for the protection of person and property. The safety provisions of applicable laws, building and construction codes shall be observed.
- B. The Contractor shall comply with the U.S. Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970 (PL 91-596), and under Hours and Safety Standards Act Section 107 of the contract Work. Hours and Safety Standards Act (PL 91-54), except where state and local safety standards exceed the federal requirements and except where state safety standards have been approved by the Secretary of Labor in accordance with provisions of the Occupational Safety and Health Act, shall be complied with. Updates of the referenced regulations also shall apply.
- C. First Aid: The Contractor shall keep upon the site, at each location where Work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when people are employed on the Work.

1.07 ADJACENT STRUCTURES AND LANDSCAPING

A. Responsibility:

1. The Contractor shall also be entirely responsible and liable for all damage or injury as a result of his operations to all other adjacent public and private property, structures of any kind and appurtenances thereto met with during the progress of the Work.
2. The cost of protection, replacement in their original locations and conditions or payment of damages for injuries to such adjacent public and private property and structures affected by the work, whether or not shown on the Drawings, and the removal, relocation and reconstruction of such items called for on the Drawings or specified shall be included in the various Contract Items and no separate payments will be made therefore.
3. The Contractor is expressly advised that the protection of buildings, structures, road, tanks, pipelines, etc. and related work adjacent and in the vicinity of his operations, wherever they may be, is solely his responsibility.
4. Conditional inspection of buildings or structures in the immediate vicinity of the project which may reasonably be expected to be affected by the Work shall be performed by and be the responsibility of the Contractor.
5. Contractor shall, before starting operations, make an examination of the adjacent structures, buildings, facilities, etc., and record by notes, measurements, photographs, etc., conditions which might be aggravated by open excavation and construction. Repairs or replacement of all conditions disturbed by the construction shall be made to the satisfaction of the Owner and Engineer. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be provided to the Owner.
6. Prior to the beginning of any excavations the Contractor shall advise the Owner of all structures on which he intends to perform Work or which performance of the Work will affect.

1.08 PROTECTION OF WORK AND PUBLIC

A. Barriers and Lights:

1. During the prosecution of the Work, the Contractor shall put up and maintain at all times such barriers and lights as will effectually prevent accidents.

2. The Contractor shall provide suitable barricades, red lights, “danger” or “caution” or “street closed” signs and flagmen at all places where the Work causes obstructions to the normal traffic or constitutes in any way a hazard to the public.

B. Noise:

1. The Contractor shall eliminate noise to as great an extent as practicable at all times. Air compressing equipment shall be equipped with silencers and the exhaust of all gasoline motors or other power equipment shall be provided with mufflers. The Contractor shall construct sound barriers as necessary to eliminate noise.
2. In the vicinity of hospitals and schools, special care shall be used to avoid noise or other nuisances. The Contractor shall strictly observe all local regulations and ordinances covering noise control.
3. Except in the event of an emergency, no work shall be conducted between the hours of 6:00 p.m. and 7:00 a.m. Monday through Saturday, and all day Sunday. If the proper and efficient prosecution of the Work requires operations during the night, the written permission of the Owner shall be obtained before starting such items of the Work.

C. Access to Public Services: Neither the materials excavated nor the materials or equipment used in the construction of the Work shall be so placed as to prevent free access to all fire hydrants, valves, or manholes.

D. Dust Prevention: The Contractor shall prevent dust nuisance from his operations or from traffic by keeping the roads and/or construction areas dampened with water at all times.

1.09 CUTTING AND PATCHING

A. The Contractor shall do all cutting, fitting or patching of the Work that may be required to make the several parts thereof join and coordinate in a manner satisfactory to the Engineer and in accordance with the Drawings and Specifications.

B. The Work must be done by competent workmen skilled in the trade required by the restoration.

1.10 CLEANING

A. During Construction:

1. During construction, the Contractor shall, at all times, keep the site of the Work and adjacent premises as free from material, debris and rubbish as is

practicable and shall remove the same from any portion of the site if, in the opinion of the Owner or Engineer, such material, debris, or rubbish constitutes a nuisance or is objectionable.

2. The Contractor shall remove from the site all of his surplus materials and temporary structures when no further need therefore develops. Contractor shall be responsible and liable for all spillage and incur all associated costs including, but not limited to, costs related to repair and maintenance resulting from damages thereof, and fines that may be levied as a result of citations given by State or local regulatory agencies.

B. Final Cleaning:

1. At the conclusion of the Work, all erection plant, tools, temporary structures and materials belonging to the Contractor shall be promptly removed, and the Contractor shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances at a facility permitted to manage these materials.
2. The Contractor shall thoroughly clean all equipment and materials installed and shall deliver such materials and equipment undamaged in a bright, clean, polished and new operating condition.

1.11 MAINTENANCE OF TRAFFIC (MOT) PLAN

- A. The Contractor will have to work with the Owner's staff to generate an approved and acceptable Traffic Control Plan as applicable for their Project construction-related activities onsite. The Traffic Control Plan does not have to be prepared by a Florida Certified Traffic Planner, but does have to be prepared by a qualified individual.
- B. The Contractor shall schedule and perform the Work in such a manner as to result in the least possible disruption to the public's use of roadways, driveways, and utilities.
- C. The Contractor shall be aware of the nature of the activities at a transfer station which may restrict access to portions of the site due to general transfer station operations.

1.12 PHOTOGRAPHS AND VIDEO

- A. The Contractor shall provide preconstruction photographs and video prior to commencement of work on the site. Comprehensive preconstruction photographs and video shall be taken at representative locations to be designated by the Owner that cover all elements of the Work. The photographs shall be high quality digital color images and shall indicate the date, name of work, and the location where the

photograph was taken. Photos and videotape shall be submitted to Engineer/Owner for review and acceptance prior to start of work.

- B. The Contractor shall provide construction photographs showing the progress of the work. The photographs shall be taken of such subjects as may be directed and shall indicate the date, name of work, and the location where the photograph was taken. Starting one month after the date of the preconstruction photographs and continuing as long as the work is in progress, monthly photographs shall be taken at approximately the same location as the preconstruction photographs.
- C. Upon final acceptance of the work, photographs shall be made of the work where directed by the Owner.

1.13 MISCELLANEOUS

- A. Existing Facilities: The Work shall be conducted to maintain existing facilities in operation insofar as is possible. Requirements and schedules of operation for maintaining existing facilities in service during construction shall be described in the Specific Provisions.
- B. Use of Chemicals: All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfection, polymer, reactant, or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions. Contractor shall obtain written approval from Owner prior to use of chemicals. Contractor shall maintain a file onsite of MSDS for any used chemicals.
- C. Cooperation With Other Contractors and Forces:
 - 1. During progress of Work under this Contract, it may be necessary for other contractors and persons employed by the Owner to work in or about the project.
 - 2. The Owner reserves the right to put such other contractors to work and to afford such access to the work area to be performed at times as the Owner deems proper.
 - 3. The Contractor shall not impede or interfere with the work of such other contractors engaged in or about the Work and shall so arrange and conduct the work that such other contractors may complete their work at the earliest date possible.
 - 4. The Contractor shall not interfere with or disrupt the operation of the transfer station.

- D. Fuels and oils stored on site shall have secondary containment, approved by the engineer.
- E. Construction shall be conducted and shall result in construction of the improvements of this project in full accordance with the conditions of the permits granted for the project.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 LOCATION AND SCOPE OF WORK

- A. Work included in this Contract will be conducted at the Porter Transfer Station, 1326 Good Homes Road, Orlando, Florida 32891. The Porter Transfer Station is owned by the Orange County Board of County Commissioners and operated by the Solid Waste Division of Orange County Utilities, (Owner).

- B. Elements of the Project include, but are not limited to, building construction; scale demolition; electrical; retaining wall construction; guardrail; chain link fence; clearing and grubbing; excavation and backfill; grading; erosion and sedimentation control; seeding and mulching; sodding; roadway repair; roadway construction; piping; surveying; clean-up and restoration; and all other Work necessary for a complete and functioning Project as shown in the Contract Documents.

1.02 REQUIREMENTS INCLUDED

- A. The Work to be performed under this Contract shall consist of furnishing all tools, equipment, materials, supplies, and manufactured articles, furnishing all transportation and services, including fuel, power, water, and essential communications, and performing 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 of which are made a part hereof, and including detail sketches as may be furnished by the Engineer from time to time during construction in explanation of said Contract Documents and clarifications. The Work shall be complete, and all Work, materials, and services not expressly shown or called for in the 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.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work for this project includes, but is not limited to, removal and disposal of the existing scale and selective appurtenances located in the northwest corner of the site to include, but not limited to, roadway materials, or any part thereof including masonry, steel, reinforced concrete, plain concrete, asphalt, electrical facilities, and any other material or equipment shown or specified to be removed on the Contract Drawings. The Work proposed under this contract also includes

construction of a new elevated Citizen's Drop-Off Area with adjacent transfer trailer parking, one new truck scale and associated electrical, one prefabricated scalehouse and associated electrical and sanitary services, one Household Hazardous Waste building, access roads, driveways, stormwater management features and associated appurtenances for the site improvements.

- B. The Contractor shall be aware of the nature of the activities at a transfer station which may restrict access to portions of the site due to general transfer station operations.
- C. The Contractor shall complete all Work described above and all Work incidental whether specifically mentioned or not in accordance with the Drawings, Specifications, and Contract Documents.

1.04 WORK BY OTHERS

- A. Work may be conducted at the site by other contractors during the performance of the Work under this contract. The Contractor shall conduct their operations to minimize interference with other contractors and shall cooperate fully with such contractors and the project representatives to provide continued safe access to perform their respective contracts.

1.05 CONTRACTOR USE OF SITE

- A. Access to Site: Limited to public rights-of-way at the scalehouse facility.
- B. Working Hours and Period: Except in the event of an emergency, no work shall be conducted between the hours of 6:00 p.m. and 7:00 a.m. Monday through Saturday, and all day Sunday. No Work shall be performed on legal holidays without written permission of the Owner. The transfer station is closed on legal holidays and Sundays. If the Contractor desires to work after the hours stated or on legal holidays, it shall be requested in writing at least forty-eight (48) hours in advance.
- C. The Contractor shall reimburse the Owner for additional construction management and/or inspection costs incurred as a result of unscheduled Work in excess of the working hours indicated in 1.05.B. The Contractor will be reimburse the County \$125/hour when the Contractor's Work exceeds 50 hours per week. Such billings shall be deducted from Payment due the Contractor on a monthly basis.
- D. Construction Operations: Limited to the areas as noted on Drawings.
- E. Limited Use of Property: Construction shall not obstruct the Owner normal access to, and use of, the existing scale on the western portion of the site during all facility hours of operation.

1.06 WORK SEQUENCING AND SCHEDULING CONSTRAINTS

- A. The Contractor shall schedule and perform the Work in such a manner as to result in the least possible disruption to the public's use of roadways, driveways, and utilities. Utilities shall include but not be limited to, drainage structures, ditches and canals, gas, and electric. Prior to commencing with the Work, the Contractor shall perform a location investigation of existing underground utilities and facilities in accordance with Section 01530 - Protection of Existing Facilities and shall have obtained all required permits and permissions. The Contractor shall also deliver notice to the Owner/Engineer of all planned disruption to roadways and utilities 7 days in advance of the disruption.

1.07 SALVAGE

- A. The Owner may desire to salvage certain existing items that are to be dismantled and removed during the course of construction. Prior to removal of any existing equipment from the site of the Work, the Contractor shall ascertain from the Owner/Engineer whether or not the particular item or items are to be salvaged unless identified in the Contract Documents. Items to be salvaged shall be stockpiled on the site in a location as directed by the Owner.

1.08 STORAGE

- A. 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.

1.09 AVAILABLE INVESTIGATION REPORTS

- A. The following report is included in Attachment B of this Project Manual. This report is made available for the convenience of the Contractor. The Owner does not guarantee the depth, extent, or character of the material present. The Contractor shall make such examination of the site of the Work, and any material sources, as may be necessary to inform himself of the conditions under which the Work is to be performed.
1. "Geotechnical Exploration Report Porter Transfer Station Improvements", Blue Marlin Engineering, August 31, 2017.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

- A. Payments to the Contractor shall be made on the basis of the Bid Items as full and complete payment for furnishing all material, labor, tools and equipment, and for performing all construction/operations necessary to complete the Work included in the Contract Documents. Such compensation shall also include payments for any loss or damages arising directly or indirectly from the Work or from any discrepancies between the actual quantities of Work and those shown in the Contract Documents, or from any unforeseen difficulties which may be encountered during the prosecution of the Work until final acceptance by the Owner and Engineer.
- B. The prices stated in the Bid Form include all costs and expenses for taxes, labor, equipment, material, commissions, transportation charges and expenses, patent fees and royalties, labor for handling material during inspection, together with any and all other costs and expenses for performing and completing the Work, as shown on the Drawings and specified herein. The basis of payment for Bid Items at the price shown in the Bid Form shall be in accordance with its description of the item in this section and as related to the Work specified and shown on the Drawings.
- C. The Contractor's attention is called to the fact that the quotations for the various items of Work are intended to establish a total price for completing the Work in its entirety. The cost of Work for which there is not a separate Bid Item shall be included in a related Bid Item, or shall be distributed over all Bid Items, such that the bid for the project reflects the total price for completing the Work in its entirety.
- D. The Owner will have the right to issue one or more Change Orders prior to Final Payment, which will reconcile actual quantities furnished and accepted with the estimated quantities found in the Bid Form.
- E. Payment of any Bid Item, in part or in full, prior to Final Payment, shall not be regarded as acceptance of that item.
- F. The Contractor's attention is called to the fact that if shown, the estimated quantities appearing in the Bid Form consists of the Engineer's opinion of what will be required to complete the Work as designed. Neither the Owner nor the Engineer guarantees the accuracy or exactness of the figures. The actual quantities will be determined during and after construction, based upon the measurements herein described. The estimated quantities are not a guarantee of the magnitude of Work. The Owner reserves the right to authorize additional

amounts of any or all of the Bid Items, and to reduce or totally eliminate any of the Bid Items, without affecting any other Bid Items.

- G. All existing elevations and dimensions shown on the Drawings are approximate and the Contractor is responsible to field verify all elevations and dimensions, as needed.
- H. The Contractor shall immediately report overpayment on any item.
- I. The Owner will have the right to deduct for overpayment of any item, when discovery of overpayment is made, and to adjust the amounts due the Contractor accordingly.
- J. The Owner will have the right to require the Contractor to expose any item which was covered after installation (unless previously inspected and tested by Engineer) for the purpose of measuring, testing, or inspecting the item; and the Contractor shall comply with such request. No separate or additional payment will be made for such extra work. The Contractor shall, when accepted or directed to by the Owner, restore and repair the Work in conformance to the Contract Documents.
- K. Work performed beyond the Contract requirements shall be approved and accepted before payment may be made. Mere knowledge by the Owner or the Engineer that the Contractor has performed a task shall not constitute acceptance of the task for the purpose of payment, and the Owner will not be under obligation to pay for the task.
- L. The Owner reserves the right to request of the Contractor a breakdown of any of the Lump Sum Bid Items, which the Contractor shall promptly provide. The breakdown shall consist of labor, equipment, and the cost of material for the Bid Item or the various components included within the Bid Item.
- M. Lump Sum items have been established for all portions of the Work except as previously noted. The term "Lump Sum" shall mean complete payment for the unit of Work described. Where the unit measurement is described as "Lump Sum", the unit shall include all necessary appurtenances and incidentals required to complete the unit of Work in its entirety. Measurement of the Lump Sum Work will be estimated by the values in the Schedule of Values as applied to the completed portion of Work for purposes of monthly payment estimates.
- N. The Contractor shall be responsible for establishing contracts with its subcontractors, which have a measurement and payment in accordance with this Section. If the Contractor establishes a contract with its subcontractors, which is in conflict with this Section, any additional cost incurred will be borne by the Contractor.

- O. Restoration is not a separate pay item but is considered to be an integral part of the Work under the contract, and all contract bid prices include the cost of restoration necessitated by the Work related to that bid item. Restoration includes existing structure and property, paving, stabilized roads, drainage piping and ditches, catch basins, head walls, yard culverts, driveways, lawns and ground areas, walkways, and irrigation systems, which are altered, removed or damaged during construction. Cleanup is an integral part of restoration.

PART 2 - MEASUREMENTS

- A. Progress payments for Lump Sum Bid Items will be considered on a percent completed basis. The Schedule of Values prepared as per the General Conditions will be used as the basis of the percent complete. The Contractor shall estimate the value of the Work performed, subject to the review and acceptance by the Engineer.
- B. Payment will be made for the Unit Price Bid Items listed on the Bid Form for the amount bid based on the actual amount authorized by the Engineer and installed or removed and replaced. Related work not specifically identified but necessary for satisfactory completion of the Work associated with each Bid Item shall be considered incidental to the Work and included in the Unit Price. Unit Price Items shall be used only at the written direction of the Engineer. The quantities of the Unit Price Items authorized and installed or removed and replaced shall not necessarily be the quantity indicated on the Bid Form, and depending on Project requirements, some Unit Price Items may not be authorized at all.
- C. The Engineer and Owner will review installed quantities prior to making payments. The Contractor shall give the Engineer and Owner access to all field data, calculations, and computations. In the event of discrepancies or the need for additional field data to confirm quantities, the Contractor shall be responsible for the additional field measurement cost.
- D. Prior to submitting the first requisition for payment, the Contractor shall secure the Engineer's and Owner's concurrence on the methods and procedures for making field measurements and the manner in which calculations will be performed in preparation of progress and final payment estimates.
- E. Quantity estimates, field measurements, certifications, and related backup information that are submitted in support of payment request will be considered by the Owner as having been prepared by the Contractor, even when prepared by or submitted on behalf of the Contractor by others.
- F. The value of furnished materials, for which partial progress or full payment is made during the course of the Work that remain unused at the closing of the Contract, shall be deducted from the amounts due the Contractor in the Final Payment.

PART 3 – BID FORM

- A. The Bid Form for the items contained within this Section can be found in the Contract Documents.

PART 4 - PAYMENT ITEMS (BY BID ITEM NO.)

- A. Bid Item 001 - Mobilization/Demobilization (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of work completed.

Payment: Payment for this Item shall be on a Lump Sum basis as described below. No price adjustments will be made for this Item due to changes in the Work. Item includes, but not limited to, performance of preparatory paperwork and construction operations, permits required of the Contractor by State and local laws and regulations, bonds, insurance, movement of personnel and equipment to the project site, safety equipment, furnishing and installing at the beginning of the project as well as removing and disposing at the conclusion of the Project, required facilities to begin Work on a substantial phase of the Contract.

The Contract Price for mobilization/demobilization shall be subject to the following provisions:

- a. The maximum amount allowed to be bid for mobilization/demobilization is 5 percent of the total bid price.
- b. Partial payments for mobilization/demobilization will be made in accordance with the following schedule.

Condition or Percent of Total Contract Amount Earned	Cumulative Allowable Percent of the Lump Sum Price for the Item
All permits, bonds, insurance Transportation of all equipment/facilities Preparatory work and operations Fire protection and safety program Finalized/Approved detailed construction schedule Finalized/Approved schedule of values Finalized/Approved schedule of submittals	25
10 percent total contract amount earned	40
25 percent total contract amount earned	60
50 percent total contract amount earned	80
100 percent total contract amount earned	100

The final payment for mobilization/demobilization will not be made until all temporary facilities, temporary erosion and sedimentation controls, equipment, and appurtenances have been removed from the site.

B. Bid Item 002 - Surveying and Control (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a Lump Sum basis for all surveying and control Work required by the Contract Documents. This Work includes, but not limited to, establishment of appropriate local site benchmarks, baseline surveys, location of utilities, stakeout of elevation and positional information required to complete the construction, progress payment surveys, utility installation surveys, and obtaining all survey information required to compile Record (As-Built) Drawings as required by the Contract Documents. The Lump Sum price proposed shall be full compensation for performing the surveying Work required wherein no measurement will be made. Payment for this Lump Sum Item will be made based on the value of materials furnished or services and Work completed using estimates provided by Contractor and approved by Owner's representative.

C. Bid Item 003 - Demolition (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a Lump Sum basis for all demolition required as part of the site improvements as indicated on the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, quality control, permits, and all other incidentals necessary to complete the selective demolition of the existing truck scale with interior guardrail, stop arm and accessories, traffic light, foundation, and associated electrical connections; selective demolition of asphalt and concrete pavement areas; selective demolition temporary removal of chain link fence; selective demolition of stormwater pipes and drainage structures, selective demolition of electrical services; selective demolition of trees; selective demolition of traffic signs; and loading, hauling and disposal of demolition debris at County transfer trailers located at the site. The Contractor will not be required to pay disposal fees for demolition debris (Project generated). No payment will be made for demolition outside of the construction baseline shown on the Contract Drawings or otherwise not indicated for demolition without prior approval of the Engineer.

D. Bid Item 004 - Sediment and Erosion Control (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a Lump Sum basis for all sediment and erosion control required as part of the site improvement and as indicated on the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, and all other incidentals necessary for sedimentation and erosion control at the site as required by the Contract Documents, applicable laws and regulations, and standards of practice. This Work includes, but not limited to, furnishing, installing, maintaining, and removal after Project completion: silt fence, temporary or intermediate seeding and mulching, temporary stormwater channels and diversions, ditch blocks, sediment traps, and temporary construction entrances. This Work also includes removal of sediment from roads, stormwater channels, and stormwater ponds resulting from Contractor's work and depositing it at the Contractor's staging area or stockpile area as indicated by the Owner. The Lump Sum price proposed shall be full compensation for performing sedimentation and erosion control required wherein no measurement will be made. Payment for this Lump Sum Item will be made based on the value of materials furnished or services and Work completed using estimates provided by Contractor and approved by Owner's representative.

E. Bid Item 005 - Household Hazardous Waste Center and Sump Pump (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a Lump Sum basis for a complete and operational new Household Hazardous Waste (HHW) Center as indicated in the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, appurtenances, permits, and all other incidentals necessary to construct the new HHW code compliant metal building, related utility connections, and operational features as indicated in the Contract Drawings and Specifications. This Work includes, but is not limited to: geotechnical and structural review and assessment, excavation for foundations, footings, and retaining walls, subgrade compaction and testing, structural fill and limerock base material, compaction and testing, retaining walls, reinforcing steel, cast-in-place concrete slab construction and testing, welding, structural steel and related connection material, fabrication, assembly, and erection, roof metal deck, walls, overhead doors, louvers, gutters and downspouts, exhaust fans, concrete pipe bollards, concrete curbs, trench drain and associated pipe connections, drain valve box and catch basin with valve, chain link fence with swing gates, emergency shower and eye wash stations, potable water line and associated pipe connections, entire electrical system including all appurtenances (i.e., cables and wiring, fixtures, mounting hardware, electrical panels, light fixtures, wiring, conduit, light poles, electrical accessories, grounding, etc.), and all other related Work to provide a fully functional HHW Center. Payment for installation of utility lines outside of the HHW Center footprint will be paid under the respective line item.

F. Bid Item 006 - Scale House and Grinder Pump Station (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a Lump Sum basis for a complete and operational new Scale House (8' x 32' prefabricated structure) as indicated in the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, appurtenances, permits, and all other incidentals necessary to install the prefabricated code compliant prefabricated scale house trailer, related utility connections, and operational features as indicated in the Contract Drawings and Specifications. This Work includes, but is not limited to: geotechnical review and assessment, excavation for foundations, footings, subgrade compaction and testing, structural fill compaction and testing, prefabricated scale house trailer and related connection material, assembly, erection, and anchoring. Prefabricated scale house trailer to include, but not limited to: mounted AC unit, windows, interior/exterior doors, interior finishes, corrugated metal siding, hardware, bathroom and sink, handrails and stairs, potable water line and associated pipe connections, entire electrical system including all appurtenances (i.e., cables and wiring, fixtures, mounting hardware, electrical panels, light fixtures, wiring, conduit, light poles, electrical accessories, grounding, etc.), entire grinder pump station (i.e., fittings, sump and piping installation and connections, pump, placement and testing of the pump, pump discharge hoses, check and ball valves), and all other related Work to provide a fully functional Scale House. Payment for installation of utility lines outside of the scale house footprint will be paid under the respective line item.

G. Bid Item 007 - Scale House Canopy (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a Lump Sum basis for a complete and operational Scale House Canopy as indicated in the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, appurtenances, permits, and all other incidentals necessary to install the prefabricated code compliant Scale House Canopy and operational features as indicated in the Contract Drawings and Specifications. This Work includes, but is not limited to: geotechnical and structural review and assessment, excavation for foundations, footings, subgrade compaction and testing, structural fill compaction and testing, canopy roof and related connection material, assembly, erection, and anchoring, and all other related Work to provide a fully functional Scale House Canopy.

H. Bid Item 008 - Truck Scales, Scale Ramps, Stop/Go Light, Traffic Arm and Unattended Terminal (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a Lump Sum basis for a complete and operational new Truck Scale and Scale Ramps as indicated in the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, appurtenances, and all other incidentals necessary to install the truck scale and concrete ramps, related utility connections, and operational features as indicated in the Contract Drawings and Specifications. This Work includes, but not limited to: geotechnical review and assessment, excavation for foundations, footings, subgrade compaction and testing, structural fill compaction and testing, geogrid material, truck scale and related connection equipment, delivery, installation, reinforcing steel, cast-in-place concrete washout slab construction and testing, concrete approach and exit ramps construction and testing, guardrail, entire electrical system including all appurtenances (i.e., cables and wiring, fixtures, mounting hardware, electrical panels, light fixtures, wiring, conduit, light poles, electrical accessories, grounding, etc.), and all other related Work to provide a fully functional Truck Scale and Scale Ramps. Payment for installation of utility lines outside of the Truck Scale and Scale Ramps footprint will be paid under the respective line item.

I. Bid Item 009 - Citizens Drop-off Area and Transfer Trailer Bays (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a Lump Sum basis for a complete and operational new Citizens Drop-off Area and Transfer Trailer Bays as indicated in the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, appurtenances, and all other incidentals necessary to install the Citizens Drop-off Area, Transfer Trailer Bays, related utility connections, and operational features as indicated in the Contract Drawings and Specifications. This Work includes, but not limited to: geotechnical review and assessment, excavation for foundations, footings and retaining walls, subgrade compaction and testing, structural fill and limerock base material, compaction and testing, reinforcing steel, cast-in-place for concrete slab and retaining walls, expansion joints, retaining wall weep holes and pipe and all related materials, specified concrete design for loading zone and ramps, concrete testing, geogrid, drainage stone, trench drain and associated 6-inch SCH 80 PVC stormwater drainage pipe, and all other related Work to provide a fully functional Citizens Drop-off Area and Transfer Trailer Bays. Payment for installation of utility lines outside of the Citizens Drop-off Area and Transfer Trailer Bays footprint will be paid under the respective line item.

J. Bid Item 010 – Water Utility (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a lump sum basis to connect the existing 1-inch PVC water line to the new Scale House and to the HHW Center as indicated in the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, appurtenances, and all other incidentals necessary to complete this Item. This Work includes, but is not limited to: excavation to design grades, clean soil backfill material, pipe bedding, 1-inch PVC pipe installation, hose bib installation, backfilling, soil compaction and testing, fittings, piping location wire, connections to the Scale House and HHW Center utility lines, pipe location markings, quality control surveying, traffic control, coordination with Owner to avoid impacts to transfer station operations, surface restoration, and all other related Work to provide a fully functional water pipe and service.

K. Bid Item 011 – Storm Drainage Utility (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this item shall be for installing the stormwater drainage pipes and precast structures as indicated in the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, appurtenances, and all other incidentals necessary to complete this Item. This Work includes, but is not limited to: excavation to design grades, clean soil backfill material, pipe bedding, pipe installation, backfilling, soil compaction and testing, fittings, piping location wire, connections to the HHW Center and Transfer Trailer Bays trench drain lines, pipe location markings, quality control surveying, traffic control, coordination with Owner to avoid impacts to transfer station operations, surface restoration, and all other related work to provide a fully functional storm drain system.

L. Bid Item 012 – Sanitary Sewerage Utility (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a lump sum basis for installing PVC pipe from the grinder pump station to the connection point with the existing sanitary sewer manhole and from the HHW center to the grinder pump station as indicated in the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, appurtenances, and all other incidentals necessary to complete this Item. This Work includes, but is not limited to: excavation to design grades, clean soil backfill material, pipe bedding, PVC pipe installation, backfilling, soil compaction and testing, fittings, piping location wire, connections to grinder pump station and existing sanitary sewer manhole, pipe location markings, quality control surveying, cleanouts, traffic control, coordination with Owner to avoid impacts to transfer station operations,

surface restoration, and all other related work to provide a fully functional sanitary pipe and service.

M. Bid Item 013 – Roadway – Asphalt Paving (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a Lump Sum basis for a complete and operational paved roadway as indicated in the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, appurtenances, and all other incidentals necessary to install the asphalt paving at locations indicated for removal and new expansion areas as indicated in the Contract Drawings. This Work includes, but not limited to: subgrade compaction and testing, proof rolling, removal and replacement of objectionable subgrade material, geogrid material, fine grading, stabilized subgrade, limerock base course, asphalt pavement, finish grading or road shoulders, traffic control, coordination with Owner to avoid impacts to transfer station operations, quality control surveying, incidentals, and all other Work required for a complete and acceptable system. No payment will be made for asphalt paving where testing has indicated that the installed material does not meet the specified requirements or outside of limits of construction without prior approval of the Engineer.

N. Bid Item 014 – Signing and Marking (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a Lump Sum basis for a complete and operational signing and marking as indicated in the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, appurtenances, and all other incidentals necessary to install the traffic signs and pavement markings at locations indicated in the Contract Drawings. This Work includes, but not limited to: sign panels complete with reflective sheeting, painting, and message, sign posts and support, excavation and foundation. Permanent pavement markings on the final wearing surface includes, but not limited to: cleaning and preparing of surfaces, removal of old pavement markings, repair of final surface if damaged during cleaning, materials and application, curing and protection of all markings, and traffic control. Pavement markings shall be in accordance with the most current Florida Department of Transportation Standard Specification for Road and Bridge Construction. No payment will be made for signs and paved markings that contain imperfections or damages as a result of installation.

O. Bid Item 015 – Sodding (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a Lump Sum basis for installed and established sodding. The pay Item includes addition of topsoil, conditioning the topsoil with fertilizer and/or lime application, soil testing, fine grading, supplying and installing seed and mulch, watering, replanting, repair of erosion, maintaining areas seeded through final acceptance of the Work, and any other Work necessary to produce a uniform stand of grass. No payment will be made for sodding placed outside of the limits of construction shown on the Contract Drawings without prior approval of the Engineer. Payment of sodding shall not relieve the Contractor of the need to maintain sod throughout warranty period.

P. Bid Item 016 – Cameras and Communications Equipment (Lump Sum)

Measurement: Measurement for this Item shall be on a Lump Sum basis based on percentage of Work completed.

Payment: Payment for this Item shall be on a Lump Sum basis for a complete and operational communications line as indicated in the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, appurtenances, and all other incidentals necessary to install the communications line as indicated in the Contract Drawings.

Q. Bid Item 017 – Electrical and Lighting (Lump Sum)

Measurement: The lump sum price for this item includes all work required to construct the control, electrical and electrical system. The work shall include, but not limited to interior and exterior lighting, electrical panels, conduits, raceways, relays, electrical outlets, power supply to the new structures, coordination with the power company, and permitting. All necessary certifications, QA/QC and production of record documents shall be included with this item.

Payment: Payment for this Item shall be on a Lump Sum basis for a complete and operational communications line as indicated in the Contract Drawings. This Work shall consist of furnishing all necessary materials, equipment, transportation, labor, appurtenances, and all other incidentals necessary to install the electrical and lighting as indicated in the Contract Drawings.

END OF SECTION

Orange County - Porter Transfer Station Site Improvements
1326 Good Homes Road, Orlando, Florida
CIP No. 4410-038-1061-6310
SEQ No. 91566

Bidders must provide prices for each line item for their bid to be considered responsive

Item No.	Description	Unit	Quantity	Unit Price (\$)	Amount (\$)
001	Mobilization/Demobilization	LS	1		
002	Surveying and Control	LS	1		
003	Demolition	LS	1		
004	Sediment and Erosion Control	LS	1		
005	Household Hazardous Waste Center and Sump Pump	LS	1		
006	Scale House and Grinder Pump Station	LS	1		
007	Scale House Canopy	LS	1		
008	Truck Scales, Scale Ramps, Traffic Light, Traffic Arm and Unattended Terminal	LS	1		
009	Citizens Drop-Off Area and Transfer Trailer Bays	LS	1		
010	Water Utility	LS	1		
011	Storm Drainage Utility	LS	1		
012	Sanitary Sewerage Utility	LS	1		
013	Roadway - Asphalt Paving	LS	1		
014	Signing and Marking	LS	1		
015	Sodding	LS	1		
016	Cameras and Communications Systems	LS	1		
017	Electrical and Lighting	LS	1		
		LS	1		
SUBTOTAL BID PRICE					
TOTAL BID PRICE					
TOTAL BID PRICE written in words:					

SECTION 01027

APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.01 PAY REQUEST SUBMISSION

- A. Submit applications for payment to the Engineer in accordance with schedule established by General Conditions of the Contract and Contract between Owner and Contractor.

1.02 FORMAT AND DATA REQUIRED

- A. Submit payment applications following the Contractor's Narrative Report Outline and the Owners standard application form in accordance with Article 18, Payment and Completion, of the General Conditions.
- B. Provide itemized percent completed items according to Work items listed in the schedule of values accepted by the Engineer.
- C. Provide from each subcontractor/supplier, a Subcontractor's/Supplier's Certification in accordance with Article 18 of the General Conditions.
- D. Provide Sales Tax Report. This report shall include a list of sales tax paid during one pay period lagging the period described in the application for payment.

1.03 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

- A. Application Form:
 - 1. Fill in required information, including that for Change Orders executed prior to date of submittal of application.
 - 2. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.
 - 3. Execute certification with signature of a responsible officer of Contractor.
- B. Continuation Sheets:
 - 1. Fill in total list of all scheduled component items of Work, with item number and scheduled dollar value for each item.
 - 2. Fill in dollar value in each column for each scheduled line item when work has been performed or products stored. Round off values to nearest dollar, or as specified for Schedule of Values.

3. List each Change Order executed prior to date of submission or the pay request, at the end of the Schedule of Values. List by Change Order Number, and description, as thou an original component item of Work.
4. To receive approval for payment on component material stored on site, submit copies of the original paid invoices with the application for payment. Any materials stored on site that are included in the pay request must be installed prior to the next pay request submitted.
5. As provided for in the “Certification of Contractor” form, the Contractor shall certify, for each current pay request, that all previous progress payment received from the Owner, under this Contract, have been applied by the Contractor to discharge in full all obligations of the Contractor in connection with Work covered by prior Applications for Payment, and all materials and equipment incorporated into the Work are free and clear of all liens, claims, security interest and encumbrances.

Contractor shall attach to each Application for Payment like affidavits by all Subcontractors.

6. Contractor will complete the sales tax form with each pay request and will maintain records of the sales taxes should the Owner need receipts for confirmation of the information.

1.04 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

- A. When the Owner or the Engineer requires substantiating data, Contractor shall submit suitable information, with a cover letter identifying:
 1. Project.
 2. Application number and date.
 3. Detailed list of enclosures.
 4. For stored products:
 - a. Item number and identification as shown on application.
 - b. Description of specific material.
- B. Submit one copy of data and cover letter for each copy of application.
- C. The Contractor is to maintain an updated set of drawings to be used as Record Drawings in accordance with Section 01720. As a prerequisite for monthly progress payments, the Contractor is to exhibit the updated record drawings for review by the Owner and the Engineer.

1.05 PREPARATION OF APPLICATION FOR FINAL PAYMENT

- A. Fill in Application form as specified for progress payments.
- B. As a prerequisite for final payment, Contractor is to submit a “Consent of Surety” acknowledgement of final payment request letter showing amount of payment which the Contractor is requesting.

1.06 SUBMITTAL PROCEDURE

- A. Submit Applications for Payment to the Engineer for review at the time stipulated during the pre-construction meeting.
- B. Number of copies for each Application for Payment:
 - 1. Engineer: Two (2) copies
 - 2. Contractor: As required for his needs
 - 3. Owner: Seven (7) copies
- C. When the Engineer finds the payment application properly completed and correct, the Contractor will proceed with submittal in accordance with Article 18, Payment and Completion, of the General Conditions.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SCHEDULE OF VALUES

PROJECT NAME: _____ CONTRACT NO. _____
 CONTRACTOR NAME: _____ PAY REQUEST NO. _____
 PROJECT NO. _____ FROM: _____ TO _____

CONTRACT QUANTITIES					WORK PERFORMED (previous payment)		WORK PERFORMED THIS (current payment)		WORK PERFORMED TO DATE (total to date)	
ACTIVITY NO.	DESCRIPTION	QUAN	UNIT	COST PER UNIT	TOTAL COST OF ITEM	QUAN	TOTAL COST OF ITEM	QUAN	TOTAL COST OF ITEM	% COMP.
	TOTAL COST OF COLUMNS:				\$		\$		\$	

CHANGE ORDER _____ 01 - CONTRACT QUANTITIES					WORK PERFORMED (previous payment)		WORK PERFORMED THIS (current payment)		WORK PERFORMED TO DATE (total to date)	
ACTIVITY NO.	DESCRIPTION	QUAN	UNIT	COST PER UNIT	TOTAL COST OF ITEM	QUAN	TOTAL COST OF ITEM	QUAN	TOTAL COST OF ITEM	% COMP.
	TOTAL COST OF COLUMNS:				\$		\$		\$	

TOTAL COST OF SCHEDULE OF VALUES:					\$		\$		\$	
TOTAL COST OF CHANGE ORDERS:					\$		\$		\$	
TOTAL COST CONTRACT TO DATE:					\$		\$		\$	

MATERIALS STORED ON SITE

PROJECT: _____ CONTRACTOR: _____ FOR PERIOD ENDING: _____ PAY REQUEST NO: 1 DATE PREPARED: 3/11/2018

ITEM NO.	DESCRIPTION	SOV ACTIVITY NO.	VALUE OF STORED MATERIAL LAST PERIOD			(-) VALUE OF MATERIAL INSTALLED			(-) VALUE OF MATERIAL DELIVERED			(-) VALUE OF STORED MATERIAL THIS PERIOD			VENDOR INVOICE NUMBER
			QUAN.	UNIT PRICE	INVOICE AMOUNT	QUAN.	UNIT PRICE	INVOICE AMOUNT	QUAN.	UNIT PRICE	INVOICE AMOUNT	QUAN.	UNIT PRICE	INVOICE AMOUNT	
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DRAW SCHEDULE

PROJECT NAME: _____
 CONTRACTOR NAME: _____
 CONTRACT NO.: _____
 PROJECT NO. _____ PAY REQUEST NO. **1**
 CONTRACT AMOUNT: \$ _____ FOR PERIOD ENDING: -

PAY REQUEST #	PERIOD FROM (Date)	PERIOD TO (Date)	ACTUALS (Previous Paid / Approved Pay Request Balance Due)	ESTIMATED DRAWS (Estimated Total Work Performed + Estimated Stored Materials + Retainage)	BALANCE TO FINISH
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RELEASE OF LIENS

PROJECT: _____ CONTRACT: - _____ PAY REQUEST NO: 1

CONTRACTOR: _____ FOR PERIOD ENDING: - _____ DATE PREPARED: 3/21/2018

NO.	SUBCONTRACTORS/SUPPLIERS/LIENORS (Maintain running list of Subcontractors, Vendors, Suppliers, etc. for entire project)	NOTICE TO OWNER (Date if provided to Contractor / OCU)	FINAL RELEASE OF LIENS (Date provided to Contractor. Provide additional copy for Final PR)	NOTICE OF NONPAYMENT RECEIVED (Date)	DESCRIPTION OF WORK (Trade & Type of Work performed this pay period)	SOV ACTIVITY NO. (Work performed this Pay Period)	Partial Release of Lien (Included for Work Performed During Previous Pay Period)
	(Company Name)	(Date)	(Date)	(Date)	(Trade, Type, Description)	(Activity ID)	(Yes or Blank)
1							
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SECTION 01041

PROJECT COORDINATION

PART 1 - GENERAL

1.01 OBSTRUCTIONS

- A. All water pipes, storm drains, force mains, telephone or power cables or conduits, and all other obstructions, whether or not shown, shall be temporarily removed from or supported across proposed construction area. Before disconnecting any pipes or cables, the Contractor shall obtain permission from the Owner, or shall make suitable arrangements for their disconnection by the Owner. The Contractor shall coordinate these operations with the Owner. The Contractor shall be responsible for any damage to any such pipes, conduits or cables, and shall restore them to service promptly as soon as the Work has progressed past the point involved. Locations of water, sanitary, drainage, power and telephone installations in vicinity of proposed work must be verified in the field. Any discrepancies or differences found shall be brought to the attention of the Owner in order that necessary changes may be made to permit progress of Work. These conditions are supplemental to general requirements elsewhere in these specifications.

1.02 DAMAGE TO EXISTING STRUCTURES AND UTILITIES

- A. The Contractor shall be responsible for maintaining and repairing all damage to roads beyond the limits of this Contract, buildings, telephone or other cables, water pipes, sanitary pipes, or other structures which may be encountered, whether or not shown on the Drawings.
- B. Information shown on the Drawings as to the location of known existing utilities has been prepared from the most reliable data available to the Engineer. This information is not guaranteed, however, and it shall be the Contractor's responsibility to determine the location, character and depth of any existing utilities. The Contractor shall assist the utility companies, by every means possible to determine said locations. Extreme caution shall be exercised to eliminate any possibility of any damage to utilities resulting from his activities.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01050

SITE CONDITIONS SURVEY

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall perform, or obtain other professional subcontractors to complete topographic surveys that meet the minimum standards of Chapter 61-G17 of the Florida Administrative Code (FAC) to document elevations, grades, locations, maintain survey control during construction, and perform related field engineering as specified in the Contract Documents.

1.02 SURVEY REFERENCE POINTS

- A. The Contractor shall locate survey reference points prior to starting work and the Contractor shall protect and preserve all permanent survey reference points during construction.
 - 1. The Contractor shall make no changes or relocate any survey reference point without prior written notice to the Engineer.
 - 2. The Contractor shall report to the Engineer when any survey reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
 - 3. The Contractor, at no additional cost to the Owner, shall replace and re-survey reference points that have been lost or destroyed by the Contractor. The replaced survey reference point shall be surveyed by a registered professional land surveyor licensed in the State of Florida. Replacement will be based on original survey control.
- B. Prior to any work, the Contractor shall immediately notify the Engineer of any discrepancies with the survey reference points from the coordinates and elevations provided.

1.03 RECORD DRAWINGS (AS-BUILT DRAWINGS)

- A. All survey record documents, submitted for approval by the Engineer, shall be signed and sealed by a professional land surveyor licensed in the State of Florida.
- B. Submitted record documents shall include the following:
 - 1. As stages of the Work are completed, Contractor will submit a site survey, signed and sealed by a professional land surveyor licensed in the State of Florida. The Record Drawing information shall be submitted on 24 inch by 36 inch sheets, as well as AutoCAD Drawing files (compatible with

AutoCAD 2014) on CD-ROM. Eight original signed and sealed hard copies (by a professional land surveyor licensed in the state of Florida) and eight CD-ROM's with the AutoCAD drawing files, shall be submitted.

2. AutoCAD Drawing files requirements:
 - a. Contour lines shall be continuous, unbroken polylines with a width of zero and an elevation (z-coordinate) assigned according to the elevation of the contour line.
 - b. All spot elevations shall have horizontal controls with vertical z-coordinates.
 - c. Contours shall be at one foot intervals, with index contours at every fifth interval.
 - d. Objects in the Record Drawings shall be drawn to scale.
 - e. Unless otherwise stated, all surveys shall be at a scale of 1" = 50'.
 3. All survey information submitted shall be on the State Plane Coordinate System. Survey information is referenced to the East Zone of the Florida State Plane Coordinate System, NAD 83, 2007 Adjustment. The elevations are to the North American Vertical Datum of 1988 (NAVD88).
 4. All submitted Record Drawings shall have survey control monuments shown on the Record Drawings for the purposes of orientation, both horizontally and vertically.
 5. If multiple sheets are required for the Record Drawings, each sheet shall include match lines as required.
 6. All electrical, stormwater, water, sanitary sewer and underground piping shall be surveyed.
- C. The Contractor understands and agrees that existing elevations and contours, which may be shown on the Contract Drawings, are solely for the Engineer's information. Actual quantities of soils and other materials required to complete the Work are the Contractor's responsibility. The Contractor shall determine existing elevations for the purpose of conducting the Work as required by the Contract Documents. The Contractor is responsible to notify the Owner and the Engineer in writing of any and all discrepancies prior to beginning Work.

1.04 SUBMITTALS

- A. The Contractor shall submit the name and address of the registered professional land surveyor licensed in the State of Florida to the Engineer.

- B. Upon request of the Engineer, the Contractor shall submit documentation signed by the licensed surveyor in the State of Florida, certifying that elevations and locations of improvements are in conformance with the Contract Documents, or if not in conformance, certify as to variances from the Contract Documents.
- C. Record Drawings - The Contractor shall provide and submit to the Engineer, for approval, signed and sealed Record Drawing surveys for all work (to include any areas outside the limits of construction disturbed by the Contractor) as follows:
1. Pre-construction: A pre-construction survey of the limits of construction and 50 feet beyond the limits of construction as defined in the Contract Documents will be prepared by a registered land surveyor licensed in the State of Florida. The pre-construction survey shall meet the minimum standards of Chapter 61-G17 of the Florida Administrative Code.
 - a. The pre-construction topographic information shall be collected on a 50 foot by 50 foot grid, at a minimum, and as necessary (i.e., spot elevations, grade breaks, ditches, mounds, structure locations, piping, pipe inverts, other permanent structures as required, etc.) so as to provide an accurate representation of the contour topography.
 - b. The elevation and grades for the pre-construction survey shall be within an accuracy of 0.1 feet vertical and 0.5 feet horizontal as shown on the Contract Drawings.
 2. Excavation Limits: A topographic survey representing the horizontal and vertical limits of excavation.
 3. Subbase Soils: A topographic survey representing the finish grade elevation and limits of the subbase soils of the flexible and rigid pavements. The survey shall represent the surface of the completed subgrade soils prior to installation of either the stabilized subgrade for the flexible pavement or for the subgrade of the rigid pavement.
 4. Stabilized Subgrade: A topographic survey representing the finish grade elevations and limits of the stabilized subgrade surface of the flexible pavement. This survey shall represent the surface of the stabilized subgrade prior to installation of the limerock base of the flexible and rigid pavements.
 5. Limerock Base Surface: A topographic survey representing the finish grade elevations and limits of the completed limerock base surface. This survey shall represent the surface prior to installation of the S-I asphalt or concrete pavement slab.

6. Final Survey: A survey representing all features of the completed Project including but not limited to: top of concrete and asphalt surface, locations and inverts of stormwater features, utility locations and inverts, structure footprints, and other installed features.
- D. All partial field surveys are to include photocopies of the field surveyor's log which have been signed and dated by the surveyor performing the survey.
- E. The Contractor shall submit a Record Survey signed by the identified registered professional land surveyor licensed in the State of Florida once completed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONTRACTOR RESPONSIBILITIES

- A. The Contractor shall retain the services of a registered land surveyor licensed in the State of Florida to identify existing control points and maintain survey control during construction.
- B. The Contractor shall identify survey reference points.
- C. The Contractor shall provide civil, structural or other professional engineering services specified or required to execute the Contractor's construction methods.
- D. The Contractor shall be responsible for the preservation of all benchmarks, stakes, and marks. If any benchmarks, stakes, or marks are disturbed by the Contractor, the Contractor shall not proceed with any work until such points, marks, lines and elevations as may be necessary for the prosecution of the Work have been established.
 1. The accuracy of any method of staking shall be the responsibility of the Contractor. All engineering for vertical and horizontal control shall be the responsibility of the Contractor.
- E. The surveyor shall maintain a complete, accurate log of all control and survey work as it progresses. This log shall be available for periodic review by the Engineer.
- F. Grade elevations and locations will be required periodically during the prosecution of the Work. The Contractor's Florida licensed land surveyor will provide and maintain as-built notes and a finished Record Drawing updated as construction is completed. Record Drawings reflecting elevations and location information shall be submitted to the Engineer.
- G. All surveys shall be topographic surveys that meet the minimum standards of Chapter 61-G17 of the Florida Administrative Code. Surveys shall include (but are not limited to) grading, elevations, structure locations, pipe inverts, piping, and other permanent structures.

- H. The elevation and grades shall be within an accuracy of 0.1 feet vertical and horizontal as shown in the Contract Documents. Unless otherwise stated, all surveys shall be at a scale of 1" = 50', with contours at one foot intervals. However, any measurement noted in the specifications on the drawing as "Minimum" requires the minimum dimension noted.
- I. The final topographic information shall be collected on a 50-foot by 50-foot grid, at a minimum, and as necessary (i.e., spot elevations, grade breaks, ditches, mounds, etc.) so as to provide an accurate representation of the contour topography. For ditches, spot elevations shall be taken, at a minimum, every 50 linear feet to include, at a minimum, the centerline of the ditch, the toe and top of ditch slopes, and any grade breaks.

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work:
1. The Engineer shall schedule and administer a Pre-Construction meeting, periodic progress meetings, and specially called meetings throughout the progress of the work. The Engineer shall:
 - a. Prepare agenda for meetings
 - b. Make physical arrangements for meetings
 - c. Preside at meetings
 2. Representatives of Contractor's, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
 3. The Contractor shall attend meetings to ascertain that work is expedited and consistent with Contract Documents and construction schedules.
- B. Related Requirements Described Elsewhere:
1. Construction Schedules: General Conditions
 2. Shop Drawings, Working Drawings, and Samples: Section 01340
 3. Project Record Documents: Section 01720

1.02 PRECONSTRUCTION MEETING

- A. A preconstruction meeting shall be scheduled for no later than five (5) days after date of Notice to Proceed.
- B. Location: The Porter Transfer Station offices.
- C. Attendance:
1. Owner
 2. Engineer and his professional consultants
 3. Contractor's superintendent

4. Major subcontractors
5. Others as appropriate

D. Suggested Agenda:

1. Distribution and discussion of:
 - a. List of major subcontractors and suppliers
 - b. Projected schedules
2. Critical work sequencing: Relationships and coordination with other contracts and/or work.
3. Major equipment deliveries and priorities.
4. Project coordination: Designation and responsible personnel.
5. Procedures and processing of:
 - a. Field decisions
 - b. Proposal requests
 - c. Submittals
 - d. Change orders
 - e. Applications for payment
6. Submittal of Shop Drawings, project data and samples.
7. Adequacy of distribution of Contract Documents.
8. Procedures for maintaining Record Documents.
9. Use of premises:
 - a. Office, Work and storage areas.
 - b. Owner's requirements.
 - c. Access and traffic control.
10. Construction facilities, controls and construction aids.
11. Temporary utilities.

12. Safety and first aid procedures.
13. Check of required Bond and Insurance certifications.
14. Completion time for contract and liquidated damages.
15. Request for extension of contract time.
16. Request for a Bi-weekly job meeting for all involved.
17. Security procedures.
18. Procedures for making partial payments.
19. Guarantee on completed work.
20. Equipment to be used.
21. Project inspection
22. Labor requirements.
23. Laboratory testing of material requirements.
24. Inventory of material stored on site provisions.
25. Housekeeping procedures.
26. Posting of signs.
27. Pay request submittal dates.
28. Equal opportunity requirements.

1.03 PROGRESS MEETINGS

- A. At the discretion of the Owner, periodic progress meetings may be held.
- B. Location of the meetings: Porter Transfer Station offices.
- C. Attendance:
 1. Engineer and his professional consultants as needed.
 2. Contractor
 3. Owner's representative
 4. Subcontractors as appropriate to the agenda.

5. Others as appropriate.
- D. Suggested Agenda:
1. Review approval of minutes of previous meeting.
 2. Review approval of safety minutes of previous meeting.
 3. Review of work progress since previous meeting.
 4. Field observations, problems, conflicts.
 5. Problems which impede Construction Schedule.
 6. Review of off-site fabrication, delivery schedules.
 7. Corrective measures and procedures to regain projected schedule.
 8. Revisions to Construction Schedule.
 9. Progress schedule during succeeding work period.
 10. Coordination of schedules.
 11. Review submittal schedules; expedite as required.
 12. Maintenance of quality standards.
 13. Pending changes and substitutions.
 14. Review proposed changes for:
 - a. Effect on Construction Schedule and on completion date.
 - b. Effect on other contracts of the Project.
 15. Other business.
 16. Construction schedule.
 17. Critical/long lead items.
- E. The Contractor is to attend progress meetings and is to study previous meeting minutes and current agenda items to be prepared to discuss pertinent topics such as deliveries of materials and equipment, progress of the work, etc.
- F. The Contractor is to provide a current submittal log at each progress meeting in accordance with Section 01340.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01311

CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.01 REQUIREMENTS

- A. Construction shall be coordinated to assure that the Work is completed within the Contract Times as provided in the Contract Documents. The Contractor shall coordinate his activities with any Subcontractors to allow the orderly and timely completion of all the Work.
- B. All construction schedules shall be of the critical path method, bar chart type, and shall be prepared using SURETRACK, PRIMAVERA P3, Microsoft Project or equal.
- C. Construction schedules shall show all relationships and critical paths. Backup data shall be provided as requested by the Engineer. This data shall include, as a minimum, relationships and float.
- D. The construction schedule shall be comprehensive, covering both activities at the site of the Work and offsite activities such as design, procurement and fabrication. The Contractor shall promptly advise the Engineer and Owner of any occurrence that may impact the construction schedule. No revision to the approved baseline construction schedule shall be made without the review and acceptance by the Engineer and Owner.

1.02 SUBMITTAL PROCEDURES

- A. Submittal Requirements.
 - 1. Time phased logic network, computer generated.
 - 2. Computerized network analysis
 - a. Activity sort by early start, organized by related elements
 - b. Activity sort by float, organized by related elements
 - c. Activity sort by predecessor/successor
 - 3. Narrative description of the logic and reasoning of the schedule.
 - 4. Resource allocation by activity.
- B. Time of Submittals: Within 7 calendar days after Notice to Proceed, Contractor shall submit a network diagram describing the activities to be accomplished in the

project and their dependency relationships, (predecessor/successor) as well as a tabulated schedule as herein defined. The schedule produced and submitted shall indicate milestone and completion dates identical to the milestone and completion dates specified elsewhere herein. Engineer shall review the proposed plan and schedule within 7 calendar days and state his acceptance or rejection of the schedule.

1. Within 10 working days after the conclusion of Engineer's review, Contractor shall revise the network diagram as required and resubmit the network diagram and a tabulated schedule produced therefrom. The revised network diagram and tabulated schedule shall be reviewed and accepted or rejected by Engineer within 7 calendar days after receipt. The network diagram and tabulated schedule when accepted by Engineer shall constitute the project Work schedule unless a revised schedule is required due to substantial changes in the work or a change in contract time, delinquency by Contractor requiring a recovery schedule, or as otherwise provided for herein below. Activities not occurring as scheduled are delinquent if they begin after early start or they finish after early finish.
- C. Acceptance: The finalized schedule will be acceptable to Engineer when it provides an orderly progression of the Work to completion in accordance with the contract requirements, adequately defines the Contractor's work plan, provides a workable arrangement for processing the submittals in accordance with the requirements, and properly allocates resources (manpower, equipment and costs) to each activity (free of unbalances in resources). When the network diagram and tabulated schedule have been accepted, Contractor shall submit to Engineer 5 copies of the time-scaled network diagram, 5 copies of a computerized, tabulated schedule in which the activities have been sequenced by activity numbers, 5 copies of a computerized, tabulated schedule in which activities have been sequenced by early starting date, and 5 copies of a computerized tabulated schedule in which activities have been sequenced by total float.
- D. The Owner's review and acceptance of the Contractor's project schedule is for conformance to the requirements of the Contract Documents only. Review and acceptance by the Owner of the Contractor's project schedule does not relieve the Contractor of any of its responsibility whatsoever for the accuracy or feasibility of the project schedule, or of the Contractor's ability to meet the interim milestone date(s) and the contract completion date, nor does such review and acceptance expressly or implied warrant, acknowledge or admit the reasonableness of the logic, durations, manpower or equipment loading of the Contractor's project schedule.
- E. Revised Work Schedules: Contractor, if requested by Engineer, shall provide a revised Work schedule if, at any time, Engineer considers the completion date to be in jeopardy because of "activities behind schedule." "Activities behind schedule" are all activities behind the accepted work plan regardless of the

existence of positive float on the activity. The revised Work schedule shall include a new diagram and tabulated schedule conforming to the requirements of Part 1.05, "CPM Standards," designed to show how Contractor intends to accomplish the Work to meet the completion date or milestones. The form and method employed by Contractor shall be the same as for the original Work schedule.

- F. Schedule Revisions: Engineer may require Contractor to modify any portions of the Work schedule that become unfeasible because of "activities behind schedule" or for any other valid reason. An activity that cannot be completed by its original or latest completion date shall be deemed to be behind schedule. No change may be made to the sequence, duration or relationships of any activity without the express written acceptance of the Engineer.

1.03 CHANGE ORDERS

- A. Upon approval of a change order, the approved change shall be reflected in the next schedule submittal by Contractor.

1.04 CPM STANDARDS

- A. Definition: CPM, as required by this Section, shall comply with the standards outlined in the Associated General Contractors' publication, "The Use of CPM in Construction" unless specifically changed by this Section.
- B. Work Schedules: Work schedules shall include a graphic network and computerized, tabulated schedules as described below. To be acceptable the schedule must demonstrate the following:
 - 1. A logical succession of Work from start to finish. This logical succession when accepted is the Contractor's work plan and is only designed as early start to accommodate standard computerized systems.
 - 2. Definition of each activity.
 - 3. A logical flow of work crews/equipment (crews are to be defined by manpower category and manhours; equipment by type and hours).
 - 4. Show all Work activities and interfaces including all submittals and major material, and equipment deliveries.
- C. Networks
 - 1. The CPM network, or diagram, shall be in the form of a time-scaled diagram of the customary activity-on-type and may be divided into a number of separate pages with suitable notation relating the interface points among the pages. Individual pages shall not exceed 11 inch by 17

inch. Notation on each activity line shall include a brief Work description, and duration estimate, and cost of activity.

2. All construction activities and procurement including shop drawing review shall be indicated in a time-scaled format, and a calendar shall be shown on all sheets along the entire sheet length. Each activity arrow shall be plotted so the beginning and completion dates of said activity can be determined graphically by comparison with the calendar scale. All activities shall be shown using the symbols that clearly distinguish between critical path activities, non-critical activities, and float for each non-critical activity. All non-critical path activities shall show estimated performance time and float time in scaled form.

D. Duration: The duration indicated for each activity shall be in calendar days and shall represent the single best time considering the scope of the Work and resources planned for the activity including time for inclement weather.

E. Tabulated Schedules: The initial schedule shall include the following minimum data for each activity.

1. Activity numbers
2. Estimated duration
3. Activity description
4. Early start date (calendar dated)
5. Early finish date (calendar dated)
6. Status (whether critical)
7. Float
8. Cost of activity
9. Other resources including equipment hours by type, manpower by craft or crew, and materials by units.

F. Project Information: Each tabulation shall be prefaced with the following summary data.

1. Project name
2. Contractor
3. Type of tabulation (initial or updated)

4. Project duration
5. Project schedule completion date
6. Projected completion date
7. Variance analysis per activity

1.05 PROGRESS MEETINGS

- A. For the periodic progress meeting, the Contractor shall submit a three (3) week look-ahead schedule showing all activities in progress, uncompleted or schedule to be worked during the three weeks. All activities shall indicate percent complete. The schedule shall also show the planned resources and any deviations from that plan. Supervisors and general labor not assigned to specific activities may be shown as an “additional labor” line so that the total resources equal the manpower on site.
- B. The updated schedule shall be submitted in the form, sequence, and number of copies requested for the initial schedule.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01340

SHOP DRAWINGS, WORKING DRAWINGS, AND SAMPLES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. The Contractor shall submit to the Engineer for review and exception, if any, such working drawings, shop drawings, test reports and data on materials and equipment (hereinafter in this article called data), and material samples (hereinafter in this article called samples) materials list, certificates and affidavits as are required for the proper control of Work, including but not limited to those working drawings, shop drawings, data and samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.
2. Within fourteen (14) calendar days after the Effective Date of the Agreement, the Contractor shall submit to the Engineer a complete materials list of preliminary data on items for which shop drawings are to be submitted. Included in this materials list shall be the names of all proposed manufacturers furnishing specified items. Review of this list by the Engineer shall in no way expressed or implied relieve the Contractor from submitting complete shop drawings and providing materials, equipment, etc., fully in accordance with the Specifications. This procedure is required in order to expedite final review of shop drawings.
3. The Contractor is to maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the Owner and the Engineer. This log should include the following items:
 - a. Submittal-description and number assigned.
 - b. Date to Engineer.
 - c. Date returned to Contractor (from Engineer).
 - d. Status of submittal (reviewed no comments, reviewed comments as noted, rejected, revise and resubmit, and not reviewed).
 - e. Date of resubmittal and return (as applicable).
 - f. Date material release (for fabrication).
 - g. Projected date of fabrication.

- h. Projected date of delivery to site.
 - i. Specification section.
 - j. Drawings sheet number.
- B. Related Requirements Described Elsewhere:
 - 1. Conditions of the Contract.
 - 2. Project Record Documents: Section 01720.

1.02 CONTRACTOR'S RESPONSIBILITY

- A. **It is the duty of the Contractor to check all drawings, data and samples prepared by or for him before submitting them to the Engineer for review.** Each and every copy of the Drawings and data shall bear Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement. Shop drawings shall indicate any deviations in the submittal from requirements of the Contract Documents. If the Contractor takes exception to the specifications, the Contractor shall note the exception in the letter of transmittal to the Engineer.
- B. Determine and verify:
 - 1. Field measurements.
 - 2. Field construction criteria.
 - 3. Catalog numbers and similar data.
 - 4. Conformance with Specifications.
- C. The Contractor shall furnish the Engineer a schedule of shop drawings submittals fixing the respective dates for the submission of shop and working drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall indicate those that are critical to the progress schedule.
- D. The Contractor shall not begin any of the Work covered by a drawing, data, or a sample returned for correction until a revision or correction thereof has been reviewed and returned to him, by the Engineer, with approval.
- E. The Contractor shall submit to the Engineer all drawings and schedules sufficiently in advance of construction requirements to provide no less than seven (7) calendar days for checking and appropriate action from the time the Engineer receives them.

- F. Each submittal shall be for an individual material. All submittals shall be accompanied with a transmittal letter prepared in duplicate containing the following information:
1. Shop drawing cover page per paragraph 1.04.D of this Section.
 2. Date.
 3. Project title and number.
 4. Contractor's name and address.
 5. The number of each shop drawing, project data, and sample submitted.
 6. Notification of deviations from Contract Documents.
 7. Submittal log number conforming to Specification section numbers.
- G. The Contractor shall submit two (2) copies of descriptive or product data submittals to complement shop drawings for the Engineer plus four (4) copies to the Contractor. The Engineer will retain one (1) set. All shop drawings shall be submitted with one (1) reproducible pdf. and two (2) sets of prints. The Engineer will review the hard copies and return to the Contractor the additional set(s) marked-up with appropriate review comments. All shop drawings shall be sized appropriately and legible for review.
- H. The Contractor shall be responsible for and bear all costs of damages which may result from the ordering of any material or from proceeding with any part of Work prior to the completion of the review by Engineer of the necessary shop drawings.
- I. The Contractor shall be fully responsible for observing the need for and making any changes in the arrangement of piping, connections, wiring, manner of installation, etc., which may be required by the materials/equipment he proposed to supply both as pertains to his own work and any work affected under other parts, headings, or divisions of drawings and specifications.

1.03 ENGINEER'S REVIEW OF SHOP DRAWINGS

- A. The Engineer's review of drawings, data and samples submitted by the Contractor will cover only general conformity to the Specifications, external connections, and dimensions which affect the installation. The Engineer will have five (5) calendar days to review these documents. The Engineer's review and exceptions, if any, will not constitute an approval of dimensions, quantities, and details of the material, equipment, device, or item shown.
- B. The review of drawings and schedules will be general, and shall not be construed:
1. As permitting any departure from the Contract requirements;

2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials;
 3. As approving departures from details furnished by the Engineer, except as otherwise provided herein.
- C. If the drawings or schedules as submitted describe variations per paragraph 1.04.E., and show a departure from the Contract requirements which Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting an exception.
- D. When reviewed by the Engineer, each of the shop drawings will be identified as having received such review being so stamped and dated. Shop drawings stamped “REVISE AND RESUBMIT” and with required corrections shown will be returned to the Contractor for correction and resubmittal.
- E. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention, in writing or on resubmitted shop drawings, to revisions other than the corrections requested by the Engineer on previous submissions. The Contractor shall make any corrections required by the Engineer.
- F. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the Engineer.
- G. Shop drawings and submittal data shall be reviewed by the Engineer for each original submittal and first and second resubmittal; thereafter review time for subsequent resubmittals shall be charged to the Contractor in accordance with the terms of the Engineer’s Agreement with the Owner.
- H. When the shop drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.
- I. Partial submittals will not be reviewed. Submittals not complete will be returned to the Contractor for resubmittal. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items for:
1. Systems.
 2. Processes.
 3. As indicated in specific specifications sections.

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

1.04 SHOP DRAWINGS

- A. When used in the Contract Documents, the term "shop drawings" shall be considered to mean Contractor's plans for materials and equipment which become an integral part of the project. These drawings shall be complete and detailed. Shop drawings shall consist of fabrication, erection and setting drawings and schedule drawings, manufacturer's scale drawings, and wiring and control diagrams. Cuts, catalogs, pamphlets, descriptive literature, and performance and test data, shall be considered only as supportive to required shop drawings as defined above. As used herein, the term "manufactured" applies to standard units usually mass-produced; and "fabricated" means items specifically assembled or made out of selected materials to meet individual design requirements.
- B. Manufacturer's catalog sheets, brochures, diagrams, illustrations and other standard descriptive data shall be clearly marked to identify pertinent materials, product or models. Delete information which is not applicable to the Work by striking or cross-hatching.
- C. Drawings and schedules shall be checked and coordinated with the Work of all trades involved, before they are submitted for review by the Engineer and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval shall be returned to the Contractor for resubmission.
- D. Each shop drawing shall have a blank area 3- located adjacent to the title block that display the following:
 - 1. Project Title and Number.
 - 2. Name of project building or structure.
 - 3. Number and title of the shop drawing.
 - 4. Date of shop drawing or revision.
 - 5. Name of Contractor and subcontractor submitting drawing.
 - 6. Supplier/manufacturer.
 - 7. Separate details when pertinent.
 - 8. Specification title and number.
 - 9. Specification section.

10. Application Contract Drawing Number.

- E. If drawings show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in his letter of transmittal. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the Contractor fails to describe such variations, he shall not be relieved of the responsibility for executing the Work in accordance with the Contract, even though such drawings have been reviewed.
- F. Data on materials and equipment include, without limitation, materials and equipment lists, catalog data sheets, cuts, performance curves, diagrams, materials of construction and similar descriptive material. Materials and equipment lists shall give, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.
- G. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name, and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained.
- H. All manufacturers or equipment suppliers who proposed to furnish equipment or products shall submit an installation list to the Engineer along with the required shop drawings. The installation list shall include at least five (5) installations where identical equipment has been installed and has been in operation for a period of at least one (1) year.
- I. Only the Engineer will utilize the color "red" in marking Shop Drawing submittals.

1.05 WORKING DRAWINGS

- A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the Contractor's plan for temporary structures such as temporary bulkheads, support of utilities, ground water control systems, forming and falsework; for underpinning; and for such other Work as may be required for construction but does not become an integral part of the project.
- B. Copies of working drawings shall be submitted to the Engineer where required by the Contract Documents or requested by the Engineer, and shall be submitted at least seven (7) calendar days (unless otherwise specified by the Engineer) in advance of their being required for Work.
- C. Working drawings shall be signed by a registered Professional Engineer, currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use. Prior

to commencing such Work, working drawings must have been reviewed without specific exceptions by the Engineer, which review will be for general conformance and will not relieve the Contractor in any way from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the Contractor; the Owner and Engineer shall have no responsibility therefor.

1.06 SAMPLES

- A. The Contractor shall furnish, for review by the Engineer, samples required by the Contract Documents or requested by the Engineer or Owner. Samples shall be delivered to the Engineer as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until accepted by the Engineer.
- B. Samples shall be of sufficient size and quantity to clearly illustrate:
1. Functional characteristics of the product, with integrally related parts and attachment devices.
 2. Full range of color, texture and pattern.
 3. A minimum of two samples of each item shall be submitted.
- C. Each sample shall have a label indicating:
1. Name of project.
 2. Name of Contractor and Subcontractor.
 3. Material or equipment represented.
 4. Place of origin.
 5. Name of producer and brand (if any).
 6. Location in project.
- (Samples of finished materials shall have additional marking that will identify them under the finished schedules).
- D. The Contractor shall prepare a transmittal letter for each shipment of samples containing the information required in paragraph 1.06 C. above. He shall enclose a copy of this letter with the shipment and send a copy of this letter to the Engineer. Review of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify any Contract requirements.

- E. Accepted samples not destroyed in testing shall be sent to the Engineer or stored at the site of the Work. Accepted samples of the hardware in good condition will be marked for identification and may be used in the Work. Materials and equipment incorporated in Work shall match the accepted samples. Samples which failed testing or were not accepted will be returned to the Contractor at his expense, if so requested at time of submission.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION



Sample Shop Drawing/Submittal Form
Orange County Solid Waste Division
 5901 Young Pine Road • Orlando, Florida 32829 • (407) 836-6600

SHOP DRAWING/SUBMITTAL CONTROL FORM # _____

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

ENGINEER: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT NAME: _____

CONTRACTOR INFORMATION

SUBMITTAL DATE: _____ NUMBER: _____ NO. OF COPIES SENT: _____

- ORIGINAL SUBMITTAL RESUBMITTAL SUPPLEMENT INFORMATION ONLY

NOTE: If other than original then include: Date of Original _____ Submittal No. of Original _____

A. SPECIFICATION SECTION AND SUB-SECTION NUMBER: _____

B. DESCRIPTION: _____

C. SUPPLIER/VENDOR: _____

D. INSTALLATION BY: _____

THE GENERAL CONTRACTOR HAS REVIEWED THE SHOP DRAWING, SAMPLE OR SUBSTITUTION SUBMITTED HEREWITH AND HAS DETERMINED AND HEREBY CERTIFIES THAT IN ALL RESPECTS THIS SUBMITTAL IS IN FULL COMPLIANCE AND CONFORMANCE WITH THE CONTRACT SPECIFICATIONS, DRAWINGS AND ALL OTHER CONTRACT REQUIREMENTS PERTAINING THERETO.

ENGINEER INFORMATION

NO. OF COPIES RECEIVED _____

NO. OF COPIES RETURNED _____

<u>ACTIVITY</u>	<u>DATE</u>	<u>PERSON</u>	<u>COMMENT</u>
RECEIVED	_____	_____	_____
RETURNED	_____	_____	_____

- STATUS: NO EXCEPTIONS TAKEN MAKE CORRECTIONS AS NOTED
 AMEND AND RESUBMIT REJECTED SEE REMARKS

COMMENTS:

SECTION 01370

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. The Contractor shall submit to the Engineer a Schedule of Values allocated to the various lump sum portions of the Work at the Pre-Construction Conference and in accordance with the successful bidder's bid schedule/cost estimating worksheet.
- B. Upon request of the Engineer, the Contractor shall support the values with data which will substantiate their correctness.
- C. The Schedule of Values, unless objected to by the Engineer, shall be used only as the basis for the Contractor's Applications for Payment.

1.02 RELATED REQUIREMENTS

- A. General Conditions and Requirements of the Contract.

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES

- A. Type schedule on an 8-1/2" x 11" white paper; Contractor's standard forms and computer printout will be considered for approval by the Engineer upon Contractor's request. Identify schedule with:
 - 1. Title of project and location.
 - 2. Owner and purchase order number.
 - 3. Engineer and project number.
 - 4. Name and address of Contractor.
 - 5. Contract designation.
 - 6. Date of submission.
- B. Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing unit values for progress payments during construction.
- C. Identify each line item with the number and title of the respective major section of the specifications.
- D. For each line item which has installed value of more than \$20,000, breakdown costs to list major products or operations under each item.

- E. For the various portions of the Work:
 - 1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.
 - 2. Total installed cost, with overhead and profit
- F. Round off figures to nearest dollar.
- G. Make sum of total costs of all items listed in schedule equal to total Contract Sum.

1.04 PREPARING SCHEDULE OF UNIT MATERIAL VALUES

- A. Submit a separate schedule of unit prices for materials to be stored on which progress payment will be made.
- B. Make form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.
- C. Include in unit prices only:
 - 1. Cost of the material.
 - 2. Delivery and unloading at site.
 - 3. Sales taxes.
- D. Make sure that unit prices multiplied by quantities given, equal material cost of that item in Schedule of Values.

1.05 REVIEW AND RESUBMITTAL

- A. After review by Engineer and Owner, revise and resubmit Schedule of Values and Schedule of Material Values as required.
- B. Resubmit revised Schedules in same manner

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.01 SITE INVESTIGATION AND CONTROL

- A. The Contractor shall verify all dimensions in the field and check field conditions continuously during construction. The Contractor shall be solely responsible for any inaccuracies built into the Work due to Contractor's failure to comply with this requirement.
- B. The Contractor shall inspect related and appurtenant Work and report in writing to Engineer any conditions which will prevent proper completion of the Work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the Contractor at Contractor's sole cost and expense.

1.02 INSPECTION OF THE WORK

- A. All Work performed by the Contractor shall be inspected by the Contractor and nonconforming Work shall be noted and promptly corrected. The Contractor is responsible for the Work conforming to the Contract Documents.
- B. The Work shall be conducted under the general observation of the Engineer and is subject to inspection by representatives of the Owner acting on behalf of the Owner to ensure compliance with the requirements of the Contract Documents. Such inspection may include plant, shop, or field inspection, as required. The Engineer or any inspector(s) shall be permitted access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated.
- C. The presence of the Engineer or any inspector(s), however, shall not relieve the Contractor of the responsibility for the proper execution and inspection of the Work in accordance with all requirements of the Contract Documents. Compliance is a duty of the Contractor, and said duty shall not be avoided by any act or omission on the part of the Engineer or any inspector(s). Inspection of Work, later determined to be nonconforming shall not be cause or excuse for acceptance of the nonconforming Work. The acceptance of nonconforming Work shall be approved by the Owner when adequate compensation is offered and it is in the Owner's best interest.
- D. All materials and articles furnished by the Contractor shall be subject to inspection, and no materials or articles shall be used in the Work until they have been inspected and accepted by the Engineer or other designated representative. No Work shall be backfilled, buried, cast in concrete, hidden, or otherwise

covered until it has been inspected. Any Work so covered in the absence of inspection shall be subject to uncovering at the Contractor's expense. Where uninspected Work cannot be uncovered, such as in concrete cast over reinforcing steel, all such Work shall be subject to demolition, removal, and reconstruction under proper inspection and no additional payment will be allowed.

- E. The Engineer or any inspector(s) will not supervise, direct, control or have authority over or be responsible for the Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of the Contractor to comply with Laws and Regulations applicable to furnishing or performance of the Work.
- F. The Engineer will not be responsible for the acts or omissions of the Contractor or of any subcontractor, any supplier, or of any other person or organization performing or furnishing any of the Work.

1.03 TIME OF INSPECTION AND TESTS

- A. Any samples and test specimens required under these Specifications shall be furnished and prepared for testing in ample time for the completion of the necessary tests and analyses before said articles or materials are to be used. Contractor shall furnish and prepare all required test specimens at Contractor's own expense. Whenever the Contractor is ready to backfill, bury, cast in concrete, hide, or otherwise cover any Work under this Contract, the Engineer shall be notified not less than 24 hours in advance to request inspection before beginning any such Work of covering. Failure of the Contractor to notify the Engineer at least 24 hours in advance of any such inspections shall be reasonable cause for the Engineer to order a sufficient delay in the Contractor's schedule to allow time for such inspection, any remedial, or corrective work required, and all costs of such delays, including its impact on other portions of the Work, shall be borne by the Contractor.

1.04 SAMPLING AND TESTING

- A. When not otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered. However, the Owner reserves the right to use any generally-accepted system of inspection which, in the opinion of the Engineer, will ensure the Owner that the quality of the workmanship is in full accord with the Contract Documents.
- B. Any waiver of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial

work, shall not be construed as a waiver of any technical or qualitative requirements of the Contract Documents.

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

1.05 CONSTRUCTION QUALITY ASSURANCE TESTING

- A. The Owner shall conduct independent testing of the Work to provide adequate confidence that items or services meet contractual and regulatory requirements.
- B. The Engineer and Construction Quality Assurance (CQA) Contractor shall perform the following:
 - 1. Review Contractor submittals and prequalification test results to verify that the proposed materials and construction methods conform to the Project
 - 2. Inspect the soil subgrade and other soil layer surfaces for compliance with the project specifications before additional materials are placed;
 - 3. Monitor soil placement to verify that no deleterious material is present;
 - 4. Sample and perform conformance testing of the materials used in construction and notify the Contractor of non-complying results;
 - 5. Document that the soil components are constructed using the specified equipment and procedures;
 - 6. Documenting that each soil component is constructed to the lines and grades and to the specified thickness shown on the Drawings;
 - 7. Monitor each soil construction activity to verify that no damage is caused to underlying geosynthetics;
 - 8. Record density and field moisture content measurements and test locations on test logs to verify uniform achievement of specified compaction parameters for each lift, except for the vegetative topsoil layer;
 - 9. Monitor the final thickness of each soil component;
 - 10. Perform quality assurance testing (as required) to determine the acceptability of the Work during construction; and

1. CQA Consultant will document that the quality assurance requirements have been addressed and satisfied.
- C. The inspections and testing shall include the following:
1. Soil pre-qualification testing
 2. Concrete slump tests
 3. Soil compaction testing
- D. If a defect is discovered in the Work, the CQA Consultant will evaluate the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Consultant will evaluate the extent of the deficient area by additional tests at the expense of the Contractor.
- E. In addition to any other inspection or quality assurance provisions that may be specified, the Owner shall have the right to independently select, test, and analyze, at the expense of the Owner, additional test specimens of any or all of the materials to be used. Results of such tests and analyses shall be considered along with the tests or analyses made by the Contractor to determine compliance with the applicable specifications for the materials so tested or analyzed provided that wherever any portion of the Work is discovered, as a result of such independent testing or investigation by the Engineer, which fails to meet the requirements of the Contract Documents, all costs of such independent inspection and investigation and all costs of removal, correction, reconstruction, or repair of any such Work shall be borne by the Contractor.

1.06 RIGHT OF REJECTION

- A. The Engineer or designated representative, acting for the Owner, shall have the right at all times and places to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the Work at the site. If the Engineer or designated representative, through an oversight or otherwise, has accepted materials or Work which is defective or which is contrary to the Contract Documents, such material, no matter in what stage or condition of manufacture, delivery, or erection, may be rejected.
- B. The Contractor shall promptly remove or replace rejected articles or materials from the site of the Work after notification of rejection.
- C. All costs of removal and replacement of rejected articles or materials, as specified herein, shall be borne by the Contractor.

- D. Failure to promptly remove and replace rejected work shall be considered a breach of this Specification and the Owner may after 7 days notice, terminate the Contractor's right to proceed with the affected work and remove and replace the Work and issue a backcharge to cover the cost of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 QUALITY CONTROL PLAN

- A. The Contractor shall prepare and submit a Quality Control Plan to the Engineer for the Work contained in the Contract Documents prior to beginning Work. The Quality Control Plan will indicate the actions, documentation, and responsible party or parties that will assure compliance with the Technical Specifications and Contract Documents and quality requirements for inspections and testing that must be implemented. The Quality Control Plan will contain a checklist of quality control related activities applicable to various construction activities for scheduling and implementation purposes.

END OF SECTION

SECTION 01410

TESTING AND TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 GENERAL

- A. Required testing services are to assist in determination of compliance of the Work. Required services do not relieve the Contractor of its responsibility for compliance with requirements of the Contract Documents.
- B. Required services are not intended to limit the Contractor's own quality control procedures, but to establish minimum testing level necessary to monitor compliance of construction materials and methods with Contract Requirements.

1.02 SUBMITTALS

- A. Submit two (2) copies of the following information within fourteen (14) calendar days of the Notice to Proceed:
 - 1. Independent Testing Laboratory
 - a. Name, address, and telephone number.
 - b. Name of Registered Engineer and responsible officer.
 - c. Certification of testing laboratory.
 - d. Qualifications.
 - 2. Schedule of tests
 - a. Reference to Specification section.
 - b. Description of test and applicable standards.
 - 3. Submit two (2) copies of each report

1.03 LIMITATIONS OF AUTHORITY OF INDEPENDENT LABORATORY

- A. Independent laboratory is not authorized to:
 - 1. Approve or accept any portion of the Work.
 - 2. Assume or perform duties of the Contractor.
 - 3. Stop Work.

1.04 CONTRACTOR RESPONSIBILITIES

- A. Inspections, tests, and similar quality control services are the Contractor's responsibility; these services also include those specified to be performed by an independent laboratory and not directly by the Contractor.

- B. Employ and pay an independent laboratory or other qualified agency to perform quality control services specified.
- C. Cooperate with independent laboratory(ies) performing required inspections, tests, and similar services. Notify the independent laboratory no less than 24 hours in advance of scheduling of tests.
- D. Provide such auxiliary services as requested. These auxiliary services include, but not limited to:
 - 1. Providing access to the Work.
 - 2. Taking samples or assistance with taking samples.
 - 3. Delivery of samples to test laboratories.
 - 4. Security and protection of samples and test equipment at the project site.
- E. Contractor and each independent laboratory shall coordinate the sequence of their activities to minimize delay in progress of the Work.
- F. Contractor and each independent laboratory shall coordinate their Work to avoid removing or replacing work to accommodate inspections and tests. Contractor shall be responsible for scheduling times for inspections, tests, taking samples, and similar activities.
- G. Inspections and tests required by codes or ordinances, or by a plan approval authority, and made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor.

1.05 RETEST RESPONSIBILITIES AND CONVENIENCE TESTING

- A. Where results of inspections, tests, or similar services prove unsatisfactory and do not indicate compliance with requirements of the Contract Documents, repeats of the inspections, tests, or similar services shall be conducted following revision or replacement of the affected Work.
- B. Cost of repeat inspections, tests, or similar services shall be the Contractor's responsibility, regardless of responsibility or original inspection, test, or similar service.
- C. Cost of inspections, tests, or similar services performed exclusively for the Contractor's convenience, shall be the sole responsibility of the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01530

PROTECTION OF EXISTING FACILITIES

PART 1 - GENERAL

1.01 GENERAL

- A. The Contractor shall protect all existing utilities and improvements not designated for removal and restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than they were prior to such damage or temporary relocation, all in accordance with requirements specified herein, and in accordance with the requirements of the Contract Documents.
- B. Listing of elevations of existing underground utilities shall not relieve the Contractor from responsibility for safe operations or damage to adjacent utilities and structures.
- C. The Contractor shall determine the exact locations and depths of all utilities indicated on the Contract Drawings which affect the Work. In addition to those indicated, the Contractor shall make exploratory excavations, as the Contractor deems necessary, to verify location of existing underground utilities within the project area. All such exploratory excavations shall be performed as soon as practicable after award of Contract and, in any event, a sufficient time in advance of construction to avoid possible delays to Contractor's Work. When such exploratory excavations show the utility location as indicated on the Contract Drawings to be in error, the Contractor shall so notify Engineer.
- D. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and depth of the utility.
- E. The Contractor shall provide barriers to prevent unauthorized entry to the construction area, to allow Owner's use of the site, and to protect existing facilities and adjacent properties from damage from construction operations.
- F. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.02 RIGHTS-OF-WAY

- A. The Contractor shall not do any Work that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electric transmission line; any fence; or any other structure, nor shall the Contractor enter upon the rights-of-way involved until notified by the Engineer that the Owner has secured authority therefor from the property owner. After authority has been obtained, the Contractor shall give said owner due notice of Contractor intention to begin Work, and shall give said owner convenient access and every facility for

removing, shoring, supporting, or otherwise protecting such pipeline, transmission line, ditch, fence, or structure and for replacing same.

- B. When two or more Contracts are being executed at one time on the same or adjacent land in such manner that Work on one Contract may interfere with that on another, the Owner shall decide which Contractor shall have priority to perform and in what manner. When the territory of one Contract is the necessary or convenient means of access for the execution of another Contract, such privilege of access or any other reasonable privilege may be granted by the Owner to the Contractor so desiring, to the extent, amount, manner, and times permitted. No such decision as to the method or time of conducting the Work or the use of territory shall be made the basis of any claim for delay or damage.

1.03 PROTECTION OF STREET OR ROADWAY MARKERS

- A. The Contractor shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced for easy and accurate restoration. It shall be the Contractor's responsibility to notify the Engineer of the time and location that Work will be done. Such notification shall be sufficiently in advance of construction that there will be no delay due to waiting for survey points to be satisfactorily referenced for restoration. All survey markers or points disturbed, without proper authorization by the Engineer, will be accurately restored by the Owner at Contractor's expense after all street or roadway resurfacing has been completed.

1.04 RESTORATION OF PAVEMENT

- A. All paved areas shall be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents or in the requirements of the agency issuing a permit. All temporary and permanent pavements shall conform to the requirements of the affected pavement owner.

1.05 EXISTING UTILITIES AND IMPROVEMENTS

- A. The Contractor shall protect all utilities and other improvements which may be impaired during construction operations. It shall be Contractor's responsibility to ascertain the actual location of all existing utilities and other improvements indicated on the Contract Drawings that will be encountered in its construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. The Contractor shall take all possible precautions for the protection of unforeseen utility lines for uninterrupted service and such special protection as may be directed by the Engineer.

- B. In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder will, upon proper application by the Contractor, be notified by the Engineer to move such property within a specified reasonable time. The Contractor shall not interfere with said property until after the expiration of the time stipulated.
- C. The right is reserved to the Owner and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the Work of this Contract.
- D. Existing utility lines that are shown on the Contract Drawings or the locations of which are made known to the Contractor prior to excavation that are to be retained and all utility lines that are constructed during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired by Contractor at Contractor's expense.
- E. If the Contractor damages any existing utility lines that are not shown on the Contract Drawings or the locations of which are not made known to Contractor prior to excavation, or were, or could not have been verified or located by the Contractor prior to starting Work, a written report thereof shall be made immediately to the Engineer.
- F. When utility lines that are to be removed are encountered within the area of operations, Contractor shall notify the Engineer a sufficient time in advance for the necessary measures to be taken to prevent interruptions of the service.
- G. All repairs to a damaged improvement shall be inspected and approved by an authorized representative of the improvement before being concealed by backfill or other Work.
- H. Where the proper completion of the Work requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is shown on the Contract Drawings, Contractor shall at Contractor's own expense, remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to the Engineer and the owner of the facility. In all cases of such temporary removal or relocation, restoration to former location shall be accomplished by Contractor in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.
- I. All oil and gasoline pipelines, power, telephone, or other communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the Work shall be maintained continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the Engineer are made with the owner of said pipelines, duct, main, irrigation line,

sewer, storm drain, pole, wire, or cable. The Contractor shall be responsible for and shall make good all damage due to Contractor's operations and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

1.06 NOTIFICATION BY THE CONTRACTOR

- A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, Contractor shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than 3 working days nor more than 5 working days prior to excavation so that a representative of said owners or agencies can be present during such Work if they so desire.

1.07 SUBSURFACE OBSTRUCTIONS

- A. The Contractor shall field determine, before trenching and associated excavations are begun, the depth and location of existing utilities. Utility locations indicated on the Contract Drawings were obtained from the records available, but have not been field verified, nor have depths been measured or observed. The Contractor shall submit descriptions, depths, and locations of subsurface obstructions to the Engineer for review.
- B. In excavation, backfilling, and laying pipe, care shall be taken not to remove, disturb, or injure existing pipes, conduits, or structures. If necessary, Contractor at his own expense shall sling, shore-up, and maintain such structures in operation.
- C. The Contractor shall obtain the permission of and give sufficient notice to the proper authorities of Contractor's intention to remove or disturb any pipe, conduit, etc., and shall abide by their regulations governing such Work.
- D. In the event subsurface structures are broken or damaged in the execution of the Work, Contractor shall immediately notify the proper authorities and, at the option of said authorities, either repair the damage at once at his own expense or pay the proper charges for repairing said damage. Repairs shall be made to the satisfaction of the Engineer. The Contractor shall be responsible for any damage to persons or property caused by such breaks or due to his own neglect in reporting and/or repairing such damages.
- E. The Owner or Engineer will not be liable for any claims made by the Contractor based on underground obstructions that could have been reasonably identified as being different than that indicated on the plans. Contractor shall uncover subsurface obstructions in advance of construction so that the method of avoiding same may be determined before the Work reaches the obstruction.

1.08 CONFLICTS WITH OTHER UTILITIES

- A. It shall be Contractor's responsibility to give the appropriate utility company sufficient advance notice so their representatives may verify the utility location on the job site when trenching operations begin. The Contractor shall coordinate and cooperate with these utilities to ensure that no damages occur which would cause interruption of their services.
- B. All temporary support or minor adjustment which does not require replacement or direct by-pass connections to these existing services (such as all direct-buried telephone cables or 2 inch and smaller gas lines) will be the responsibility of the Contractor.
- C. Where it may be necessary to relocate gas mains or telephone ducts (defined here as gas lines larger than 2-1/2 inches and telephone cables within ductwork) to allow construction or where major relocation of small services requires replacement or performing connections to the existing lines, all such relocation Work is the responsibility of and must be performed by the respective utility companies. The Contractor shall immediately notify the proper utility company and the Engineer in writing of the occurrence and location of such required relocations.
- D. The Owner will not be responsible for any delay or inconvenience to the Contractor resulting from the existence, removal, or adjustment of any public or private utility that could have been reasonably identified. Additional costs incurred as a result thereof shall be borne by the Contractor and considered as included in the contract unit prices bid for the various pay items.
- E. Relocation or realignment of storm drains, leachate lines, or sewer lines which may interfere with the construction shall be the responsibility of the Contractor.
- F. Where storm drains, leachate lines, or sewer lines are removed by the Contractor to facilitate construction and replaced in their original position, there shall be no direct payment made. All related costs shall be included in the unit price bid for the construction involved.

1.09 POLE RELOCATION AND PROTECTION

- A. The Contractor shall take notice of the number of power and telephone support poles within or near the project limits. Several may be in proximity to or in direct conflict with the construction operation. The relocation of all poles shall be the responsibility of and must be performed by the respective utility companies. The Contractor shall immediately notify the proper utility company and the Engineer in writing of the occurrence and location of such required relocations.
- B. For all poles, it is intended that they shall be supported with mud jacks or by other means of bracing, as required, to maintain them in a stable condition.

1.10 EXISTING FENCE

- A. At various locations within the project area, existing fences may conflict with or impair construction operations. The Contractor shall protect these fences in place where they do not conflict with construction operations. Where a fence may conflict with the backswing of machinery or otherwise impede construction, Contractor shall contact the Engineer and arrange for the temporary removal or relocation of the fence. Any fence removed or temporarily relocated shall be restored to its original condition and location unless otherwise arranged with the owner(s) of the fence. Where it is impossible to salvage the existing materials to reconstruct the fence, the fence shall be replaced “in kind”.
- B. All cost for such temporary removal, replacement, or “in kind” replacement shall be included in the respective bid prices. No direct payment will be made for fence replacement unless specifically noted otherwise.

1.11 UTILITY INVESTIGATION

- A. Prior to commencing with trench or other excavations required for the performance of the Work, Contractor shall conduct a field investigation for the purpose of determining existing locations of all underground utilities and facilities which are shown on the Contract Drawings. The investigation shall be made by hand or machine excavation. All such excavations shall include removal of surface material and obstructions required to perform the excavations. The Contractor shall provide sheeting, shoring, and bracing, as required, to minimize the required size of the excavation and support adjacent ground, structures, roadways, and utilities. After the data is obtained at each excavation site, Contractor shall immediately backfill each excavation site. Backfill shall be compacted sand for the full depth. The surface shall be returned to its original grade and condition except that paved areas may be temporarily surfaced and maintained where excavations required for the performance of the Work coincide with the location of the investigative location. The Contractor shall be responsible for all costs associated with repair of roadways, paving, structures, underground and above ground utilities, and facilities damaged in conducting the investigations.
- B. Findings of the investigation shall be reported to the Engineer. The Contractor shall clearly designate all found utilities and facilities discovered whether or not shown on the Contract Drawings. The Contractor shall provide written detailed description of any underground utility or facility conflicting with the elevation or alignment of the Work.
- C. The Contractor shall describe size, material, and location of existing underground utilities and facilities. Locations and elevations shall be referenced to project stationing, distance from base line, and project bench marks.

1.12 PROTECTION OF TREES TO REMAIN

- A. The Contractor shall install a protective barrier around trees not selected for removal and that are located within the project limits. The protective barrier must remain in place until the land alteration and construction activities are completed or until commencement of grade finishing and sodding. No ground disturbance must occur within the barricaded area.

- B. The barricade shall be placed around the tree at the canopy dripline (vertical line that extends downward from the outermost tips of the tree's branches to the ground).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01568

TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 GENERAL

- A. The Work specified in this Section shall include installing, maintaining and removing temporary erosion and pollution controls as necessary or as indicated on the Drawings. All temporary erosion and pollution controls shall be installed and approved by the Engineer prior to beginning construction of each phase or sequence of the Work. All existing and foreseeable conditions that affect the Work both inside and outside the construction limits shall be Contractor's responsibility.
- B. Temporary erosion controls shall include but not limited to:
 - 1. Grassing, mulching, sodding, netting, watering and reseeding on-site surfaces and soil and borrow area surfaces.
 - 2. Providing interceptor ditches or temporary drainage pipes at those locations, which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits of applicable laws and regulations, and as approved by the Engineer.
- C. Temporary pollution controls shall include, but are not limited to:
 - 1. Silt dams, silt fences, traps, barriers, and appurtenances at the foot of sloped surfaces.
 - 2. Silt dams, traps, or barriers installed in drainage ways (i.e., swales or surface drainage courses), and other areas of stormwater discharge.
- D. The Contractor shall provide effective temporary erosion and sediment control measures during construction and until final controls become effective, or until the Work is accepted by Engineer. The Contractor may, with approval from Engineer, perform Work outside the construction limits to establish, maintain or enhance the erosion control systems.
- E. At no time will runoff that has contacted excavated waste be allowed to discharge off-site. The Contractor shall plan waste activities to assure that off-site discharge does not occur.
- F. The Contractor shall be solely responsible for all costs (including investigation, sampling, testing, analysis, engineering and remedial construction) related to off-

site discharge of leachate or contaminated stormwater resulting from ineffective control of leachate or stormwater discharge by Contractor.

- G. The Contractor shall install additional erosion and pollution control measures deemed necessary by the Engineer as a result of variations in the Contractor's operations, or shall perform repairs to existing system as directed by the Engineer. Additional controls or repairs shall be installed at no additional cost to Owner.
- H. Fill material stockpiles shall be protected at all times by on-site drainage controls which prevent erosion of the stockpile material. Control of dust from such stockpiles may be required, depending upon their location and the expected length of time the stockpiles will be present.
- I. All erosion and siltation control devices shall be checked regularly by the Contractor, especially after each rainfall event and will be cleaned out and/or repaired as required.

PART 2 - PRODUCTS

2.01 EROSION CONTROL

- A. Netting Grade 1800 - Miramat, as manufactured by Mirafi or approved equal.

2.02 SEDIMENTATION CONTROL

- A. Bales:
 - 1. Bales shall be clean, seed free cereal hay type bales.
- B. Silt Fence:
 - 1. Envirofence, as manufactured by Mirafi or approved equal.
- C. Filter Stone:
 - 1. Grade No. 57 crushed stone, as described in FDOT Standard Specifications.
- D. Concrete Block:
 - 1. Hollow, non-load bearing type concrete blocks.
- E. Stakes:
 - 1. Commercial grade, relatively free of knots or irregularities, durable.

PART 3 - EXECUTION

3.01 EROSION CONTROL

- A. Minimum procedures for erosion control grassing are:
 - 1. Scarify slopes to a depth of not less than six inches and remove large clods, rock, stumps, roots and debris.
 - 2. Sow seed within 24 hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.
 - 3. Apply mulch loosely and to a thickness of between $\frac{3}{4}$ inch and $1\frac{1}{2}$ inches.
 - 4. Apply netting over mulched areas on sloped surfaces, if necessary.
 - 5. Roll and water seeded areas in a manner, which will encourage sprouting of seeds and growing of grass. Reseed areas that exhibit unsatisfactory growth. Backfill and seed eroded areas.

3.02 SEDIMENTATION CONTROL

- A. The Contractor shall install and maintain silt dams, traps, barriers, and appurtenances as required.
- B. The Contractor shall control systems that deteriorate and filter stone that is dislodged shall be replaced or repaired at no additional cost to the Owner.

3.03 PERFORMANCE

- A. During construction, denuded areas are to be covered immediately by mulch (such as straw, hay, synthetic fiber) or by sod or seed and mulch with temporary or permanent vegetation.
- B. Areas to be developed may require temporary sediment basins and may be used by Contractor as a positive remedy against downstream siltation. Prior to final inspection, accumulated silt and debris shall be removed from the stormwater management system or temporary sedimentation basins.
- C. Floating and/or staked silt barriers will be anchored in place to protect against accumulation of silt and sediment upstream and downstream of the Work. Silt barriers will be placed so as to effectively control silt and sediment dispersion under the conditions present at site. Silt fences also shall be installed, where necessary, outside limits of construction.
- D. All swales, ditches, channels, retention ponds and detention areas will be sodded as required as soon as possible.

- E. Should any of the temporary erosion and sediment control measures employed by Contractor fail to produce results which comply with the requirements of the State of Florida, County or Engineer; Contractor shall immediately take whatever steps necessary to correct the deficiency at no additional cost to Owner.

3.04 DUST CONTROL

- A. Dust control shall be provided in accordance Section 02221 - Excavation, Backfill, Fill and Grading of these Specifications.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

- A. General provisions of Contract, including General and Supplementary Conditions.

1.02 SECTION INCLUDES

- A. Administrative and procedural requirements governing the Contractor's selection of products for use in the project.
- B. Administrative and procedural requirements for handling requests for substitutions.
- C. Requirements for product list submittal.

1.03 SUBSTITUTION REQUESTS

- A. Submit a separate request for each proposed substitution; original signature sets in accordance with shop drawings Section 01340, each on form bound into Project Manual. Document each request with complete data substantiating compliance of proposed substitution with requirements of Contract Documents.
 - 1. Designate Specification section and Article number.
 - 2. Identify manufacturer by name and address, trade name, model number or catalog number.
 - 3. List product description, performance and test data, applicable reference standards, availability of maintenance service and source of replacement materials.
 - 4. Give itemized comparison of qualities of proposed substitution with specified product, changes required in other elements of the Work due to substitution and effect on progress schedule.
 - 5. Give name and address of similar projects on which product was used and date of installation.
 - 6. Provide cost data comparing proposed substitution with specified product and state the amount of net change to Contract Price.
- B. During Bidding period, times for submittal of substitution requests are stated in the Instructions to Bidders.

- C. After Bidding period, up to thirty (30) days after date of Notice to Proceed, Engineer will consider written requests from Contractor for proposed substitutions of products. Subsequent requests will be considered only in case of product unavailability or other condition beyond control of the Contractor.
- D. Do not order or install substitute products without written acceptance from the Engineer. Do not imply or indicate substitutions on shop drawings or product data submittals without a separate formal request.
- E. Engineer will determine acceptability of substitution. The burden of proof of acceptability of a proposed substitution is upon the Contractor; information submitted must demonstrate that characteristics of the proposed substitution are equal to or better than those of the specified product. Only one request for substitution for each product will be considered. If not accepted, Contractor shall provide specified product.
- F. Request for substitution constitutes a representation that the Contractor:
 - 1. Has investigated the proposed product and determined that it is equal to or superior in all respects to the specified product.
 - 2. Will provide same or greater warranties for proposed product as for the specified product.
 - 3. Will coordinate installation of substitution accepted into the Work and make other changes and adjustments as may be required to make the Work complete in all respects.
 - 4. Waives all claims for additional costs due to substitution which may later become apparent.
 - 5. Agrees to reimburse the Owner for the additional service charges of the Engineer and their Consultants for evaluation and review of the proposed substitution.

1.04 PRODUCT LIST

- A. Prepare the product listing schedule with information on each item tabulated under the following column headings:
 - 1. Related Specification section number.
 - 2. Generic name used in Contract Documents.
 - 3. Proprietary name, model number and similar designations.
 - 4. Manufacturer's and name and address.

5. Supplier's name and address.
 6. Installer's name and address.
 7. Projected delivery date, or time span of delivery period.
- B. Within fifteen (15) days after date of Notice to Proceed, submit five (5) copies of product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.
- C. The Engineer will respond in writing to the Contractor, within 30 days of receipt of the completed product list schedule. No response within this time period constitutes no objection to listed manufacturers or products, but does not constitute a waiver of the requirement that products comply with Contract Documents.

1.05 QUALITY ASSURANCE

- A. To the fullest extent possible, provide products of the same kind, from a single source.
- B. When the Contractor is given the option of selecting between two (2) or more products for use on the project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- C. Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
1. Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
 2. Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.
 - 1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
- B. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
- C. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
- D. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
- E. Store heavy materials away from the project structure in a manner that will not endanger the supporting construction.
- F. Store products subject to damage by the elements above ground, under cover in a weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION

- A. Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
 - 1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
 - 2. Where available, provide standard products, which meet the specified requirements, of types that have been produced and used successfully in similar situations on other projects.

- B. Product selection is governed by the Contract Documents and governing regulations, not by previous project experience. Procedures governing product selection include the following:
1. Where only a single source product or manufacturer is named, provide the product indicated or submit a request for substitution for any product or manufacturer not named.
 2. Where two (2) or more sources of products or manufacturers are named, provide one (1) of the products indicated or submit a request for substitution for any product or manufacturer not named.
 3. Where Specifications describe a product or assembly, listing exact characteristics required, without use of a brand or trade name, provide any product or assembly that provides the characteristics and otherwise complies with Contract requirements.
 4. Where Specifications require compliance with performance requirements, provide any products that comply with the specified requirements.
 5. Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
 6. Where Specifications require matching an established Sample, the Engineer's decision will be final on whether a proposed product matches satisfactorily.
 7. Where specified product requirements are indicated to be selected from manufacturer's standard colors, patterns, textures, or similar condition, select a product and manufacturer that complies with other specified requirements. The Engineer will select the color, pattern and texture from the product line selected.
 8. The description of specific qualities takes precedence over specified reference standards. The description of specific qualities and specified reference standards together take precedence over the named products of designated manufacturers.

C. Source Manufacturers:

1. Primary source products and manufacturers named in a Specification section are listed as standards of quality to which other products will be compared.
2. Additional source manufacturers named in a specification are those manufacturers considered by the Engineer as generally capable of

manufacturing products which may conform to the specified requirements. However, their being listed does not guarantee or imply that any or all of their products will be considered as equal to the specified requirements.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTALLATION INSTRUCTIONS

- A. When Contract Documents require installation of Work to comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to all parties involved in the installation, including copies to the Engineer.
- B. Handle, install, connect, condition, clean, and adjust products in accordance with such instructions and in conformance with specified requirements. Should job conditions or specified requirements conflict with manufacturer's instructions, notify Engineer for additional instructions.
- C. Do not omit preparatory steps or installation procedures unless specifically modified or exempted by Contract Documents.
- D. Do not proceed with work without clear instructions.

SUBSTITUTION REQUEST

PROJECT: _____ DATE: _____

TO: SCS ENGINEERS
5850 South Semoran Blvd.
Orlando FL 32803

FROM: CONTRACTOR BIDDER SUPPLIER MANUFACTURER

HEREBY REQUESTS ACCEPTANCE OF THE FOLLOWING PRODUCT OR SYSTEMS AS A SUBSTITUTION IN ACCORD WITH PROVISIONS OF DIVISION ONE OF THE SPECIFICATIONS:

1. SPECIFIED PRODUCT OR SYSTEM:

Generic Description: _____ Specification Section No. _____ Art. ___ Para. __

2. SUPPORTING DATA:

Product data for proposed substitution is attached (description of product, reference standards, performance and test data).

Sample attached. Sample will be sent if requested.

3. PRODUCT OR SYSTEM QUALITY COMPARISON:

	<u>Specified Product</u>	<u>Substitution</u>
Name, brand:	_____	_____
Catalog No.:	_____	_____
Manufacturer:	_____	_____
Vendor:	_____	_____
Significant variations:	_____	_____

_____ Maintenance Service Available Locally: Yes No

Spare Parts Source: _____

4. EFFECT OF SUBSTITUTION:

Affects other parts of work: No Yes

Explain: _____

Substitution changes Contract Time: Add/Deduct ___ days.

Saving or credit to Owner if accepted: \$ _____.

Extra cost to Owner if accepted: \$ _____.

5. PREVIOUS INSTALLATIONS:

Attach list of local similar projects on which proposed substitution was used and dates of installations.

6. STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT REQUIREMENT: I/we have investigated the proposed substitution and:

a. believe that it is equal or superior in all respects to specified product, except as stated above; and

b. will provide the same warranty as specified for specified product; and

- c. have included complete cost data and implications of the substitution; and
- d. will pay redesign and special inspection costs caused by the use of this product; and
- e. will pay additional costs to other contractors caused by the substitution; and
- f. will coordinate the incorporation of the proposed substitution in the Work; and
- g. will modify other parts of the work as may be needed, to make all parts of the Work complete and functioning; and
- h. waive future claims for added cost to Contract caused by the substitution; and
- i. agree to pay to the Owner or Engineer the hourly rate of One Hundred Fifty Eight Dollars (\$158.00) per hour for cost of Engineer to evaluate and review the proposed substitution.

Name and Title: _____ Date _____

Signature: _____

ENGINEER'S REVIEW AND ACTION:

- Substitution not accepted:
- Resubmit with additional information:
- Substitution is accepted.
- Substitution is accepted, with the following comments:

By: _____ Date: _____

OWNER'S ACCEPTANCE:

- Substitution is accepted.
- Substitution is accepted, with the following comments:

By: _____ Date: _____

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Comply with requirements stated in Conditions of the Contract and in specifications for administrative procedures in closing out the Work.
- B. Related Work Described Elsewhere:
 - 1. Conditions of the Contract. Fiscal provisions, legal submittals and additional administrative requirements.
 - 2. Project Record Documents: Section 01720
 - 3. The respective sections of specifications: Closeout Submittals Required of Trades.

1.02 SUBSTANTIAL COMPLETION (BENEFICIAL OCCUPANCY)

- A. When Contractor considers the Work as substantially complete, he shall submit to Engineer:
 - 1. A written notice that the Work, or designated portion thereof, is substantially complete.
 - 2. A list of items to be completed or corrected.
- B. Within a reasonable time after receipt of such notice, Engineer shall make an inspection to determine the status of completion.
- C. Should Engineer determine that the Work is not substantially complete:
 - 1. The Engineer will promptly notify Contractor in writing, giving the reasons therefore.
 - 2. Contractor shall remedy the deficiencies in the Work and send a second written notice of substantial completion to Engineer.
 - 3. Engineer will re-inspect the Work.
- D. When Engineer finds that the Work is substantially complete, he will:
 - 1. Prepare and deliver to Owner a tentative Certificate of Substantial Completion on form provided herein, with a tentative list of items to be

completed or corrected before final payment.

2. After consideration of any objections made by Owner as provided in Conditions of the Contract, and when Engineer considers Work substantially complete, he will execute and deliver to Owner and Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

1.03 FINAL INSPECTION

- A. When Contractor considers the Work is complete, he shall submit written certification that:
 1. Contract Documents have been reviewed.
 2. Work has been inspected for compliance with Contract Documents.
 3. Work has been completed in accordance with Contract Documents.
 4. Work is completed and ready for final inspection.
- B. The Engineer will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
- C. Should Engineer consider that the Work is incomplete or defective:
 1. Engineer will promptly notify the Contractor in writing, listing the incomplete or defective Work.
 2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to Engineer that the Work is complete.
 3. The Engineer will re-inspect the Work.
- D. When the Engineer finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

1.04 REINSPECTION FEES

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

1.05 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER

- A. Evidence of compliance with requirements of governing authorities.
- B. Project Record Documents: To requirements of Section 01720.
- C. Evidence of Payment and Release of Liens: To requirements of General and Special Conditions.
- D. Certificate of Insurance for Products and Completed Operations.

1.06 FINAL ADJUSTMENT OF ACCOUNTS

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

1.07 FINAL APPLICATION FOR PAYMENT

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Maintain at the site for the Owner one record copy of:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications of the Contract Documents.
 - 5. Engineer's Field Orders or written instructions.
 - 6. Approved shop drawings, working drawings and samples.
 - 7. Field test records.
 - 8. Construction photographs.
- B. Related Requirements Described Elsewhere:
 - 1. Shop Drawings, Working Drawings, And Samples: Section 01340
 - 2. Progress Schedules: General Conditions

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Store documents and samples in Contractor's field office apart from documents used for construction.
 - 1. Provide files and racks for storage of documents.
 - 2. Provide locked cabinet or secure storage space for storage of samples.
- B. File documents and samples in accordance with CSI (Construction Specifications Institute) format with section numbers as provided herein.
- C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.
- D. Make documents and samples available at all times for inspection by the Engineer.

- E. As a prerequisite for monthly progress payments, the Contractor is to exhibit the currently updated “Record Documents” for review by the Engineer and Owner.

1.03 MARKING DEVICES

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

1.04 RECORDING

- A. Label each document “PROJECT RECORD” in neat large printed letters.
- B. Record information concurrently with construction progress.
 - 1. Do not conceal any work until required information is recorded.
- C. Drawings: Legibly mark to record actual construction:
 - 1. Depths of various elements of foundation in relation to finish first floor datum.
 - 2. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Actual installed pipe material, class, etc.
 - 3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
 - 4. Field changes of dimension and detail.
 - 5. Changes made by Field Order or by Change Order.
 - 6. Details not on original contract drawings.
 - 7. Structure and piping relocations.
- D. Specifications and Addenda: Legibly mark each section to record:
 - 1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
 - 2. Changes made by Field Order or by Change Order.
- E. Shop Drawings (after final review and approval): Provide two (2) sets of record drawings for each process equipment, piping, electrical system and instrumentation system.

1.05 SUBMITTAL

- A. At Contract closeout, deliver record documents to the Engineer for the Owner.
- B. Accompany submittal with transmittal letter in duplicate, containing:
 - 1. Date.
 - 2. Project title and number.
 - 3. Contractor's name and address.
 - 4. Title and number of each record document.
 - 5. Signature of Contractor or his authorized representative.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Scope of requirements:
 - 1. Compile specified warranties and bonds as specified in these Specifications.
 - 2. Co-execute submittals when so specified.
 - 3. Review submittals to verify compliance with Contract Documents.
 - 4. Submit to Engineer for review and transmittal to Owner.
- B. Related Work Described Elsewhere:
 - 1. Instructions to Bidders: Bid Bonds
 - 2. General Conditions of the Contract: Performance Bond and Payment Bond
 - 3. General Conditions of the Contract: Instructions to Contractors
 - 4. Contract Closeout: Section 01700

1.02 SUBMITTAL REQUIREMENTS

- A. Assembly warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Number of original signed copies required: Two each.
- C. Table of Contents: Neatly 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 8-1/2 inches x 11 inches, punch sheets for standard three-post binder.
 - a. Fold larger sheets to fit into binders.
 2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS".

List:
 - a. Title of project.
 - b. Name of Contractor.
- C. Binders: Commercial quality, three-post binder, with durable and cleanable plastic covers and maximum post width of two inches.

1.04 WARRANTY SUBMITTALS REQUIREMENTS

- A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. Manufacturer's warranty period shall be concurrent with Contractor's for one (1) year, unless otherwise specified, commencing at the time of final acceptance by Owner. Certain materials will require a longer term warranty. These limits will be designated in the specification for those materials.
- B. Contractor shall be responsible for obtaining certificates for equipment warranty for all major equipment which lists for more than \$1,000. Engineer reserves the right to request warranties for equipment not classified as major. Contractor shall still warrant equipment not considered to be "major" in the Contractor's warranty period even though certificates of warranty may not be required.

- C. In the event that the equipment manufacturer or supplier is unwilling to provide a warranty commencing at the time of Owner acceptance, the Contractor shall obtain from the manufacturer a two (2) year warranty commencing at the time of equipment delivery to the job site. This two-year warranty from the manufacturer shall not relieve Contractor of the one (1) year warranty starting at the time of Owner acceptance of the equipment.
- D. Owner shall incur no labor or equipment cost during the guarantee period.
- E. Guarantee shall cover all necessary labor, equipment and replacement parts resulting from faulty or inadequate design, improper assembly or erection, defective workmanship and materials, leakage, breakage or other failure of all equipment and components furnished by manufacturer.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01800

HEALTH AND SAFETY REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL

- A. The Contractor shall comply with all federal, state, and local safety codes, ordinances, and regulations, including the requirements of the United States Occupational Safety and Health Administration (OSHA), and other such safety measures as may be required by the above-mentioned regulatory agencies as required for Work being performed.
- B. The Contractor shall comply with the requirements of 29 CFR 1910.132 for worker personal protection equipment requirements.
- C. The Contractor shall comply with the document "A Compilation of Landfill Gas Field Practices and Procedures" prepared by the Landfill Gas Division of the Solid Waste Association of North America (SWANA) dated March 1992..
- D. All Work shall be performed in strict accordance with the Contractor's Health and Safety Plan, as described below in Section 1.02.
- E. The Contractor is advised that decomposing refuse produces landfill gas (LFG) which is approximately 50 percent methane by volume. Landfill gas is colorless, can be odorless or odorous, may contain hydrogen sulfide, is combustible, and may contain no oxygen. Landfill gas can also migrate through soil on or near the landfill. The Contractor is therefore advised of the need for precautions against fire, explosion, and asphyxiation when working in or near excavations which are in or near refuse fill areas.
- F. The Contractor will use a Health and Safety Officer for construction oversight that is currently trained in accordance with OSHA regulations 29 CFR 1910.120. The Health and Safety Officer must have completed the 8-hour Management and Supervisor Training, 40-hour Health and Safety Training course and necessary refresher courses, and Medical Monitoring. Copies of current training certificates will be provided to the Engineer for the Health and Safety Officer prior to the start of the Work. The Health and Safety Officer shall be on-site during all intrusive activities and shall inspect ongoing activities on a daily basis. The Health and Safety Officer shall conduct a weekly site safety meeting for all on-site personnel.
- G. No smoking will be allowed in areas of exposed refuse, near pump stations, pipelines or any other locations where landfill gas may accumulate.

- H. Actions that potentially endanger workers should be stopped immediately and brought to the Owner or Engineer's attention. Health and Safety is the responsibility of the Contractor.

1.02 DESCRIPTION OF HEALTH AND SAFETY PLAN

- A. The Contractor shall submit a Health and Safety Plan to the Engineer. The Health and Safety Plan shall include descriptions of the methods, equipment and safety procedures to be used during construction activities, including excavating, trenching, backfilling, borrowing and other construction activities. In preparing the Health and Safety Plan, the Contractor shall consider the various materials such as municipal solid waste (MSW), industrial waste, etc. that may be encountered while conducting all operations necessary to complete the Work.
- B. At a minimum, the Health and Safety Plan shall address the following:
 - 1. Site description and history.
 - 2. Project activities and coordination with other Contractors and site operations.
 - 3. Hazard evaluation.
 - 4. On-site safety responsibilities, including supervisory responsibilities.
 - 5. Personnel training.
 - 6. Work zones.
 - 7. Atmospheric and work-space monitoring.
 - 8. Personnel protection, clothing and equipment.
 - 9. Emergency procedures, including maps and phone numbers for emergency response.
- C. In addition to addressing issues related to activities associated with construction activities in landfills, the Health and Safety Plan shall address issues including trench safety, operations adjacent to heavy equipment, traffic safety, first aid, heat stress and environmental monitoring, site security (including security of open excavations), and other project-specific topics.
- D. The review of the Health and Safety Plan by the Engineer shall be for method and content only, and to inform the Engineer of the health and safety procedures which must be followed by the Engineer and Owner. The Contractor shall retain responsibility and liability for the application, adequacy and safety of the methods

and monitoring. However, the Work shall not begin until the Health and Safety Plan has been submitted and reviewed by the Engineer.

- E. The Contractor's duties and responsibilities for safety in connection with the Work shall continue until such a time Work is complete and Owner has released Contractor from the Project.

1.03 SAFETY EQUIPMENT

- A. At a minimum, the Contractor shall have the following equipment on site:
 - 1. Hard hats, work gloves, reflective work vests and hardtoe shoes for all personnel.
 - 2. First aid kit.
 - 3. Fire extinguishers, two 50-pound dry chemical type.

1.04 GENERAL SAFETY REQUIREMENTS

- A. One person, to be present at all times during the construction, shall be designated to assure observance of the safety procedures. This person shall be trained in the use of all of the recommended safety equipment.
- B. Smoking or open flame shall be prohibited on the disposal area, within 50 feet of the construction area, or as directed by the Contractor.
- C. No worker shall be allowed to work alone at any time in or immediately near an excavation and/or construction area. Another worker shall be present outside the area possibly affected by landfill gas.
- D. Site operations will take place in conditions of adequate light only.
- E. Areas of open refuse (i.e., excavations and trenches) will be monitored for combustible gases, methane, volatile organics, hydrogen sulfide and oxygen through the use of field gas meters or Drager-type colorimetric tubes. Respiratory protection for acid gases and organic vapors will be used by the worker while monitoring gas levels. Appropriate respiratory protection will be taken by other workers as necessary.
- F. No workers will be allowed in any trench or excavation while excavation of the area is in progress. Entry into the excavation shall be made only after the Contractor has monitored the air in the excavation, and determined the appropriate level of personal protection required for entry into the excavation. Site workers in excavations must be supervised at all times.

- G. Site workers will limit their dermal exposure to excavated refuse. Minimal skin protection includes safety-toe boots, long pants, long-sleeved shirts, safety glasses, and rubber gloves to be used when handling refuse.
- H. All heat or torch welding or joining with solvents should take place in areas away from exposed refuse when possible. When Work must take place in an excavation, appropriate ventilation measures shall be taken, as addressed in the Contractor's Health and Safety Plan.
- I. All personnel must wear hard hats.
- J. Start-up and shutdown of equipment shall not be done in areas of exposed refuse.
- K. The Contractor shall comply with all provisions of state, federal, or local codes regarding Work in confined spaces, including the need for monitoring, safety harnesses, and documentation of confined space activity. The atmospheric condition within confined spaces shall be monitored for oxygen, combustible gas, and hydrogen sulfide before entry. No confined spaces shall be entered without first verifying the safety of the environment.
- L. When construction and/or working in a manhole, vault, or other subgrade enclosure in and/or adjacent to the landfill site, the interior atmosphere shall be tested for the presence of oxygen, hydrogen sulfide, and combustible gas before entry and continuously when occupied. The person entering should wear a parachute-type safety harness with attached tether secured to the surface. A SCBA shall be available for use if needed. Forced air ventilation fans shall be used to provide a fresh air stream.
- M. In addition to conforming to the safety rules and regulations of governmental authorities having jurisdiction, the Contractor is advised of the presence of methane gas emanating from the natural decomposition of refuse buried at the job site and shall take precautions to ensure the safety of workers and the public.
- N. The Contractor shall demonstrate to the Engineer on a daily basis that all safety equipment is functioning properly, that all monitoring instruments are calibrated, and that the instrument operators are sufficiently knowledgeable in the use of the safety equipment.

1.05 ACCIDENT PREVENTION

- A. Precaution shall be exercised by the Contractor at all times for the protection of persons (including employees) and property. The safety provisions of applicable laws and of building and construction codes shall be observed. Machinery, equipment, and other hazards shall be guarded or eliminated. First aid kits shall be provided in a readily accessible location or locations.

- B. The Contractor shall make all reports as are, or may be, required by any authority having jurisdiction, and permit all safety inspections of the Work being performed under this Contract. Before proceeding with any construction Work, the Contractor shall take the necessary action to comply with all provisions for safety and accident prevention.

1.06 PAYMENT FOR SAFETY REQUIREMENTS

- A. Payment for complying with the safety requirements for construction on the Work site shall be included in the contract unit price paid for the various items of Work wherein it is required and no separate payment will be made therefore.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

DIVISION 2

Site Work

SECTION 02065

DEMOLITION

PART 1 - GENERAL

1.01 GENERAL

- A. The Contractor shall furnish all labor, materials, equipment and incidental Work necessary for the removal and disposal of structures, foundations, piping, roadway materials, or any part thereof including masonry, steel, reinforced concrete, plain concrete, asphalt, electrical facilities, and any other material or equipment shown or specified to be removed on the Contract Drawings.
- B. Demolition shall result in the complete removal and disposal of existing structures and appurtenances from the site as indicated on the Contract Drawings, the salvaging of indicated items and the cleanup after completion of the demolition Work.
- C. The Contractor shall carry out demolition so that adjacent structures, which are to remain, are not endangered. Any damage done to existing facilities which are to remain shall be repaired at the Contractor's expense to the satisfaction of the Owner.
- D. Demolition of the existing scale shall commence only after the new scale and scalehouse facility has been constructed and approved for occupancy.
- E. The Owner may wish to retain ownership of some of the materials and will direct the Contractor to a designated stockpile/storage area if this is the case. Material to be salvaged shall be removed with the minimum amount of damage. Any salvaged items that are determined to be of no value to the Owner after removal and Owner's inspection shall be disposed of according to this Section.
- F. The Contractor shall provide dust control and make provisions for safety. Contractor shall comply with applicable Occupational Safety and Health Administration (OSHA) regulations, Federal, State and local safety requirements.
- G. Existing site structures and appurtenances affected herein are indicated generally on the Demolition Plan.
 - Planning the Work. These reports are made available for the convenience of the Contractor. The Owner does not guarantee the depth, extent, or character of the material present. The Contractor shall make such examination of the site of the Work, and any material sources, as may be necessary to inform himself of the conditions under which the Work is to be performed.

1.02 SUBMITTALS

- A. Quality Control Submittals:
 - 1. Submit one copy of each permit as required by Federal, State and local jurisdictions for all phases and operations of the Work.
 - 2. The Contractor will submit one copy of the Demolition Plan to the Engineer for information only.
 - 3. The review of the Demolition Plan by the Engineer shall be for method and content only, and to inform the Engineer of the procedures. The Contractor shall retain responsibility and liability for the application, adequacy and safety of the methods and monitoring. However, the Work shall not begin until the Demolition Plan has been submitted and reviewed by the Engineer.

1.03 QUALITY ASSURANCE

- A. Before the Work of this Section is started, the Contractor will be responsible for obtaining all permits and licenses required by Federal, State and local jurisdictions for all phases and operations of the Work and shall furnish a copy of same to the Engineer prior to commencing Work.
- B. Before the Work of this Section is started, Contractor will prepare a detailed Demolition Plan. The Demolition Plan shall include, but not be limited to, detailed outline of intended demolition and disposal procedures. The Demolition Plan will not relieve the Contractor of complete responsibility for the successful performance of the Work in accordance with all applicable Federal, State, and local codes and restrictions.
- C. The Contractor shall issue written notices of planned demolition to companies or local authorities owning utility conduit, wires or pipes running to or through the Project site. Copies of said notices shall be submitted to the Engineer.
- D. The Contractor shall notify utility companies or local authorities furnishing gas, water, electrical, telephone or sewer service to remove any equipment owned by them in structures to be demolished and to remove, disconnect, cap or plug their services to facilitate demolition.

1.04 SCHEDULING

- A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 PROTECTION

- A. The Contractor shall provide warning signs, protective barriers, and warning lights as necessary adjacent to the Work as required. The Contractor shall maintain these items during the demolition period as required.
- B. The Contractor shall undertake no demolition Work until all mechanical and electrical services affected by the Work have been properly disconnected. Cap, reroute or reconnect interconnecting piping or electrical services that are to remain in service either permanently or temporarily. The Contractor shall locate, identify and protect utilities, benchmarks, piping, and structures that are not to be removed from damage during demolition activities.
- C. The Contractor shall perform testing and air purging where the presence of hazardous chemicals, gases, flammable materials or other dangerous substances is apparent or suspected, and eliminate the hazard before demolition is started.
- D. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people and transfer station trailers around demolition area.

3.02 DEMOLITION REQUIREMENTS

- A. The use of explosives will not be permitted.
- B. Carefully protect all mechanical and electrical equipment against dust and debris.
- C. Provide safe access to, and egress from, all working areas at all times with adequate protection from falling material. Erect temporary protection, such as walks, fences, and railings, where required by authorities having jurisdiction.
- D. Protect existing site improvements and appurtenances to remain.
- E. Promptly repair damages caused to adjacent facilities or structures by demolition operations at no cost to Owner.

3.03 DISPOSAL OF DEMOLISHED MATERIALS:

- A. All materials resulting from the demolition of the existing scale facility such as rubbish, scrap pieces, equipment, excess soils, etc. (demolition debris) shall be disposed of by the Contractor as directed by the Owner or Engineer.
- B. The Contractor shall be responsible for loading and transporting demolition debris to the Porter Transfer Station tipping floor, or other designated on-site area as

directed by the Owner for disposal as soon as practical. The Owner will not charge the Contractor a tipping fee, but the Contractor shall be responsible for loading and hauling the material. Demolition debris shall be loaded into transport vehicles and hauled by the Contractor to the Owner's scale facility then to the Porter Transfer Station tipping floor or other on-site area as directed by the Owner for disposal. The cost for hauling demolition debris shall be included in the Bid Price.

- C. Any voids remaining by the demolition activities shall be backfilled with clean common fill and compacted to the grades identified on the Contract Drawings.
- D. Contractor shall be responsible for collection of windblown debris.
- E. The site shall be left in a clean condition satisfactory to the Owner and Engineer, free from demolition debris, rubbish or other materials.
- F. All interrupted utility services shall be returned to their preexisting state and disconnect temporary services, unless otherwise specified.

END OF SECTION

SECTION 02070

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Section 02065, Demolition

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.03 SUBMITTALS

- A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required, before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
 - 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
 - 2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
 - 3. List products to be used and firms or entities that will perform Work.
 - 4. Indicate dates when cutting and patching is to be performed.
 - 5. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
 - 6. Approval by the County Project Manager to proceed with cutting and patching does not waive the County Project Manager's right to later

require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.04 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load carrying capacity or load-deflection ratio. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements.
 - a. Structural concrete
 - b. Structural steel
 - c. Miscellaneous structural metals
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety-related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance or decreased operational life or safety. Obtain approval of the cutting and patching proposal before cutting and patching operating elements or safety related systems.
- C. Visual Requirements: Do not cut and patch exposed construction in a manner that would, in the OWNER's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.

PART 2 – PRODUCTS

2.01 MATERIALS

Use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect unless otherwise indicated by Owner. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 – EXECUTION

3.01 INSPECTION

Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding if unsafe or unsatisfactory conditions are encountered. Before proceeding, meet at the site with all parties involved in cutting and patching. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION

- A. Provide temporary support of work to be cut.
- B. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas and interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit, or ductwork serving the building.

3.03 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction.
 - 1. In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping.
 - 2. Cut through concrete using a cutting machine such as a Carborundum saw or diamond core drill.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 - 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3.04 CLEANING

Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature.

END OF SECTION

SECTION 02071

GEOGRID

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work specified in this section includes subgrade preparation, placement, and installation as required for the completion of the geogrid as shown on the Drawings and as specified herein, in accordance with provisions of the Contact Documents. Triaxial geogrid is specified for roadway and structural footings and uniaxial geomembrane is specified for the scale, scale approach, and drop-off areas.
- B. All materials shall conform to the following requirements and shall be of new stock of the highest grade available, free from defects and imperfections, and recently manufactured.
- C. The Contractor shall coordinate the testing and installation of the geogrid with the other materials required for the project.

1.02 QUALIFICATIONS

- A. **Manufacturer Qualifications:** A qualified Manufacturer shall be a company, corporation, or firm regularly engaged in the development and manufacture of geogrids with a history of successful production of geogrid for a minimum period of three years. The geogrid shall be manufactured by a single Manufacturer. The Manufacturer shall submit written information on the following:
 - 1. Quality Control procedures for production or a Quality Control Procedures Manual. Sampling procedures, test frequencies, and methods shall be defined. The Manufacturer shall, at a minimum, comply with the quality control specification for this project.
 - 2. Verification that the Manufacturer has successfully supplied geogrid during the last three years. The Manufacturer shall submit written information as follows:
 - a. Name and location of project and date of installation.
 - b. Contact name and phone number for each project.
 - c. Geogrid type and surface area of geogrid installed.

1.03 CONSTRUCTION QUALITY CONTROL

- A. Construction Quality Control (CQC) shall be performed by the geogrid Installer. The Installer's responsibilities shall include, but not be limited to:
1. Supervise all geogrid installation activities.
 2. Perform and document quality control testing for parameters listed in Table 02070-1 for the uniaxial geogrid and in Table 02070-2 for the triaxial geogrid prior to installation.
 3. Certify geogrid materials and installation as meeting requirements of the Contract Documents.

1.04 SUBMITTALS

- A. Thirty days prior to the delivery of the geogrid to the site the following information shall be submitted to the Engineer for review:
1. Manufacturer's qualifications.
 2. Manufacturer's recommended installation procedures.
 3. Sample warranties.
 4. Geogrid resin information & quality control certificates certifying that they meet all requirements of Tables 02070-1 and 02070-2.
 5. Geogrid manufacturer material information & Quality Control certificates.
 6. Loading, unloading, and storage equipment recommendations.
 7. A list indicating correlation between the Manufacturer's Quality Control Certificates and individual geogrid rolls.
 8. A sample of each proposed geogrid material.
- B. Roll Certification: Written on company letterhead, roll certification shall be provided for each roll of geogrid, including roll identification number, and the results of quality control testing performed by the Manufacturer.
- C. Warranty: The Manufacturer shall warranty the geogrid material for a period of not less than 20 years. The Contractor shall warranty workmanship for a period of not less than 2 year from the date of final acceptance.

PART 2 - PRODUCTS

2.01 GEOGRID PROPERTIES

- A. The uniaxial geogrid shall be a regular grid structure formed by uniaxially drawing a continuous sheet of select high density polyethylene material and shall have aperture geometry, rib and cross sections sufficient to permit significant mechanical interlock with the soil layer in the areas as shown on the Drawings. The geogrid shall be Tensar, UX11000MSE, or an approved equal and shall meet the properties in Table 02070-1.
- B. The triaxial geogrid shall be a regular grid structure formed in a single layer of extruded sheets of polypropylene and oriented in three substantially equilateral directions, so the resulting ribs have a high degree of molecular orientation which continues at least in part through the mass of the integral node. The resulting geogrid structure shall have apertures that are triangular in shape, and shall have ribs with depth-to-width ratios greater than 1.0. The geogrid shall be Tensar, TriAX160 and TriAx7, or an approved equal and shall meet the properties in Table 02070-2.

TABLE 02071-1 – UNIAXIAL GEOGRID MATERIAL PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE
			UX1100 MSE
Tensile Strength @ 5% Strain ⁽²⁾	D6637-10 Method A	kN/m (lb/ft)	27 (1,850)
Ultimate Tensile Strength ⁽²⁾	D6637-10 Method A	kN/m (lb/ft)	58 (3,970)
Junction Strength	D7737-11	kN/m (lb/ft)	54 (3,690)
Flexural Stiffness ⁽³⁾	D7748-12	mg-cm	500,000
Resistance to Long Term Degradation ⁽⁴⁾	EPA 9090	Percent	100
Resistance to UV Degradation ⁽⁵⁾	D4355-05	Percent	95
Maximum Allowable Strength for 120-year Design Life ⁽⁶⁾	GRI-GG4-05	kN/m (lb/ft)	21.2 (1,450)
Minimum Reduction Factor for Installation Damage (RFID) ⁽⁷⁾	--	--	1.05
Reduction Factor for Creep for 120-year Design Life (RFCR) ⁽⁸⁾	D5262-04	--	2.60
Minimum Reduction Factor for Durability (RFD)	--	--	1.00

Notes

1. Dimension measurements are nominal and minimum average roll values unless otherwise noted. Test methods are most recently published from ASTM unless otherwise noted.
2. True resistance to elongation when initially subjected to a load measured without deforming test materials under load before measuring such resistance or employing "secant" or "offset" tangent methods of measurement so as to overstate tensile properties.
3. Resistance to bending force determined using one minimum meter long specimen.
4. Resistance to loss of load capacity or structural integrity when subjected to chemically aggressive environments in accordance with EPA 9090 immersion testing.
5. Resistance to loss of load capacity or structural integrity when subjected to 500 hours of ultraviolet light and aggressive weathering.

6. Reduction factors are used to calculate the geogrid strength available for resisting force in long-term load bearing applications. Allowable Strength (T_{allow}) is determined by reducing the ultimate tensile strength (T_{ult}) by reduction factors for installation damage (RF_{ID}), creep (RF_{CR}) and chemical/biological durability ($RF_D = RF_{CD}RF_{BD}$) per GRI-GG4-05 [$T_{allow} = T_{ult}/(RF_{ID}RF_{CR}RF_D)$].
7. Minimum value is based on Installation Damage Testing in Sand, Silt, and Clay soils. Coarser soils require increased RF_{ID} values.
8. Reduction Factor for Creep determined for 120-year design life and in-soil temperature of 20°C using standard extrapolation techniques to creep rupture data obtained following the test procedure in ASTM D5262-04. Actual design life of the completed structure may differ.

TABLE 02071-2 – TRIAXIAL GEOGRID MATERIAL PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE	
			TriAx TX160	TriAx TX7
Rib Pitch - longitudinal ⁽¹⁾	D4759-02	mm (inches)	40 (1.60)	40 (1.60)
Rib Pitch - diagonal ⁽¹⁾	D4759-02	mm (inches)	40 (1.60)	40 (1.60)
Mid-Rib depth - diagonal ⁽¹⁾	D4759-02	mm (inches)	1.6 (0.06)	2.0 (0.08)
Mid-Rib depth - transverse ⁽¹⁾	D4759-02	mm (inches)	1.4 (0.06)	1.6 (0.06)
Mid-Rib width - diagonal ⁽¹⁾	D4759-02	mm (inches)	1.0 (0.04)	1.0 (0.04)
Mid-Rib width - transverse ⁽¹⁾	D4759-02	mm (inches)	1.2 (0.05)	1.3 (0.05)
Rib Shape		--	Rectangular	Rectangular
Aperture shape		--	Triangular	Triangular
Junction Efficiency	D6637-10, D7737-11	Percent	93	--
Radial Stiffness at low strain ⁽²⁾	D6637-10	kN/m @ 0.5% strain (lb/ft @ 0.5% strain)	300 (20,580)	--
Resistance to chemical degradation ⁽³⁾	EPA 9090	Percent	100	--
Resistance to ultra-violet light and weathering ⁽⁴⁾	D4355-05	Percent	70	--

- Notes**
1. Dimension measurements are nominal and minimum average roll values unless otherwise noted. Test methods are most recently published from ASTM unless otherwise noted.
 2. Radial stiffness is measured from tensile stiffness measured in any in-plane axis from testing.
 3. Resistance to loss of load capacity or structural integrity when subjected to chemically aggressive environments in accordance with EPA 9090 immersion testing.
 4. Resistance to loss of load capacity or structural integrity when subjected to 500 hours of ultraviolet light and aggressive weathering in accordance with ASTM D4355-05.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. The geogrid shall be packaged and shipped by manufacturer in a manner to protect the integrity of the geogrid from damage.
- B. Each roll shall be delivered to the site bearing markings which provide: the roll and manufacturer's lot number, type, length and width of the material; and the proper direction to unroll the material to facilitate layout and positioning in the field.
- C. The Contractor shall provide transportation, labor, and handling for delivery of the geogrid to and from the project location. Special transportation or handling

requirements required for the geogrid shall be provided by the Contractor. The equipment for transportation, handling, loading and unloading the geogrid shall be of sufficient size and capacity to safely and efficiently handle geogrid materials without damage occurring. The type, size and capacity shall be according to Manufacturer requirements.

- D. The Contractor shall check the geogrid upon delivery to assure that the proper material is received.
- E. Geogrids shall be stored above -20°F (-29°C) and be shaded from prolonged periods of direct exposure to sunlight.
- F. The Contractor shall prevent excessive mud, wet cement, epoxy and such materials which may affix themselves to the gridwork, from contacting the geogrid material.
- G. Geogrid stored on-site shall be done in a manner that is consistent with manufacturer's instructions. Storage shall be arranged in a manner to provide easy access for inspection, with seals and labels intact and legible. Storage of the geogrid is the responsibility of the Contractor. A dedicated storage area shall be selected at the job site that is away from high traffic areas and is level, dry and well-drained.
- H. Rolled geogrid may be laid flat or stood on end for storage. Rolls laid flat shall not be more than four rolls high and shall be stored in a manner to prevent sliding or rolling of the stacks. The geogrid shall not be stored or unloaded in areas which will impair the operations of the landfill facility or cause damage.
- I. All geogrid stored on site shall be covered with a plastic sheet or tarpaulin, or as recommended by the Manufacturer, until installation.
- J. All geogrid material which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified, shall be promptly removed from the site by the Contractor and replaced at no additional cost to the Owner.

3.02 GEOGRID INSTALLATION

- A. Geogrid shall be installed at the proper locations and alignment as recommended by the Manufacturer.
- B. Overlap, joints, and repairs shall be in accordance with Manufacturer's recommendations.
- C. Anchoring of the geogrid shall be performed as recommended by the Manufacturer.
- D. At a minimum, the Contractor shall

1. Install Tensar TriAx 160 geogrid to the extents of the limerock base for roadways and concrete slabs in accordance with the Manufacturer's recommendations.
2. Install uniaxial geogrid to the extents of the limerock base for scale approaches and scale foundations in accordance with the Manufacturer's recommendations.
3. Install three layers separated by six inches of Tensar TX-7 triaxial geogrid under the HHW Building footings and extending seven feet beyond the building footing.
4. Install two layers separated by six inches of Tensar TX-7 triaxial geogrid under the Scalehouse footings extending five feet beyond the footing.

3.03 SUBBASE PREPARATION

- A. The soil underneath the geogrid layer shall be well-drained, and free of sticks, roots, organic matter, MSW, and stones larger than 1-inch in any dimension. Acceptable soil types, as classified by the Unified Soil Classification System (ASTM D 2487), SP, SP-SM, SC or SP-SC or other soil as approved by the Engineer. For soils with Atterberg limits, Liquid Limit shall be less than 30 with a Plasticity index greater than 10.
- B. Soils, which yield or exhibit pumping due to excessive moisture, shall be excavated and replaced with general fill or materials as approved by the Engineer.
- C. Soil materials excessively wet or dry are considered unsuitable. Allow such material to dry, or moisten, as required, to bring material generally within 3 percent of optimum moisture content range for specified compaction
- D. The surface upon which the geogrid material will be installed shall be inspected by the CQA Inspector and certified by the geogrid Installer to be in accordance with the requirements of this specification.
- E. It shall be the Installer's responsibility to indicate to the Engineer any change in the condition of the subbase that could cause the subbase to be out of compliance with any of the requirements of this section or the project specification rendering the geogrid unacceptable for deployment.
- F. All areas that have been subject to erosion shall be repaired and tested in place as shown on the drawings. The repaired surface for geogrid placement shall be even with no abrupt changes or breaks in grade. No standing water or excessive moisture shall be allowed.

3.04 REPAIR

- A. Holes or tears in the geogrid shall be repaired by placing a patch extending 2 feet beyond the edges of the hole or tear. The patch shall be secured to the original geogrid by spot welding or tying every 6 inches.

3.05 BACKFILL

- A. Backfill material shall be placed within the anchor trench in a manner which prevents the geogrids position from changing.
- B. No vehicles, including trucks or 3- and 4-wheeled ATV's are allowed on the geogrid once it is placed until the 1 foot layer of soil has been placed on top of the geogrid. If ruts are created in the backfill during construction, they shall be filled with additional soil rather than blading adjacent material into the rut.

3.06 FINAL ACCEPTANCE

- A. The Contractor shall retain ownership and responsibility for the geogrid until final acceptance by the Owner.
- B. Final acceptance of the geogrid by the Owner will occur when:
 - 1. Installation activities are completed.
 - 2. Documentation of installation is completed and the Contractor's final report is submitted to, and approved by the Engineer.
 - 3. Documents presented in Part 1.04, this Section have been submitted to the Engineer, and approved.

END OF SECTION

SECTION 02110

SITE CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 GENERAL

- A. The Work specified in this section includes clearing (i.e., removal of materials found on the surface of the ground such as trees, brush, etc.) and grubbing (i.e., removal of materials at, or protruding from, the surface of the ground such as grass, stumps, roots, rocks, etc.) materials, which are understood by generally accepted practice not to be suitable for construction of the Work as shown on the Contract Drawings and specified herein.
- B. The Contractor shall provide necessary protection as required to prevent damage to existing improvements indicated to remain in place, as specified in Section 01530 - Protection of Existing Facilities.
- C. The Contractor shall control fugitive dust in accordance with local and state requirements.
- D. Prior to site clearing operations, the Contractor shall implement the appropriate provisions of Section 01568 - Temporary Erosion and Sedimentation Controls.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 SITE CLEARING

- A. Site clearing activities shall be conducted to minimize interference with roads, streets, walks, and other adjacent facilities. The Contractor shall not close or obstruct streets, walks or other facilities.
- B. All trees within the limits of the Work shall be removed except where noted on the Drawings. Trees noted on the Drawings to remain shall be protected as specified in Section 01530 - Protection of Existing Facilities.
- C. Tree removal shall include removal of stumps and roots to a minimum depth of 2 feet below original ground level.
- D. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable materials.

- E. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

3.02 DISPOSAL OF SITE CLEARING MATERIALS

- A. Land clearing debris and unsuitable soils shall be transported to the stockpile areas designated by the Engineer at no additional cost to the Owner. Disposal shall conform to all County, State and Federal regulations.
- B. No soils shall be removed from the site. All suitable soils shall be incorporated into the Work or stockpiled as described in Section 02221 - Excavation, Backfill, Fill and Grading.

END OF SECTION

SECTION 02120

PAVEMENT AND SURFACING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This work shall consist of furnishing all labor, materials, tools, testing and equipment necessary to install and construct all road base coarse and bituminous asphaltic paving.

1.02 RELATED WORK

- A. Section 01050 – Surveying
- B. Section 02221 – Excavation, Backfill, Fill and Grading
- C. Section 02900 – Seeding and Sodding

1.03 SUBMITTALS

- A. Furnish certification from concrete, bituminous and aggregate producers attesting that materials conform to the requirements of the 2013 Florida Department of Transportation Standard Specifications for Road and Bridge Construction (FDOT Specifications) and March 2008 FDOT Flexible Pavement Manual.

1.04 CONSTRUCTION QUALITY CONTROL

- A. Source Quality Control:
 - 1. Use materials conforming to requirements of the FDOT Specifications Section 334 and the latest workbook for revisions.
 - 2. Use products of a bituminous asphalt concrete producer regularly engaged in production of bituminous asphalt concrete conforming to the standards referenced herein.
 - 3. Maintain quality of work by using products of a qualified bituminous concrete producer and qualified plant operating workmen.
- B. Construction Quality Assurance (CQA)
 - 1. Testing will be conducted by the Contractor for Quality Control and by the Construction Manager for verification to determine compliance with the specified degree of compaction and moisture content in accordance with

FDOT Specification Section 200-6.4. for subbase and FDOT Specification Section 160-7 for subgrade. Testing will be performed according to requirements outlined in FDOT Standard Specifications for Road and Bridge Construction Section 330.

C. Referenced Standards:

1. ASTM International (ASTM):

- a. D1557, Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.5-kg) Rammer and 18-in (457-mm) Drop
- b. D2922, Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- c. D3017, Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

D946, Penetration-Graded Asphalt Cement for Use in Pavement Construction.

2. Florida Department of Transportation

3. Asphalt Institute

- a. MS-2, Mix Design Methods for Asphalt Concrete and Other Hot Mix Types
- b. MS-3, Asphalt Plant Manual
- c. MS-8, Asphalt Paving Manual
- d. MS-19, Basic Asphalt Emulsion Manual

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials shall conform to Florida Department of Transportation Flexible Pavement Design Manual, Revised March 2008 and as indicated on the Contract Drawings.

- 1. Aggregate Road Base: Aggregate road base shall be limerock, 3/4-inch maximum grading conforming to FDOT Section 911.

Liquid Asphalt: Liquid asphalt for tack coats base shall be Type RS-1 or RS-2 and shall comply with FDOT Section 300. Liquid asphalt for prime coats on the aggregate road base shall be Type RC-70 or RC-250 and shall comply with FDOT Section 300.

2. Asphalt Concrete: Asphalt concrete shall be Superpave SP-12.5, Traffic Level C in accordance with FDOT Section 334.
3. Refer to Section 02765 for roadway striping material.

PART 3 EXECUTION

3.01 PAVEMENT REMOVAL

- A. General:
 1. Cut any existing pavement to neat lines at the tie in of the proposed road to existing paved perimeter road.
 2. Remove pavement to final pavement restoration pay-line widths as shown on the Drawings.
 3. If pavement is removed or disturbed for a greater width without written authorization of the Engineer, the Owner will require the Contractor to replace such pavement without compensation.
- B. At joints between existing pavements and new paving work, a PG binder tack coat material shall be applied for adequate bonding.

3.02 AGGREGATE BASE PLACEMENT

- A. Subgrade: Areas to be improved shall be graded and well-compacted in accordance with paragraph 02200-3.06. Where indicated on the plans, the subgrade shall be treated with a stabilizing material (if necessary) for Type B stabilization (LBR 40) in accordance with FDOT Section 160.
- B. Aggregate Road Base: Placing of aggregate road base shall comply with FDOT Section 200. The aggregate road base shall be placed in multiple lifts. Relative compaction of each lift shall be a minimum of 98 percent of the maximum dry density as determined using methods set forth in ASTM D1557.
- C. Primed Aggregate Road Base: The aggregate road base shall be given a prime coat with liquid asphalt as specified and in conformance with FDOT Section 300.
- D. Prime coat shall be applied to the aggregate base prior to the placement of asphalt concrete pavement. The material shall be applied at a rate of no less than 0.15

gallons per square yard. Any prime coat material that has not penetrated the aggregate road base shall be “blotted” with clean dry silica sand.

3.03 ASPHALT CONCRETE PAVEMENT

- A. Placement of asphalt concrete pavement shall comply with Orange County Standards and FDOT Specification Section 330.
1. Cleaning and Base: Before any bituminous material is applied, all loose material, dust, and foreign material which would prevent proper bond with existing surface shall be removed for the full width of the application. Particular care shall be taken to clean the outer edges of the strip to be treated in order to insure that the prime or tack coat will adhere. Where the prime or tack coat is applied adjacent to curb and gutter or valley gutter, such concrete surfaces are to be protected and kept free of bituminous material.
 2. Preparation
 - a. Primer: The surface to be primed shall be clean and free of standing water. For limerock road bases, the glazed finish shall have been removed leaving a granular or porous condition that will allow free penetration of bituminous material. The temperature of the prime material shall be between 100 degrees F and 150 degrees F. The actual temperature will be that which will insure uniform distribution. The amount of bituminous material applied shall be not less than 0.10 gallon per square yard for limerock base and not less than 0.15 gallon per for sand clay, soil cement, or shell base.
 - b. A light uniform application of clean sand shall be applied prior to opening the primed base to traffic, in which case the sand shall be rolled with a traffic roller. If warranted by traffic conditions, the application shall be made only on one-half of the width of the base at one time, care being taken to secure the correct amount of bituminous material at the joint. The base shall be sufficiently moist in order to obtain maximum penetration of the asphalt.
 - c. Tack Coat: Where a bituminous surface is to be laid a tack coat shall be applied as herein specified. On newly constructed base courses the application of the tack coat shall follow the application of the prime coat, immediately prior to placing the wearing surface. The tack coat shall be applied with a pressure distributor. The bituminous material shall be heated to a suitable consistency as designed. The bituminous material shall be applied at the rate between 0.02 gallon and 0.08 gallon per square yard. The tack coat shall be applied sufficiently in advance of the laying of the wearing surface to permit drying but

shall not be applied so far in advance or over such an area as to lose its adhesiveness as a result of being covered with dust or other foreign material and shall be kept free from traffic until the wearing surface is laid.

- d. Seal Coat: Apply seal coat to surface course in accordance with AI MS-19 and FDOT standards.

3.04 CLEAN-UP AND MAINTENANCE

- A. Immediately after placement, protect pavement from mechanical injury for 3 days.
- B. During construction, surfaces of all areas including, but not limited to, roads shall be maintained on a daily basis to produce a safe, desirable, and convenient condition.
 - 1. Roads shall be swept and flushed after backfilling, and re-cleaned as dust, mud, stones and debris caused by the work, or related to the work again accumulates.
 - 2. Failure of the Contractor to perform this work shall be cause for the ENGINEER to order the work to be done by others, and backcharge all costs to the Contractor.
- C. Repair or Correction of Unsatisfactory Conditions: All unsatisfactory conditions, as determined by the Engineer, resulting from the work shall be corrected.
- D. Any subnormal or dangerous condition caused by the work, on any surface, shall be repaired or corrected within two hours of observance or notification of its existence. If repairs or corrections are not made within this period, the Owner shall cause to have the work completed with the resulting cost subtracted from the Contractor's next monthly payment request. Any such costs shall be deemed a reduction in the total amount due the Contractor under the contract and no subsequent reimbursement shall be made to the Contractor by the Owner for these costs.

END OF SECTION

SECTION 02221

EXCAVATION, BACKFILL, FILL AND GRADING

PART 1 - GENERAL

1.01 SUMMARY

- A. The Work specified in this section includes excavating, trenching, shoring, transporting, stockpiling, placing, backfilling, compacting, grading, disposing materials, field testing, and quality control/quality assurance laboratory services required for the construction as shown on the Drawings and in the Specifications.
- B. Excavation, backfilling, samples, and testing shall be performed by the Contractor when the Owner's representative is present. A minimum of 24-hours prior notice shall be given to the Owner's and Engineer.
- C. Excavated material that does not contain refuse, as determined by the Engineer, may be used as general backfill if it meets the requirements of this Section. Excavated fill that contains waste will be stockpiled onsite in a location as designated by the Owner.
- D. Upon identification, the Contractor shall notify the Engineer in writing if the site conditions encountered during construction differ from that indicated on the Drawings. Notification shall include an explicit description of the differences.

1.02 QUALITY CONTROL

- A. Construction Quality Control (CQC) will be performed by an independent geotechnical consultant retained by the Owner in accordance with Section 01400. The CQC Consultant shall oversee all geotechnical activities and the quality control testing as specified herein. The CQC Consultant shall prepare a final report certifying the geotechnical activities performed on this project are in accordance with the Contract Documents. The final report shall be signed and sealed by a professional Engineer licensed in the State of Florida.

1.03 SUBMITTALS

- A. Health and Safety Plan:
 - 1. The Contractor shall submit to the Engineer for review a Health and Safety Plan as described in Section 01800 Health and Safety.
 - 2. The review of the Health and Safety Plan by the Engineer shall be for method only. The Contractor shall retain responsibility for the application, adequacy and safety of the methods. However, construction

shall not begin until the Health and Safety Plan has been submitted and reviewed by the Engineer.

B. Excavation Plan:

1. Prior to beginning Work, the Contractor shall provide a detailed excavation plan for addressing excavation, backfilling, compacting, and grading construction.
2. Plan shall include methods of excavation, slope stabilization, shoring, dewatering, and backfilling techniques.
3. Plan shall address safety issues in consideration of OSHA, Federal, State, and local safety requirements.
4. Plan shall include temporary controls for stormwater runoff and erosion control in full conformance with all existing permits.
5. Plan shall be submitted to the Engineer prior to starting construction activities.

C. For all borrow sources, the Contractor shall notify the Engineer in writing of the material source for each soil type specified within Part 2 of this Section at least 15 calendar days prior to the date of anticipated use of such material. Notification shall include:

1. Supplier's name.
2. Borrow location.
3. Documentation confirming adequate quantities are available to complete the Work.

1.04 NOTIFICATION

- A. Upon identification, the Contractor shall notify the Engineer in writing if the site conditions encountered during construction differ from that indicated on the Drawings. Notification shall include an explicit description of the differences.
- B. In the event municipal solid waste (MSW) is inadvertently excavated or disturbed, the Contractor shall notify the Engineer immediately.

PART 2 - PRODUCTS

2.01 GENERAL FILL SOIL MATERIALS

- A. Soil material may be reused for general fill provided it is free of sticks, roots, organic matter, MSW, and stones larger than 1-inch in any dimension. Remove any material that cannot be made to compact readily and replace with suitable material.
- B. Material shall be well-graded (SW), poorly graded (SP) or clayey sands (SC) as classified by the Unified Soil Classification System (USCS), or other soil as approved by the Engineer.

2.02 SUBGRADE SOIL MATERIALS

- A. Subgrade soils are natural, in-place materials. Soils shall be well-drained soil fill material reasonably free of sticks, roots, debris, organic matter, and MSW. Contractor shall remove material that cannot be made to compact readily and replace with Engineer approved fill.
- B. Soils which yield or exhibit pumping due to excessive moisture shall be excavated and replaced with general fill or materials as approved by the Engineer.

2.03 STRUCTURAL FILL

- A. Soil for structural fill use shall be well-drained, free of sticks, roots, organic matter, MSW, stones larger than 1-inch in any dimension, and should have a uniform composition. Acceptable soil types, as classified by the Unified Soil Classification System (ASTM D 2487), well-graded (SW), poorly graded (SP) or clayey sands (SC), or Engineer approved. For soils with Atterberg limits, Liquid Limit shall be less than 30 with a Plasticity index greater than 10.

2.04 TOPSOIL

- A. Material shall be fertile, natural soil, typical of the locality, free from MSW, stones (exceeding 2-inch in any dimension), roots or sticks (exceeding 1-inch diameter), clay, and weeds, and obtained from naturally well drained areas. It shall not be excessively acid or alkaline nor contain material harmful to plant growth. The material shall comply with the requirements of FDOT's Standard Specifications for Road and Bridge Construction, latest edition, for Topsoil.

2.05 QUALIFICATION TESTS

- A. Prior to placement, soils shall be tested in accordance with Table 02221-1 by the Owner's independent soil laboratory in accordance with Section 1400 Quality Control and Part 1.02 of this Section.
- B. Composite soil samples are not allowed.

- C. Testing shall be repeated every 5,000 cubic yards (in-place) or one every change in borrow source or material or upon direction of the Engineer.

TABLE 02221-1. SOIL QUALIFICATION TESTING

Material	Test	ASTM No.
General Fill	Standard Proctor	D698
	Soil Classification	D2487
	Sieve Analysis	D422
	Atterberg Limits	D4318
	Moisture Content	D2216
Subgrade	Modified Proctor	D1557
	Soil Classification	D2487
	Sieve Analysis	D422
	Atterberg Limits	D4318
	Moisture Content	D2216
	LBR Test Results	LBR of 40 Minimum
Structural Fill	Modified Proctor	D1557
	Soil Classification	D2487
	Sieve Analysis	D422
	Atterberg Limits	D4318
	Moisture Content	D2216
	LBR Test Results	LBR of 40 Minimum
Topsoil	Soil Classification	D2487

PART 3 - EXECUTION

3.01 EXCAVATION

- A. The Contractor shall conduct excavation activities according to the requirements below:
1. Layout all excavations and establish grades as shown on the Drawings. Replace existing survey markers at original location if disturbed or destroyed. Layout work shall be performed by a licensed land surveyor registered in the State of Florida.
 2. Excavation and backfilling shall be performed by the Contractor only when the Owner's representative is present. A minimum of 24-hours prior notice shall be given to the Engineer.
 3. Provide drainage at all times during construction by shaping excavated areas and maintaining ditches and drains. Protect graded areas against action of

elements. Re-establish grade where settlement, washouts, or erosion damage occurs. Damaged areas shall be repaired at no additional cost to the Owner.

4. When excavation has reached prescribed depths, the Engineer shall be notified that an inspection of the excavation may be performed.
5. If the bottom of any excavation is removed below the limits shown on the Drawings or as directed by the Engineer, it shall be backfilled at the Contractor's expense with material approved by the Engineer.
6. The Contractor shall not leave any excavations or trenches open at the completion of work each day. All open holes shall be backfilled flush with existing grade, or covered at the Engineer's direction, with acceptable material prior to the Contractor leaving the site.
7. All excavations shall conform to the Health and Safety Plan or submitted as described in Section 01800 - Health and Safety Requirements or Excavation Plan references on page 02221-2.

3.02 STOCKPILE OF MATERIALS

- A. Excavated materials shall be transported to a stockpile area designated by the Owner. Excavated materials may be segregated during excavation and the Owner shall direct locations for segregated materials.
- B. Stockpiles shall be graded to allow for stormwater run-off. Areas around the stockpiles shall be graded to divert stormwater run-on from the stockpile areas. Silt fences shall be installed and maintained around the perimeter of all stockpiles.
- C. The Contractor shall be responsible for vehicle traffic safety and shall coordinate with the Engineer to determine site-specific safety concerns.
- D. The Contractor shall sweep or wash paved roadways that become covered with soil. The Contractor shall provide all equipment, water, and personnel necessary to clear the paved roads. This activity shall be performed at a minimum of once per week or as the Engineer directs.

3.03 PLACEMENT OF GENERAL FILL

- A. Place fill materials, and backfill to the lines and grades shown on Drawings.
- B. Materials excessively wet or dry are unsuitable. Allow such material to dry, or moisten, as required, to bring material into a workable condition.

- C. The Contractor shall comply with minimum compaction criteria as contained within Table 02221-2 of this Section.
- D. In cuts, all loose or protruding rocks on the excavated side-slopes shall be loosened and removed to line or finished grade of slope. All cut and fill slopes shall be as shown on the Drawings or as directed by Engineer.
- E. Maintain proper drainage during grading operations until final acceptance. Repair any fill or grading materials which may be lost or displaced as a result of natural causes such as storms, squalls, etc. or as a result of movement, consolidation or settlement of the ground. Repair shall be performed at no additional cost to the Owner.

3.04 PLACEMENT OF STRUCTURAL FILL

- A. Prior to placement of structural fill, the Contractor shall prepare the project site in accordance with 02110 - Site Clearing and Grubbing.
- B. Placement of structural fill surrounding the geogrid layers shall be in accordance with the geogrid Manufacturer and the Geotechnical Report contained in Appendix B.
- C. Prior to placement of approved structural fill, the exposed subgrade should be proof-rolled. The proof rolling would typically consist of rolling all areas with ten complete passes of a vibratory steel drum roller with a minimum static weight of 20,000 pounds. The later five passes should be at right angles to the previous passes. Care shall be taken when selecting construction equipment sizes and the amount of traffic on the subgrade. Excess surface moisture can cause pumping and deterioration of the near surface soils.
- D. Materials excessively wet or dry are considered unsuitable.
- E. Soils which yield or exhibit pumping due to excessive moisture under this operation shall be excavated and replaced with approved material per this Section and the Geotechnical Report.
- F. Following proofrolling of the exposed subgrade soils, a density equivalent to at least 95% of the modified proctor maximum dry density (ASTM D 1557) should be achieved. Proofrolled areas should be compacted to a depth of at least 12 inches below the surface. Density tests should be performed on the compacted proofrolled soils. One in-place density test should be performed for each 2,500 square feet of proof-rolled soils. The proof-rolled area shall be accepted by the Engineer prior to structural fill placement. The Contractor shall comply with minimum compaction criteria as contained within Table 02221-2 of this Section.

- G. After site preparation, and acceptance by the Engineer, approved structural fill shall be placed in loose lift thicknesses no greater than 12 inches on the prepared subgrade as needed. Compaction shall be accomplished by mechanically compacting each 12 inch lift. The mechanical compacting would typically consist of proof rolling all areas with ten complete passes of a vibratory steel drum roller with a minimum static weight of 20,000 pounds. The later five passes should be at right angles to previous passes. Care shall be taken when selecting construction equipment sizes and the amount of traffic. Excess surface moisture can cause pumping and deterioration of the near surface soils.
- H. The Contractor shall comply with minimum compaction criteria for each 12 inch structural fill lift as contained within Table 02221-2 of this Section. Compaction is not recommended near existing structures.
- I. Each compacted structural fill layer should be compacted to at least 95% of the modified proctor maximum dry density and shall be accepted by the Engineer for the appropriate specified density prior to beginning the next layer. The filling and compaction operations should continue in 12 inch lifts and 2,500 square feet of fill soils until the desired elevation is achieved.
- J. Maintain proper drainage during grading operations until final acceptance. Repair any fill or grading materials which may be lost or displaced as a result of natural causes such as storms, squalls, etc., or as a result of movement, consolidation or settlement of the ground or foundation with acceptable material. Repair shall be performed at no additional cost to the Owner.

3.05 PLACEMENT OF TOPSOIL FINAL GRADING

- A. Grading in preparation of topsoil application shall be performed to the lines, grades, and elevations shown in the Drawings.
- B. Materials excessively wet or dry are unsuitable. Allow such material to dry, or moisten, as required, to bring material into a workable condition.
- C. Maintain proper drainage during grading operations until final acceptance. Repair any fill or grading materials that may be lost or displaced as a result of natural causes such as storms, squalls, etc.
- D. The Engineer reserves the right to make adjustments or revisions to plans as the work progresses to achieve the intent of the design.
- E. All backfilled and/or regraded slopes shall be uniformly dressed to the grades shown on the Contract Drawings.

3.06 TESTING REQUIREMENTS DURING PLACEMENT

- A. The Contractor shall place backfill and fill materials to achieve an equal or “higher” degree of compaction than undisturbed materials adjacent to the Work; however, in no case shall the degree of compaction fall below minimum compaction specified in Table 02221-2 of this Section.
- B. The location of field moisture-density tests for this Section shall be selected and approved by the Engineer.
- C. Composite soil samples are not allowed.

3.07 TOLERANCES

- A. The Contractor shall bring final grading to within the tolerance specified in Section 01050 - Site Conditions Survey.

3.08 DISPOSAL OF SURPLUS AND UNSUITABLE MATERIALS

- A. All suitable materials removed from excavation and grading activities meeting the Project Specifications shall be reused and incorporated into the Project.
- B. An on-site disposal area will be provided by the Owner for the Contractor’s use for disposal of waste materials not incorporated into the Project at no disposal fee to the Contractor.
- C. The Contractor shall be responsible for loading waste materials not incorporated into the Project through the existing scale at the facility and then to the existing Porter Transfer Station tipping floor. The Owner will not charge the Contractor a tipping fee, but the Contractor shall be responsible for excavating and loading the material. At no time shall excavated waste be stockpiled adjacent to the excavations after normal working hours.
- D. The Contractor shall coordinate disposal activities with Owner and shall not interfere with on-going transfer station operations activities. Materials shall be placed at the designated disposal site. Disposal of all surplus and unsuitable materials shall be onsite as designated by the Owner at no expense to the Contractor.
- E. Materials shall be stored in an area of sufficient distance from excavations to not create a surcharge loading adjacent to any excavation.

3.09 DUST CONTROL

- A. The Contractor shall limit airborne dust by spraying water over the construction area, or as directed by the Engineer.

TABLE 02221-2 - COMPACTION CRITERIA

LOCATION	MINIMUM COMPACTION	MINIMUM TESTING FREQUENCY
1. General Fill	95% of maximum dry density within 3 percent of optimum moisture content (ASTM D 698).	As required.
2. Subgrade	12 inches in place material (minimum LBR 40) compacted to a minimum of 95% of its modified proctor maximum dry density (ASTM D-1557 or AASHTO T-180).	2 drive-sleeves of the compacted material for percent compaction and moisture content (ASTM D 4564).
5. Structural Fill	12 inches in place material compacted to a minimum of 95% of its modified proctor maximum dry density (ASTM D-1557 or AASHTO T-180).	1 nuclear densiometer test per every lift (12 inch compacted thickness) (ASTM D 2922 & D 3017) and 2,500 square feet of fill soils.

END OF SECTION

SECTION 02510

POTABLE WATER PIPELINE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to perform all work and services for completing the construction of potable water pipeline as shown on the Drawings and described in the specifications, in accordance with provisions of the Contract Documents. The Contractor shall procure all permits required by law and shall comply with all federal, state, and local laws and ordinances relating to the performance of the work.
- B. The work shall include, but not necessarily be limited to excavation, installation of piping, valves and fittings, connections to existing well piping, disconnect of existing pipeline and capping old well piping, backfill of the trench, and hydrostatic testing.
- C. Construction shall be in conformance with the construction guidelines of "Orange County Utilities Standards and Construction Specifications Manual" (OCU Manual), most recent version. If there exists a conflict between the requirements of the OCU Manual and the Contract Documents, the stricter requirement shall take precedence.

1.02 SUBMITTALS

- A. Shop drawings for pipe, valves, and fittings.
- B. Do not incorporate materials in construction until approved by the Engineer.
- C. Guarantee: Furnish copies of manufacturer/supplier warranties or guarantees for all products provided under this specification

1.03 REFERENCE

- A. Orange County Utilities Standards and Construction Specifications Manual
February 11, 2011
 - 1. Section 2210 Water Main Design Standard
 - 2. Section 3113 Excavations, Backfill, Compaction and Grading
 - 3. Section 3114 Installation of Pipe
 - 4. Section 3210 Water Pipes, Valves, and Appurtenances

5. Section 4210 Testing and Inspection for Acceptance of Water Systems
- B. American Society for Testing and Materials (ASTM)
1. ASTM D 1784 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
 2. ASTM D 1785 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 3. ASTM D 2467 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
 4. ASTM D 2564 Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
 5. ASTM D 3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
- C. American National Standard Institute (ANSI)
1. Code for Pressure Piping, Appendix N

PART 2 - PRODUCTS

2.01 PVC PIPE

- A. PVC water distribution mains shall be manufactured in accordance with AWWA standard C900 or C909, latest edition. Pipe shall have a minimum pressure rating of 150 psi and have a maximum dimension ratio of 18. Pipe shall be blue in color.
- B. Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant, and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel. Pipe, which is not clearly marked, is subject to rejection.
- C. All pipe not factory color-coded shall have a field applied, three inch wide blue stripe down the length of the pipe.

2.02 PVC PIPE JOINTS

- A. PVC pipe shall have integral bell push on type joints conforming to ASTM D3139.

2.03 PVC PIPE JOINTS

- A. Fittings shall be in accordance with Section 3114 Installation of Pipe. All potable water main fittings shall have NSF 61 certification, and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water Applications.

2.04 ALTERNATIVE PIPING MATERIALS

- A. Alternative piping materials will be considered by the Owner if proper testing documentation, performed by recognized piping industry authorities, is submitted for review to the County prior to commencement of design. Tests on alternative piping materials should be at least as rigorous as testing conducted by ASTM, AWWA and ANSI. A letter of variance must be issued by Orange County Utilities prior to commencement of installation of any alternative material.

PART 3 - INSTALLATION

3.01 CONNECTION TO EXISTING WATER MAINS

- A. The Contractor shall make the connection while the line is in service by using a tapping sleeve or tapping saddle as appropriate. The tapping of the main shall be done using standard tapping techniques as approved by the Owner. The water mains shall be tapped in such a manner that the operation of the main in service is not disturbed and so that the potable water supply is not contaminated. Prior to making the tap, the Contractor shall assemble all materials, tools, equipment, labor and supervision necessary to make the connection.
- B. All connections to existing pipes shall be made under the direct supervision of the Orange County Utilities. Valves on existing mains shall be operated by Utilities personnel or under direct supervision.

3.02 HYDROSTATIC AND LEAKAGE TEST

- A. Water mains shall be tested as a whole or in sections between valves. The mains shall be tested in accordance with Section 4, Hydrostatic Testing, AWWA C600-87 under an average hydrostatic pressure of not less than 150 pounds per square inch for a minimum of 2 hours. All valves shall be tested for secure closure.
- B. All pumps, gauges and measuring devices shall be furnished, installed and operated by the Contractor and all such equipment and devices and their installation, shall be approved by the Owner's Inspector. All water for testing and flushing shall be potable water provided by the Contractor, at no cost to the Owner, from a source approved by the Engineer. The quantity used, which shall

be compared to the allowable quantity, shall be measured by pumping from a calibrated container, and approved by the Owner's Inspector.

- C. All restraint sections of the buried main shall be completely backfilled before such sections are tested.
- D. When leakage occurs in excess of the specified amount, defective pipe, pipe joints or other appurtenances shall be located and repaired at the expense of the contractor. If the defective portions cannot be located, the contractor, at his own expense, shall remove and reconstruct as much of the original work as necessary to obtain a water main within the allowable leakage limits upon retesting.
- E. All valves and appurtenances shall be hydrostatically tested and sterilized with the line in which they are installed.
- F. All pressure and leakage testing shall be done in the presence of the County Inspector and the Engineer of Record or his designated representative.

3.03 WATER PRESSURE TESTING AND CHLORINATING

- A. The Contractor shall conduct testing of installed pipe in accordance with Section 4210 Testing and Inspection for Acceptance of Water Systems of the "OCU Standards and Construction Manual." After testing, the line shall be thoroughly flushed until water samples show a chlorine content equal to or less than the existing system.

3.04 PIPE, FITTINGS, VALVES AND APPURTENANCES

All piping, fittings valves and appurtenances shall meet Orange County Utilities (OCU) specifications and shall be from the OCU acceptable materials list. Where other materials that are not on the acceptable materials list they shall be approved on a case by case basis by the Engineer and the Owner after a submittal describing the material's use and reason for not using a County approved product if available.

3.05 POLYVINYL CHLORIDE PIPE AND FITTINGS

- A. All PVC water mains shall have a suitable electronic locator tape buried approximately one foot below grade over the water main. The tape shall be continuous between valves and secured to each valve. The tape shall be at least 5 mils thick, 2-inch minimum width and made with an aluminum material sandwiched between 2 layers of polyethylene. It shall have imprinted in permanent black ink with 1-inch letters "CAUTION WATER MAIN BURIED BELOW" on blue background. Tapes shall be electronically detectable tape.
- B. All PVC pipe shall bear the approval seal of the National Sanitation Foundation (NSF) that will remain legible during normal handling, storage, and installation. PIPE COLOR SHALL BE BLUE FOR WATER MAINS.

1. Water Pipe
 - a. All PVC pressure pipe smaller than 2 inches in diameter shall conform to the requirements of ASTM D1785, latest revision, Class 1120 or 1220, Schedule 80 pipe with a minimum pressure rating of 200 psi at 23° C (73.4° F), for unthreaded pipe.
 - b. All PVC pressure pipe 2 inches and 3 inches in diameter shall conform to the requirements of ASTM D2241, latest revision, Class 1120 or 1220 (SDR 21) for a minimum pressure rating of 200 psi at 23° C (73.4° F), for unthreaded pipe.
 - c. All PVC pressure pipe 4 inches through 12 inches in diameter shall conform to the requirements of AWWA Standard C900. It shall have the same O.D. as ductile iron pipe and be compatible for use without special adapters with ductile iron fittings. The pipe shall conform to these standards: pipe dimension ratio (DR) of 18, working pressure of 150 psi, and laying length of 20 feet.
 - d. All PVC not buried shall be formulated for sunlight exposure and shall pass the impact strength test as described by ASTM D2444, latest revision, using TUP A with impact level of 94 ft.-lbs.
2. Fittings
 - a. Fittings for PVC pipe 3 inches and smaller shall be schedule 80 PVC with solvent welded or threaded joints and conform to the requirements of ASTM D2467, and D2464, respectively.
 - b. Fittings for PVC pipe 4 inches through 12 inches shall be ductile iron fittings. Ductile iron fittings shall be mechanical joint with a minimum pressure rating of 250 psi, and shall conform to the requirements of ANSI Standard A21.10 and A21.4.
 - c. All PVC pipe fittings shall bear the approval seal of the National Sanitation Foundation (NSF) for potable water pipe.
3. Joints
 - a. All PVC pipe 4 inches through 12 inches shall have provisions for expansion and contraction provided in the joints. All joints shall be designed for push-on makeup connection. A push-on joint may be coupling manufactured as an integral part of the pipe barrel consisting of a thickened section with an expanded bell with a groove to retain a rubber sealing ring of uniform cross-section similar and equal to Johns-Manville Ring-Tite, or may be made with a separate twin gasketed coupling similar and equal to Certainteed Fluid- Tite.

- b. Joints in PVC pipe 3 inches and smaller shall be solvent welded in accordance with the recommendations of the pipe manufacturer using the solvent welding compound non-sulphur based, furnished with the pipe, or shall be threaded joints between PVC and metal pipes, the metal shall contain the socket end and the PVC side the spigot. A metal spigot shall not, under any circumstances, be screwed into a PVC socket.
4. Restrained Joints
- a. Restrained joints for PVC pipe shall be Uni-Flange Series 1350 for PVC-PVC Joints and Uni-Flange Series 1300 for PVC ductile-iron mechanical joint fittings.
 - b. The length of pipe to be restrained shall be noted on the Drawings. Shop drawings from the manufacturer shall be submitted to and approved by the Engineer prior to actual construction.

3.06 VALVES:

- A. All valves shall be the manufacturer's standard design for the service intended and shall bear the maker's name and pressure rating cast on the body, also the valve type, size, flow direction arrow, if applicable. Valves shall open left (counter clockwise) with an arrow cast in the metal of operating handwheels or nuts indicating the direction of opening. All valves 3" and larger, for buried service, shall have mechanical joints.
- 1. Globe Valves
 - a. Valves 3" inches and smaller shall be bronze body, Class 125, Globe-type valve with inside screw, non-rising stem hand wheel operator and brass disc, manufactured by Stockham or approved equal.
 - 2. Gate Valves
 - a. All valves 4 inches through 12 inches in size shall be resilient seated gate valves. Valves 14 inches and 16 inches in size shall be resilient seated gate valves or butterfly valves.
 - b. Buried gate valves 4 inches through 16 inches in size shall be resilient seated, non-rising stem type with 2 inch operating nuts and shall conform to AWWA Standard C509.
 - c. Gate valves shall not be installed where valves are larger than 16 inches in size. Gate valves, unless otherwise specified or approved, shall be iron body, bronze trimmed, solid wedge,

resilient seat with epoxy coating or other synthetic elastomer coated gate valves with mechanical joint ends conforming to the AWWA “Standard Specification for Resilient Seated Gate Valves Water and Sewerage Systems, Designation C509”, insofar as applicable, and be no smaller than 4 inches minimum. Valves shall have a working pressure of 200 psi. Stuffing boxes shall be of the O-ring type. Valves shall be “Ken-Seal” as manufactured by Kennedy, “Metroseal” by U.S. Pipe, or approved equal.

- d. Exposed valves shall be outside screw and yoke type, flanged. Valve body and bonnet shall be coated on all exterior and interior surfaces with a fusion-bonded epoxy which meets or exceeds AWWA C550.
- e. Stuffing box follower bolts shall be of grade 304 stainless steel and the stem nut shall be of bronze. Gate valves less than 4 inches in size shall be all bronze valves and shall conform to the requirements of Federal Specification WW-V-54, Type 1, Class A.

- END OF SECTION -

SECTION 02600

STORMWATER STRUCTURES, PIPE, AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work covered in this Section includes furnishing and construction of stormwater culverts, stormwater inlet structures, stormwater outlet structures, grates, endwalls and other drainage structures shown on the Contract Drawings.

1.02 SUBMITTALS

- A. Product Data: Submit data indicating structure material, dimensions, reinforcement, grating and connection accessories.
- B. Manufacturer's Certificate: Certificates of Compliance with these Specifications shall be submitted for all materials that the products meet or exceed specified requirements.

1.03 CONSTRUCTION QUALITY ASSURANCE

- A. Construction of stormwater culverts, stormwater inlet structures, stormwater outlet structures, grates and other drainage structures shall be in accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.
- B. The existing stormwater drainage system shall remain operational during the duration of the Project.
- C. The Contractor shall verify field measurements and elevations are as indicated on the Contract Drawings.

PART 2 - PRODUCTS

2.01 REINFORCED CONCRETE PIPE

- A. The Contractor must furnish reinforced concrete pipe (RCP) unless specified otherwise on the Contract Drawings.
- B. RCP shall be a minimum of Class III with rubber gasket joints as designated in ASTM C76.
- C. RCP shall conform to the requirements of the Florida Department of

Transportation Standard Specifications for Road and Bridge Construction, latest edition, Section 941.

- D. RCP gaskets shall conform to the requirements of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, Section 942.
- E. RCP joint materials shall conform to the requirements of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, Section 430-7.

2.02 COLLECTION AREA INLETS AND OUTLET STRUCTURES

- A. The Contractor shall provide ditch bottom inlets where indicated on the Contract Drawings with steel grates in accordance with the Florida Department of Transportation Roadway and Traffic Design Standards, latest edition, Index No. 232 Type C and D.
 - 1. Ditch Bottom Inlet - FDOT Index No. 232 Type C and D with steel grate.
 - a. Pipe inlet and outlet holes to be cut in the field or precast to custom fit this application.
- B. The Contractor shall provide Type U concrete endwall with baffles where indicated on the Contract Drawings in accordance with the Florida Department of Transportation Roadway and Traffic Design Standards, latest edition, Index No. 261.
- C. Castings for inlets and other items shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength or otherwise make them unfit for the service intended. No plugging or filling will be allowed.
- D. Cast-in-place concrete inlets, endwalls, or other structures shall be constructed in conformity with the Contract Drawings. Forms shall be designed and constructed so that they may be removed without injury to the concrete, and shall be left in place for at least twenty four hours after concrete is poured.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Drainage structures, pipes, grates, and accessories shall be constructed at the locations shown on the Contract Drawings.
- B. Set inlets and pipe inverts at elevation per Contract Drawings.

- C. Verify excavation is ready to receive Work and excavations, dimensions, and elevations are as indicated on Contract Drawings.
- D. Before installation of the pipe gasket, the gasket and the surface of the pipe joint, including the gasket recess shall be clean and free from grit, dirt, or other foreign matter at the time the joints are made.
- E. All pipes shall be laid with bells or grooves uphill. As the pipes are laid throughout the Work, they must be thoroughly cleaned and protected from dirt and water. No length of pipe shall be laid until the two preceding lengths have been thoroughly embedded in place so as to prevent any movement or disturbance of the finished joint.
- F. All pipes shall be carefully laid true to the line and grade shown on the Contract Drawings. Any deviation from true alignment or grade which would result in a displacement from the normal position of the gasket as much as 1/4 inch, or which would produce a gap exceeding 1/2 inch between sections of pipe for more than 1/3 of the circumference of the inside of the pipe, will not be acceptable and where such occurs, the pipe shall be relayed without additional compensation. No mortar, joint compound, or other filler which would tend to restrict the flexibility of the gasket joint shall be applied to the gap.
- G. Fill placed around the pipe shall be deposited on both sides simultaneously to approximately the same elevation and uniformly compacted. Whenever the pipe laying is discontinued, as at night, the unfinished end is to be securely protected from displacement due to caving of the banks or from other injury.

3.02 BEDDING AND COVER MATERIALS

- A. Bedding shall conform to Specification 02221 - Excavation, Backfill, Fill and Grading.
- B. Backfilling for pipes shall conform to Specification 02221 - Excavation, Backfill, Fill and Grading.
- C. Density testing for pipes shall conform to Specification 02221 - Excavation, Backfill, Fill and Grading.

3.03 QUALITY CONTROL

- A. When tests indicate Work does not meet specified requirements, the Contractor shall remove the Work, replace, and retest.

END OF SECTION

SECTION 02630

STORMWATER UTILITY DRAINS (TRENCH DRAIN SYSTEM)

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Selection, necessary work and installation of modular precast trench drain systems at locations shown on site drawings.

1.02 RELATED SECTIONS

- A. Structural Drawings
- B. Section 02221 Excavation, Backfill, Fill and Grading
- C. Section 02600 Stormwater Structures, Pipe, and Fittings

1.03 SUBMITTALS

- A. Thirty days prior to the delivery of the geogrid to the site the following information shall be submitted to the Engineer for review:
 - 1. Product data and drawings including layout, profiles, components, and accessories.
 - 2. Manufacturer's qualifications.
 - 3. Manufacturer's recommended installation methods including anchorage.
 - 4. Loading, unloading, and storage recommendations.
- B. Quality Assurance Submittals: upon request submit the following:
 - 1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties. Reports shall be stamped by a licensed Professional Engineer.
 - 2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- C. Manufacturer warranty documents.

PART 2 - PRODUCTS

2.01 HHW BUILDING TRENCH DRAIN

- A. Manufacturer: ZURN 12” Perma-Trench Z882 Concrete Drain System or approved equal.
- B. Material: High density polyethylene (HDPE) with heavy duty frame and anchor bolts.
- C. Channels: 12 inch internal width rated for a minimum of 1 cubic feet per second.
- D. Length: Fits particular application
- E. Slope: 1.0% sloped that slopes toward center.
- F. Frames: Ductile Iron Slotted Grate Class E
- G. Grates: Ductile Iron Slotted Grate Class E
- H. Grate Hold-Down Device: bolt
- I. Grate Load Class: Class E - 134,800 lb (600 kN) per DIN / EN 1433.
- J. Outlets: channel bottom drain
- K. Accessories: Bottom dome strainer

2.02 CITIZEN’S DROP-OFF BAY TRENCH DRAIN

- A. Polycast 600 Series Polymer Concrete Drain System or approved equal.
- B. Material: Polymer concrete
- C. Channels: 4.25 inch internal width
- D. Length: Fits particular application
- E. Slope: 0.65% slope
- F. Frames: galvanized steel Polycast DA0620A or approved equal
- G. Grates: Cast iron slotted Polycast DG0641 or approved equal
- H. Grate Hold-Down Device: bolt
- I. Grate Load Class: Class C per DIN / EN 1433.
- J. Outlets: transition to well vault

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

3.02 3.01 MANUFACTURER'S INSTRUCTIONS

- A. Comply with all manufacturer product data, product technical bulletins, product catalog, installation instructions and installation section drawings.

3.03 EXAMINATION

- A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
- B. Notify Engineer of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.04 SITE PREPARATION

- A. Surface Preparation: Ensure ground conditions are suitably constructed according to the Manufacturer's recommendations.
- B. Reinforcement: All reinforcement shall be in compliance with Concrete Reinforcing Steel Institute, as shown on the site drawings, and shall be firmly held in place during concrete placement.

3.05 INSTALLATION

- A. Install precast trench drain per manufacturer installation instructions at locations indicated on the site drawings.
- B. Expansion, Construction and Control Joints: Site plans shall include the location of all concrete joints. The system shall not be used as an expansion, construction or control joint in the direction of flow. Expansion, construction and control joints oriented transverse to the direction of flow shall cross the system at a channel joint.
- C. Precast Trench Drain System Installation: Ensure channels are surrounded on all sides by concrete of minimum 3000 psi (20,684 kPa) compressive strength. Check relevant installation section drawings for minimum suggested dimensions required.
- D. Concrete Edge: Concrete shall be screeded and finished flush to the top surface of the trench drain system. No secondary edge-finishing tools shall be used.

- E. Site Tolerances: Comply with the tolerances shown in Division 2 specifications.
- F. Related Products Installation: Refer to other sections in Related Sections paragraph herein for related products installation.

3.06 FIELD QUALITY CONTROL

- A. Specifier Note: Edit section below. Establish number and duration of periodic site visits with Owner and manufacturer and specify below. Consult manufacturer for services required. Delete section if field service not required.
- B. Inspection:
 - 1. Ensure grates are in correct position and captive.
 - 2. Ensure pipe and outlet connections are cleared and checked.
- C. Manufacturer's Field Services: Provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions:
 - 1. Site Visits: one site visit prior to installation and one site visit following installation.

3.07 CLEANING

- A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

3.08 PROTECTION

- A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION

SECTION 02765

PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. This Section specifies the furnishing and application of permanent thermoplastic traffic stripes and pavement markings where indicated on the Contract Drawings.

1.02 QUALITY ASSURANCE

- A. Thermoplastic pavement markings shall be applied in accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, the Manual of Uniform Traffic Control Devices and the Florida Manual of Traffic Control and Safe Practices for Street and Highway Construction and Supplemental Specifications thereto.

1.03 SUBMITTALS

- A. Submit Certificates of Compliance stating that the materials meet the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, Sections 711 and 971.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Thermoplastic: The thermoplastic compound used shall meet the requirements of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, Section 711.

PART 3 - EXECUTION

- A. Thermoplastic pavement markings shall be applied in accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

END OF SECTION

SECTION 02830

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work under this Section shall consist of the Contractor furnishing all necessary supervision, labor, tools, materials, and equipment to perform all Work in connection with the installation of the chain link fence at the locations as indicated on the Contract Drawings.
- B. The new chain link fences and gates shall be constructed in accordance with the requirements of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, Section 550 "Fencing" for Type B fence.

1.02 SUBMITTALS

- A. The following information shall be provided:
 - 1. Product data in the form of manufacturer's technical data, specifications, and installation instructions for posts, fabric, and accessories.
 - 2. Certificates of Compliance with these Specifications shall be submitted for all materials that the products meet or exceed specified requirements.

1.03 CONSTRUCTION QUALITY CONTROL

- A. Obtain chain link fence as a complete unit, including necessary erection accessories, fittings, and fastenings from a single-source or manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Posts, rails, rods, fittings, and hardware shall be hot-dipped, zinc-coated steel. Repair of damaged galvanized metal to be by Galowelding off site or by cold galvanized high-zinc content paint.
- B. Fence components shall be galvanically compatible.

PART 3 - EXECUTION

3.01 INSPECTION

- A. The Contractor shall examine the site and report in writing to the Engineer any conditions detrimental to the proper and timely completion of the Work.

3.02 SETTING POSTS

- A. Posts shall be spaced as indicated on the Contract Drawings, measured from center to center of posts, and such measurement shall be made parallel to the slope of the ground.
- B. All posts shall be placed in a vertical position, except in unusual locations where the Consultant may direct that the posts be set perpendicular to the ground surface. All posts shall be set in concrete footings conforming to the details shown on the Florida Department of Transportation Roadway and Traffic Design Standards, latest edition, Index No. 802 and crowned at the top to shed water. Fence fabric or wire shall not be attached to the posts until the concrete has cured a minimum of 72 hours.

3.03 INSTALLING FENCE FABRIC

- A. Chain link fence fabric shall be fastened on the outward facing side of the posts, unless otherwise specified by the Engineer. The fabric shall be stretched taut and fastened to the posts. Between posts, the bottom edge of the fabric shall be fastened to the tension wires. The tension wires shall be stretched tight and installed on a straight grade between posts. The distance from the top of the fabric to the top tension wire shall be 2 inches maximum. The top edge of fabric will be fastened to a top rail with expansion sleeves.
- B. The fabric shall be fastened to end, corner, and posts with stretcher bars and stretcher bar bands. Stretcher bar bands shall be spaced at intervals not exceeding 14 inches. The fabric shall be fastened to the line posts and top rail with the wires or post clips spaced at intervals not exceeding 14 inches and to the tension wire with the wires or hog rings spaced at 18 inches center to center.

3.04 COMPLETION

- A. The area of installation shall be left neat and free of any debris caused by the erection of the fence.

END OF SECTION

SECTION 02840

ROADWAY APPURTENANCES

PART 1 - GENERAL

1.01 SUMMARY

- A. The Contractor shall furnish all labor, materials, equipment and incidental work necessary to obtain materials and install all guardrail sections specified here and shown on the Contract Drawings.
- B. The Work specified in this section includes the placement of new guardrail sections on the site as shown on the Contract Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials used for fabrication shall match FDOT Index No. 400 for guardrails and any deviation shall require approval of the Owner or Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

- A. The Contractor shall identify the required lines, levels, contours and datum.
- B. The Contractor shall locate, identify and protect all utilities from damage.
- C. The Contractor shall protect bench marks, existing pipes, structures and fences from excavation equipment and vehicular traffic.

3.02 GUARDRAILS

- A. New guardrail assemblies specified on the Contract Drawings shall conform to Section 536, "Guardrail" Index No. 400, "Guardrail" of the FDOT Specifications, and the site-specific details on the Contract Drawings.

END OF SECTION

SECTION 02890

TRAFFIC SIGNS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. This Section specifies the furnishing and installation of permanent roadway signs, sign supports, reflective sheeting, and their associated hardware.

1.02 QUALITY ASSURANCE

- A. Roadway signs, sign supports, reflective sheeting, and their associated hardware shall be in accordance with the following:
 - 1. The Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.
 - 2. Manual of Uniform Traffic Control Devices for Street and Highway Construction Maintenance and Utility Operations.
 - 3. The Florida Department of Transportation Manual on Traffic Controls and Safe Practices for Street and Highway Construction Maintenance and Utility Operations.
 - 4. Standard Highway Signs Manual published by the U.S. Department of Transportation.
 - 5. Reference Guide: Standard Alphabets for Highway Signs and Pavement Markings, published by the U.S. Department of Transportation.
 - 6. Local governmental agency having jurisdiction, whichever is more stringent.

1.03 SUBMITTALS

- A. Designation of signage will be based on the Contract Drawings. Shop drawings indicating the quantity and locations of signs shall be submitted for review prior to ordering signs.
- B. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

- C. Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, mounting heights, layout, spacing, accessories and installation details.
 - 1. Provide message list for each sign, including large-scale details or wording, lettering, etc.
- D. For each type of sign, include the following samples:
 - 1. Panel Signs: Full-size samples of each type of sign required.
 - 2. Dimensional Characters: Full-size samples of each type of dimensional character (letter and number) required. Show character style, material, finish and method of attachment.
 - 3. Approved samples will be returned to the Contractor for installation into the Project.
- E. Submit certificates stating that the roadway signs, sign supports, reflective sheeting and their associated hardware meet the Specifications of the publications as specified in Section 1.02.A above.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Roadway signs, sign supports, reflective sheeting and their associated hardware shall be in accordance with the requirements of the publications as specified in Section 1.02.A above.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install all roadway signs, sign supports, and their associated hardware in accordance with the requirements of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, the Manual of Uniform Traffic Control Devices and supplemental specifications thereto.

END OF SECTION

SECTION 02900

SEEDING AND SODDING

PART 1 - GENERAL

1.01 GENERAL

- A. The Contractor shall furnish all labor, materials, and equipment necessary to complete the Work specified in this Section to include soil preparation, liming, fertilizing, temporary grass seeding and mulching, sodding, and maintenance of all areas requiring vegetation as shown on the Contract Drawings and as specified herein.
- B. The Contractor shall construct grassing operations in strict conformity with the Contract Documents and in accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

1.02 SUBMITTALS

- A. Materials shall not be used for construction until approved by the Engineer.
- B. Seed: Signed copies of vendor's statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed. Statement shall certify that each container of seed delivered is fully labeled in accord with Federal Seed Act and equals or exceeds specification requirements.
- C. Sod: Prior to placing sod, notify the Engineer of source and permit the Engineer to inspect. Submit documentation from supplier regarding species and percentages of purity.
- D. Fertilizer: Furnish duplicate copies of invoices for all fertilizer used on the Project, along with certification of quality and warranty.
- E. Guarantee: Furnish copies of manufacturer/supplier warranties or guarantees for all products provided under this Section.

PART 2 - PRODUCTS

2.01 TOPSOIL - See Section 02221 - Excavation, Backfill, Fill and Grading.

2.02 SEED

- A. Fresh, clean, new-crop seed labeled in accord with U.S. Department of Agriculture Rules and Regulations and the FDOT Standard Specifications under

the Federal Seed Act in effect on date of bidding. Provide seed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified. Furnish seed in sealed standard containers labeled with producer's name and seed mixture and percentages of purity, germination, and weed seed for each grass seed species required.

Common Name	Minimum Percent Germ.	Minimum Percent Purity	Maximum Percent Weed-Seed
Bahia Grass (Pensacola)	80	95	1.0
Bermuda Grass (Hulled)	85	95	1.0
Top Brown Millet	85	90	1.0
Rye	90	95	1.0

2.03 SOD

- A. Provide dense, strongly rooted Bahia-grass sod less than two (2) years old and free of weeds and undesirable native grasses. Sod shall be certified by the supplier to meet Florida State Plant Board Specifications.

2.04 MULCH

- A. Provide clean, seed-free, threshed straw of oats, wheat, barley, rye, beans, peanuts or other locally available mulch material. Do not use mulch that contains an excessive quantity of matured seeds of noxious weeds, or other species that will grow or provide a menace to surrounding land. Do not use mulch material which is fresh or excessively brittle, or which is decomposed and will smother or retard growth of grass.

2.05 FERTILIZER

- A. Provide commercial fertilizer conforming to FDOT Standard Specifications, Section 982.

2.06 LIMESTONE

- A. Dolomitic limestone shall be an approved product designated for agricultural use.

2.07 SULFUR

- A. Sulfur chips shall be an approved product designated for agricultural use.

2.08 WATER

- A. The water used in the seeding and sodding operations may be obtained from any spring, pond, lake, stream or municipal water system approved of by the Engineer. The water shall be free of excess and harmful chemicals, acids, alkalies, or any substance, which might be harmful to plant growth.

PART 3 - EXECUTION

3.01 GENERAL

- A. Unless otherwise shown on the Contract Drawings, topsoil shall be placed to achieve a minimum topsoil depth of 4-inches in all areas indicated to be sodded.
- B. Mulch material shall be applied uniformly over all seeded areas.

3.02 SOIL PREPARATION

- A. The Contractor shall conduct laboratory analysis on five (5) representative soil samples to determine pH content and nutrient levels. The rate for adding sulfur or lime shall be based upon recommendation by the laboratory. The soils laboratory may be obtained through the University of Florida/IFAS Analytic Services.
- B. All areas to receive topsoil, seed and/or sod shall be raked, and all rubbish, sticks, roots and stones larger than 1-inch shall be removed. Loosen subgrade surface immediately prior to being covered with topsoil. Subgrade shall be inspected and approved by the Engineer before topsoil is placed.
- C. Topsoil shall be placed over approved areas to a depth sufficiently greater than required so that after natural settlement and light rolling the complete Work will conform to the lines, grades, and elevations as indicated on the Drawings. No topsoil shall be spread in water or while excessively wet.
- D. Loosen topsoil surface to a minimum depth of 2-inches. Remove stones over 1-inch in any dimension and sticks, roots, rubbish and other extraneous matter. Topsoil shall be inspected and approved by the Engineer before subsequent operations commence.

3.03 APPLICATION OF LIMESTONE, SULFUR AND FERTILIZER

- A. Sulfur and Limestone: If laboratory results indicate the addition of sulfur or lime is necessary, spread uniformly over designated areas to be seeded or sodded at the rate recommended. Thoroughly mix through upper 2-inches of topsoil.
- B. After application of sulfur or lime, and prior to applying fertilizer, loosen areas to be seeded or sodded with a double disc or other suitable device if soil has become

hard or compacted. Correct any surface irregularities in order to prevent pockets or low areas, which will allow water to stand.

- C. Fertilizing: Distribute fertilizer uniformly over areas to be seeded or sodded at a rate of 30 pounds per 1,000 square feet. Use a suitable distributor.
- D. Incorporate fertilizer into topsoil to depth of at least 2-inches by disk harrowing or other approved methods. Clean surface of stones or other substances, which will interfere with, turf development or subsequent mowing operations.
- E. Grade lawn areas to a smooth, even surface with a loose, uniformly fine texture. Roll and rake, remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas, which can be seeded or sodded soon after preparation.

3.04 SEEDING OPERATIONS

- A. All disturbed areas that will not be reworked or sodded within 14 days maximum shall be temporarily seeded and mulched. Disturbed areas outside the "Limits of Construction" as shown on the Contract Drawings shall be seeded and mulched and sodded at no additional cost to the County.
- B. Temporary seeding shall be in accordance with FDOT Standard Specifications, Section 570, and applied at a mixture and rate in conformance with FDOT Roadway and Traffic Design Standards (January 2000 edition) Index No. 105, for Zone I, Inland conditions. Steep slope seeding shall be in accordance with FDOT Standard Specifications.
- C. Mulching, rolling, and watering shall be in accordance with FDOT Standard Specifications.
- D. Protect seeded slopes against erosion with erosion netting or other methods approved by Engineer.

3.05 SODDING OPERATIONS

- A. All disturbed areas, except as noted above shall be final grassed with sod. Sodding and watering shall be in accordance with FDOT Standard Specifications.
- B. Sodding shall be in accordance with FDOT Roadway and Traffic Design Standards Index No. 105.
- C. On all slopes of 3 horizontal to 1 vertical or steeper, sod shall be pegged to prevent movement.

3.06 MAINTENANCE

- A. The Contractor shall keep all seeded and sodded areas watered and in good condition until the Contractor has submitted its request for Final Payment including the Contractor's release and all Subcontractor Affidavits (Final Completion).
- B. Begin maintenance of seeded and sodded areas immediately after each portion is planted and continues until final acceptance.
- C. Maintenance shall be in accordance with FDOT Standard Specifications; however, at a minimum, all temporary and final seeded and sodded areas shall be watered twice per week with a minimum of 1/4 inch water applied per watering event.

3.07 FINAL ACCEPTANCE

- A. Sodded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of specified grass is established, free of weeds, bare or dead spots and surface irregularities.
- B. Locations that were disturbed by the Contractor during construction activities shall be brought to their original condition prior to final acceptance.

END OF SECTION

DIVISION 7

Thermal and Moisture Protection

SECTION 07841

THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through the fire-resistance-rated assemblies, including both new and existing empty openings and new and existing openings containing penetrating items.
- B. Firestopping shall be designed and constructed in accordance with the Florida Building Code, Florida Fire Code and Uniform Fire Safety Standards as adopted by the State Fire Marshall and latest addendums

1.03 PERFORMANCE REQUIREMENTS

- A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
 - 1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
 - 2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
 - 3. Fire-resistance-rated roof assemblies.
 - 4. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 5. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.

- b. Penetrations located outside fire-resistive shaft enclosures.
 - c. Penetrations located in construction containing fire-protection-rated openings.
 - d. Penetrating items larger than 4-inch (100-mm-) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.
6. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
 7. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 8. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
 9. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
 10. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.04 SUBMITTALS

- A. Product Data: For each type of through-penetration firestop system product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.

- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.
- E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed through-penetration firestop systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Installer Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.
- C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

UL in "Fire Resistance Directory."

- E. Preinstallation Conference: Conduct conference at Project site.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.08 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Hilti Construction Chemicals, Inc.
 - 2. Nelson Firestop Products.
 - 3. 3M Fire Protection Products.

2.02 FIRESTOPPING

- A. General: Where UL-classified systems are indicated, they refer to the alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- C. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.

4. Collars.
5. Steel sleeves.

2.03 FILL MATERIALS

- A. General: Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
- B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
- F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- H. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- I. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
- J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- K. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.04 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:
 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.03 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
 - 2. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 3. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 4. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 5. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 FIELD QUALITY CONTROL

- A. Inspecting Agency: The Contractor shall engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.
- B. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.

- D. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.05 IDENTIFICATION

- A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Labels shall be installed above ceilings and in concealed spaces. Include the following information on labels:
 - 1. The words: "FIRE AND SMOKE BARRIER PROTECT ALL OPENINGS".
Contractor's name, address, and phone number.
Through-penetration firestop system designation of applicable testing and inspecting agency.
Date of installation.
Through-penetration firestop system manufacturer's name.
Installer's name.

3.06 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION 07841

DIVISION 10

Specialties

SECTION 10880

SCALE, UNATTENDED TERMINAL, TRAFFIC LIGHT, AND TRAFFIC ARM

PART 1 – GENERAL

1.01 GENERAL

- A. Furnish and install one steel deck motor truck scale and associated electronic controls, a traffic arm, a traffic stop and go light, and an unattended terminal.
- B. Scale shall be a new, unused Mettler-Toledo, Inc. Model VTS 231, or approved equal.
- C. The scale shall have a nominal clear and unobstructed weighing surface of not less than 70 feet inches long and 11 feet wide. The scale shall have a profile not to exceed 14.5” from the top of the scale to the top of the foundation slab or pier of the load cell bearing points.
- D. The scale shall be fully electronic in design and shall not incorporate any mechanical weighing elements, check rods, or check stays.
- E. The scale shall be designed to perform as a single weighing platform and shall be of flat-top design.
- F. The scale shall have a gross weighing capacity of 100 tons.
- G. The scale shall be designed to accept vehicles that generate up to 80,000 pounds per dual tandem axle.
- H. The scale shall have a Concentrated Load Capacity (CLC) of 100,000 pounds.
- I. The scale shall be designed to perform as a single weighing platform and shall be of flat-top design. Side rail support beams are not acceptable.
- J. The scale shall be designed to accept an average daily traffic volume of up to 250 vehicles per day, 365 days per year, for 20 years, assuming that 100% of the vehicles are fully loaded with the equivalent of 80,000 lbs. on their dual tandem axle.
- K. The scale shall be calibrated to a minimum of 120,000 pounds by 20-pound increments and not to exceed 200,000 pounds. System configurations with increments greater than 20-pound increments will not be accepted; therefore scales with gross capacities in excess of 200,000 pounds will not be acceptable in order for the scale to meet NTEP Legal For Trade regulatory requirements.

- L. The junction boxes, load cells, load cell mounting hardware, cover bolts, and fasteners shall be constructed of stainless steel. The cables shall be stainless steel sheathed.
- M. The scale shall meet the requirements set forth by the current edition of the National Institute of Standards and Technology Handbook 44 (NIST HB-44). The scale manufacturer shall provide a Certificate of Conformance (NTEP Certification) to these standards upon request.
- N. The design and manufacture of the scale weighbridge, load cells, digital instrument, printer, and associated accessories shall be of one manufacturer to maximize compatibility and availability of components. Also, the manufacturer shall have a quality system that has been registered to the standards of ISO 9001.
- O. The load cells and load cell mounting hardware shall be constructed of stainless steel. The cables shall be stainless steel sheathed. Load cells which are not stainless steel and hermetically sealed shall not be acceptable because of their inability to prevent moisture from entering the load cell and causing a premature failure.
- P. The scale shall be a Mettler-Toledo, Inc. Model VTS 231 or approved equal.

1.02 SCALE FOUNDATION REQUIREMENTS

- A. The foundation shall meet all local requirements and the minimum specifications as stated in this section.
- B. The foundation shall extend the full length and width of the scale platform.
- C. The foundation must be higher than surrounding grade to promote drainage away from the scale.
- D. The foundation shall be poured and constructed of concrete as specified on the Plans.
- E. The foundation shall be reinforced in all load-bearing areas.
- F. The foundation shall be constructed to provide positive drainage away from its center.
- G. Ensure the scale abuts the concrete approaches at each end so that the top of the scale is flush (the maximum vertical differential between any of the scale elements shall be 1/16". The maximum elevation difference between the entry scale module and the exit scale module shall be 1/16" with the approaches and the centerline of all three elements (scale modules, entry & exit approaches) are aligned.

1.03 WEIGHBRIDGE SPECIFICATIONS

- A. The scale weighbridge shall be constructed of three prefabricated scale modules each with a nominal surface dimension of 11' wide by 23'-4" long.
- B. The scale weighbridge shall be capable of weighing trucks that have dual-tandem axle weights (4 feet minimum between dual axles and at least 10 feet from next axle) of up to 80,000 pounds, and shall have a Concentrated Load Capacity (CLC) of 100,000 pounds.
- C. All welding shall be completed in accordance with the American Welding Society (AWS) D1.1 Structural Welding Code.
- D. All welding shall be performed by welding operators who have been certified to the AWS D1.1 Structural Welding Code.
- E. All welding shall be performed in position 1F to ensure maximum weld integrity.
- F. Longitudinal weighbridge members shall be welded continuously, using a high-penetration, submerged arc welding process. The use of intermittent, or stitch welds on longitudinal members or deck tread plate is unacceptable.
- G. The weighbridge shall be designed to allow access to load cell cables, base plates, and all foundation anchor bolts from the top of the scale platform.
- H. The weighbridge and load cell mounting assemblies shall be designed to allow installation or replacement of a load cell with only one additional inch of clearance required between the top of the foundation and the bottom of the weighbridge on pit-less installations.
- I. There shall be no bolted connections between the load cell and weighbridge assemblies.
- J. The load cell assembly shall be designed so that when you are at the scale weighbridge with a lifting jack, the load cell can be replaced in less than 5 minutes
- K. There shall be no field welding required for the installation of the scale.

1.04 SURFACE PREPARATION AND FINISH

- A. The weighbridge shall be shot blasted to a minimum SSPC-A-SP6 specification prior to painting.
- B. All enclosed chambers created by joining two steel members must be hermetically sealed to eliminate internal corrosion.

- C. All exterior surfaces of the scale shall have a two-part epoxy finish of Carboline 15LO or equal, providing a total Dry Film Thickness of 5-7 mils.
- D. The finish shall be force cured in order to reduce risk of contamination and insure durability of the surface.

1.05 LOAD CELL SPECIFICATIONS

- A. Each load cell shall have a minimum capacity of 50 metric tons (110,000 pounds) with 300% ultimate overload rating.
- B. All Load cells shall be certified by NTEP and meet the specifications as set forth by NIST HB-44 for Class IIII devices. The manufacturer shall provide a Certificate of Conformance to these standards upon request.
- C. All load cells shall be certified to meet the specifications set forth by the International Organization of Legal Metrology (OIML) in document R60 for C3 load cells, which requires 60% tighter accuracy tolerances than NIST HB-44 for Class IIII devices. The manufacturer shall provide a Certificate of Conformance to these standards upon request.
- D. Load cells shall be digital with an integral microprocessor and analog-to-digital conversion function located within the load cell housing.
- E. Load cells shall output only converted digital information without load correction for load position to the scale instrument. Analog output of signals from the load cell is not acceptable due to susceptibility of signal interference.
- F. The load cell assembly shall be constructed so as to perform as a rocker pin and shall have no positive fixed mechanical connectors, such as bolts or links that are required in mounting the load cell to the weighbridge or foundation base plates.
- G. The load cell shall not require check rods, flexures or chain links for stabilization, as each of these items are sources of ongoing maintenance requirements.
- H. The load cell shall not require a junction box to communicate between the load cell and scale instrument. No other devices shall be permitted between the load cell and the digital weight display. Junction boxes, summing boards, gathering boards and gathering boxes, Totalizers, external analog to digital converter boxes and sectional controller boxes will not be accepted because of their significant and inherent maintenance issues.
- I. The load cell shall be of stainless steel construction and hermetically sealed with a minimum NEMA 6P / IP68 (submersible) and IP69K rating.
- J. The load cell shall contain integral Transient Voltage Surge Suppressors (TVSS) for all input and communication lines. Each TVSS shall contain self-resetting

thermal breakers to protect the load cell components from voltage and current surges.

- K. The load cell shall come equipped with a neoprene rubber boot to keep debris from contaminating the lower bearing surface.
- L. The load cell shall have a positive-lock quick connector integral to its housing for connecting and disconnecting the load cell interface cable at the load cell. The connector shall be of glass-to-metal, pin-type construction to maintain a hermetic seal.
- M. System shall be so designed as to permit a load cell cable to be replaced without either splicing the load cell cable or replacing the load cell, either of which will contribute to eventual system failure and unnecessary service costs System shall be so designed as to permit the replacing the load cell cable without requiring that the scale must be recalibrated, further reducing service/maintenance costs.
- N. The load cell shall have the following specifications:
- O. V_{min} : 5.0 pounds maximum
- P. Hysteresis: $\pm 0.025\%$ of full scale
- Q. Non-Linearity: $\pm 0.015\%$ of full scale
- R. Creep (30 minutes): $\pm 0.017\%$ of applied load
- S. Temperature range: $-10^{\circ}\text{C} + 40^{\circ}\text{C}$
- T. The load cell interface cable shall be stainless steel sheathed for environmental and rodent protection. Neoprene covered load cell cable shall not be permitted.
- U. Load cell cables which are hard wired directly to the load cell are not acceptable due to the failure rates associated with moisture wicking into the load cell from aged cables or damaged cables, and due to the unnecessary expense associated with replacing entire load cells when only a cable has been damaged.
- V. The load cell shall have a minimum 5-year warranty against defects in materials and workmanship and failure from lightning or surge voltages. The warranty shall cover all costs associated with replacement parts, travel, mileage, on-site labor and recalibration after repair, the full cost of which shall be supported solely by the manufacturer and not in part by any other 3rd party.
- W. Load cells shall be Mettler-Toledo, Inc. POWERCELL® PDX® load cell or approved equal.

1.06 SCALE INSTRUMENT

- A. The scale instrument shall be designed for use in vehicle scale weighing applications. It shall be capable of performing basic weighing operations including but not limited to:
1. Inbound/outbound two-weighment operations with traffic light, gate or loop control.
 2. Single weighment operations where vehicle tare weights are known either through preset tares which are stored in the scale instrument memory or manually entered tare values which are entered through the keyboard.
 3. Transient vehicle weighing operations where the transaction is to be completed but the record will not be added to memory accumulators or totals.
- B. The instrument shall, as a minimum, utilize an active TFT 320x240 pixel color backlit display with graphic capability to present the transactional information along with weight to the operator. During normal weighing operations the display will incorporate the following elements:
1. Weight (25mm high characters)
 2. Time and Date
 3. Center of Zero
 4. Mode of Operation (Gross or Net)
 5. Weighing Unit (lb or kg)
- C. The scale instrument shall have the following keyboard operations:
1. 0-9 Numeric Keys
 2. . (Decimal Point)
 3. Clear
 4. Tare
 5. Zero
 6. Print
 7. Nine Application-Specific Assignable Soft Keys with icons for easy operator use to identify TempID and VehID, etc.

8. Five Scale-Function Soft Keys
 9. Screen Navigation Keys for Up, Down, Left, and Right Commands
 10. Enter
- D. The operator shall be capable of entering alphanumeric characters through the terminal without the need for an external keyboard. However, the scale instrument shall, as an accessory, be capable of being interfaced to a standard USB-style computer keyboard without modifications to the scale instrument hardware or software for the purpose of entering alphanumeric information, as well as emulation of application and scale instrument soft-key functionality, if required.
- E. The scale instrument shall have the following operational parameters:
1. Capable of communicating with up to 6 pairs of digital load cell assemblies standard, with an additional 6 pairs with an installed 24VDC power supply.
 2. Ability to digitally average the weight information sent from the load cells and updating the instrument's weight display 15 times per second.
 3. Capable of being programmed for sign-corrected net weighing so that all net weights are positive.
 4. Have a transaction counter to automatically assign sequence numbers to transactions.
 5. Have automatic zero capture on power-up selectable to capture zero at 2% or 10% of the full-scale capacity.
 6. Have adjustable digital filtering.
 7. Have adjustable automatic zero maintenance selectable for 0.5, 1, or 3 displayed increments.
 8. Have push-button zero selectable for 2% or 20% of full-scale capacity.
 9. Tare, Zero, and Print functions shall be inhibited while the weight display is changing. Motion detection shall be selectable for 0.5, 1.0, 2.0, or 3.0 increments.
 10. Only receives digital information from the load cell assemblies. There shall be no analog-to-digital conversion function in the scale instrument.
 11. Capable of providing load correction for load position.

- F. The scale instrument shall have the following service characteristics:
1. Set-up and navigation through all phases of set-up, calibration, and testing shall be intuitive through a decision-tree format.
 2. Capable of performing calibration, span, zero, and shift adjustment through software calculations that require no in-scale adjustment.
 3. Entry of information shall be accomplished through the instrument's keyboard only.
 4. Capable of assigning each load cell with its own unique identification number and displaying the weight reading of each individual load cell through the instrument without disconnecting any of the load cells from the system.
 5. Ability to display digital raw counts for the attached digital load cells with their values being updated on a real-time basis. The scale instrument shall also be capable of displaying the raw count values of multiple digital load cells on the graphical display.
 6. Ability to identify and to immediately display an error condition associated with an individual load cell in the event of a failure or out-of-tolerance condition. The displayed message shall identify the failed load cell and the cause of the failure to avoid an invalid weighment on the scale.
 7. Ability to monitor and display health of load cell network and to compare the current network status to the values captured during calibration. This is a requirement to reduce downtime and provide information to the user so that the user can proactively use the information to determine the most convenient time to address maintenance issues, while avoiding downtime at the most inopportune time.
 8. Load cell health information shall include individual load cell temperature, supply voltage at load cell, signal voltages, maximum loading. These data are vital in reducing downtime and troubleshooting time and cost.
 9. Ability to monitor the gas concentration sensors in each load cell and identify which load cell may be breached or physically damaged so that unscheduled downtime can be eliminated.
 10. Ability to access system status data through an Ethernet connection using a web server residing on the instrument for remote diagnostics

11. Ability to access system memory through an Ethernet connection using a shared data server. This allows tighter integration with customer operations.
- G. The scale instrument shall be NTEP certified and meet or exceed the specifications set forth by NIST HB-44 for Class II, III, and IIIIL Devices. The manufacturer upon request shall provide a Certificate of Conformance to these standards.
- H. The scale instrument shall be housed in a metal enclosure that is suitable for desk or wall mounting.
- I. The scale instrument shall have flexible storage capability with a minimum of 256 Mbytes of flexible memory in which to store pertinent vehicle, transactional, and commodity information. The scale instrument shall be capable of storing the weight information automatically or enabling the operator to assign a memory location to the weight manually. The scale instrument will run SQL or equivalent database application to enable possible integration into higher level databases.
- J. The scale instrument shall have subtotal and total weight accumulators.
- K. The operator shall be able to enter up to 12 digits of alphanumeric ID through the instrument keyboard.
- L. The scale instrument shall have gross/net weight switching.
- M. The scale instrument shall be capable of being programmed and calibrated in pounds or kilograms.
- N. The scale instrument shall have the following data communications capabilities:
 1. One com port RS232
 2. One com port RS232, RS422, or RS485
 3. One TCP/IP 10 Base-T and 100 Base-T Ethernet
 4. One Web server
 5. One Shared Data server
 6. One USB host port
- O. The scale instrument shall output the following information:
 1. Gross, Tare, and Net Weight
 2. ID

3. Transaction Counter
 4. Time and Date
 5. Variable Application-Specific Information
 6. Standard Reports Generated by the Scale Instrument
- P. The scale instrument shall be UL/cUL listed.
- Q. Scale instrument shall have the ability to connect with external PC software to allow configuration, data backup and restore, security unlock capabilities, FTP access to log files so as to significantly reduce service cost and downtime during any repair and maintenance of the scale.
- R. The scale instrument shall be a Mettler-Toledo, Inc. Model IND780 or equivalent.

1.07 JUNCTION BOXES AND CABLES

- A. Junction boxes shall not be permitted in the scale, attached to the exterior of the scale, or remotely mounted from the scale. Sectional controllers with encapsulated PCBs shall not be permitted due to the failure rates associated with PCBs that have wired connections made within enclosures which are not hermetically sealed.
- B. Load cell cables and scale instrument cables shall be stainless steel sheathed for environmental and rodent protection.
- C. In order to minimize maintenance issues, only a single cable shall be used to transmit data or weight signals between the weighbridge and the digital weight display.

1.08 LIGHTNING PROTECTION SPECIFICATIONS

- A. A comprehensive lightning protection system shall be provided with the scale.
- B. The system shall not require complicated wiring or devices to provide this protection.
- C. Major scale components including load cells and scale instrument shall be included in the lightning protection system.
- D. Grounding of all scale components including load cells, scale instrument, and accessories shall be to one common point. Systems with multiple ground points are not acceptable.
- E. An AC line surge protector shall conveniently plug into a common electrical outlet and have a receptacle.

- F. Each AC line surge protector required shall have one isolated, grounding, hospital-grade duplex receptacle, and an internal 15-amp circuit breaker.
- G. Verification of the lightning protection system's performance shall be available in writing from a third-party verification laboratory upon request. Proposals submitted without confirming the availability of 3rd party confirmation that the load cells, cables and instrument as a system have been able to withstand the equivalent of a lightning strike with 80,000 amperes will be rejected.
- H. The lightning protection system shall be a Mettler-Toledo, Inc. StrikeShield Lightning Protection System or equivalent.

1.09 SCALE GUARANTEE REQUIREMENTS

- A. The scale manufacturer shall warrant the scale assembly including all load cells, weighbridge structure, scale instrument and associated cables from failures due to a defect in manufacturing, workmanship, lightning, or surge voltages.
- B. The guarantee will warrant the product for a period of 10 years from date of installation or 122 months from date of shipment to the Buyer, whichever occurs first. The Contractor shall promptly correct any such defect appearing within the warranty period.
- C. The warranty shall support 100% coverage of repair parts, labor, travel time, and mileage from the closest service location, or at the manufacturer's sole discretion, replacement of the product under warranty. The full cost of warranty as specified herein shall be supported solely by the manufacturer and not in part by any other 3rd party or service provider.

1.10 UNATTENDED TERMINAL

- A. The unattended terminal shall be a standalone vehicle weight system that integrates with the Project's scale and weighing software system. It shall be connected to the Internet via Ethernet and wireless. The terminal shall have the same customer capacity as the Project scale. The terminal shall have include an RFID reader (installed at the Owner's preferred location), include a 65 QWERTY keyboard, stainless steel display, and print receipts to customers. The unattended terminal shall be a Mettler-Toledo, Inc. IND9US (compatible with Udrive 780 software) or approved equivalent.

1.11 TRAFFIC ARM AND TRAFFIC LIGHT

- A. The traffic arm shall be a high-traffic barrier that is controlled by the scalehouse operator. The 12-foot wide traffic arm shall be rated for 6,000 cycles per day with an opening time of 2.5 seconds, and operated via a remote control. The traffic arm shall have battery backup for 900 cycles when the power is down. The traffic arm

shall be break-away and constructed with corrosion resistant aluminum alloy with yellow/black stripes.

- B. The traffic light shall be a red and green traffic light with housing dimensions of 13.5" high x 13" wide, and 7" deep. The traffic light shall be aluminum with a powder coat finish or 10% fiberglass reinforced polycarbonate with colored resins integral to housing.

PART 2 - PRODUCTS

2.01 SCALE

- A. Five calendar days after the Pre-Construction Meeting, the Contractor shall provide the following new products and all ancillary and necessary components to provide a complete integrated and operable system, whether or not they are specifically mentioned in the plans or specifications:
 - 1. Mettler-Toledo, Inc. Model VTS 231 Truck Scale and update.
 - 2. Load cell(s) and related components.
 - 3. Control systems including wiring, conduit, control panels, interfaces, etc.
 - 4. Concrete for the scale module decks.
 - 5. Bumper plates, adjusting mechanisms, leveling devices, bearing plates, anchor bolts, mounting bases for all load bearing components.
 - 6. Pored-in-place reinforced concrete foundation for the scale.
 - 7. Reinforced concrete approach slabs.
 - 8. An Operations and Maintenance Manual (in a 3-ring binder) for the specific scale furnished.
 - 9. Guarantee specified in Section 1.09.
- B. The Contractor shall provide written confirmation of empirical testing data to validate the design of the weighbridge through actual life-cycle testing. During the testing process the weighbridge must see a minimum of 1 million cycles, with at least 80,000 lbs. of test load, applied on the 8 contact points of a standard truck's dual tandem axle tires. This documentation must be provided with the proposal submittal. Failure to provide this information will result in the bid being considered non-responsive.
- C. Following installation and start-up, all manufactured written certificates of warranty and guarantees shall be supplied by the Contractor.

2.02 UNATTENDED SCALE TERMINAL

- A. Fourteen days prior to installation, Contractor shall provide the following:
 - 1. Manufacturer and model
 - 2. Control systems including wiring, conduit, control, interfaces, etc.
 - 3. The Operations and Maintenance Manual for the terminal and software.
 - 4. Concrete foundation slab shop drawings.

2.03 TRAFFIC ARM

- A. Fourteen days prior to installation, Contractor shall provide the following:
 - 1. Product Data: Equipment list, system description, electrical wiring diagrams for installation, and manufacturer's data sheets on each product to be used, including:
 - a. Preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - c. Installation methods.
 - 2. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, edge conditions, and accessories.
 - a. Operation, installation, and maintenance manuals including wiring diagrams.
 - b. Risers, layouts, and special wiring diagrams showing any changes to standard drawings.
 - c. Concrete foundation slab shop drawings.

2.04 TRAFFIC LIGHT

- A. Fourteen days prior to installation, Contractor shall provide the following:
 - 1. Manufacturer and model of the traffic light.
 - 2. Control systems including wiring, conduit, control, interfaces, etc.
 - 3. The Operations and Maintenance Manual.
 - 4. Concrete foundation slab shop drawings.

PART 3 – EXECUTION

- A. The Contractor shall provide all materials, equipment and ancillary devices, whether or not shown on the plans or called out in these specifications, that are

needed to provide a complete, functioning scale system, including integration with the existing scale system operations, software, and controls, the mounting of all load cells, control conduits and wiring, control boxes, control panels, instrument displays and operator terminals whether inside or outside the scalehouse office.

- B. Contractor shall provide a start-up technician, certified by the scale manufacturer, to the site to lead the start-up and testing demonstration for the scale system.
- C. The technician shall be available for four hours on-site (not including any travel time to and from site).
- D. The technician shall instruct the Owner on the operation, trouble-shooting, calibration, maintenance and shut-down of the scale system.
- E. The start-up test of the scale system shall include the following activities led by the technician:
 - 1. Power up and calibrate the scale and demonstrate it performs all functions and is measuring accurately the weight of a stationary test vehicle of at least 80,000 pounds.
 - 2. The start-up test shall also demonstrate that the existing scale system, software and controls continues to function properly and is fully integrated with the addition of the new scale function and system.
 - 3. Simulate all alarm conditions of the scale system in order to demonstrate alarm controls are functioning properly.
- F. The Contractor shall provide all materials, equipment and ancillary devices, whether or not shown on the plans or called out in these specifications that are needed to provide a complete, functioning unattended terminal payment system, traffic arm and traffic light.

- END OF SECTION -

DIVISION 13
Special Construction

SECTION 13120

HOUSEHOLD HAZARDOUS WASTE BUILDING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish all of the necessary supervision, labor, tools, materials and equipment to perform all of the Work required to construct and install the proposed Household Hazardous Waste (HHW) building and all associated appurtenances to the foundation system in accordance with the Contract Drawings and Specifications.

1.02 REFERENCES

- A. American Institute of Steel Construction - AISC
1. AISC S335 - Specification for Structural Steel Buildings, Allowable Stress Design.
 2. AISC S342L - Load and Resistance Factor Design Specification for Structural Steel Buildings.
- B. American Iron and Steel Institute - AISI:
1. AISI - Specification for the Design of Cold-Formed Steel Structural Members, Allowable Stress Design.
- C. American Society for Testing and Materials - ASTM:
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 2. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 3. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- D. American Welding Society - AWS:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
 2. AWS D1.1 - Structural Welding Code - Steel.

- E. Metal Building Manufacturers Association - MBMA:
 - 1. MBMA - Low Rise Building Systems Manual.
- F. The Society for Protective Coatings - SSPC:
 - 1. SSPC - Steel Structures Painting Manual.

1.03 HHW BUILDING DESCRIPTION

- A. Primary Framing: Rigid frame of rafter beams and columns, braced end frames, end wall columns and wind bracing.
- B. Secondary Framing: Purlins, girts, eave struts, flange bracing, clips and other items detailed on the Contract Drawings and as required by the manufacturer.
- C. Lateral Bracing: All horizontal loads shall be resisted by main frame action.
- D. Roof System
 - 1. Shall consist of preformed metal panels, with sub-girt framing/anchorage assembly; wind bracing for specified sections as shown on the Contract Drawings; and all associated accessory components.
- E. Portal frames shall have a clear span minimum value as shown on the Contract Drawings.
- F. Total HHW building roofline area shall be as shown on the Contract Drawings.

1.04 DESIGN REQUIREMENTS

- A. Members shall be designed to withstand design loads due to pressure and suction of wind calculated in accordance with applicable code and design load schedule on the Contract Drawings and shall include, but are not limited to, the following:
 - 1. Building Code: Latest Edition of the Florida Building Code
 - 2. Building End Use: Community
 - 3. Occupancy Category: Standard (Category II)
 - 4. Wind Exposure Category: C
 - 5. Wind Speed: 140 mph, three second gust
 - 6. Roof Dead Load Superimposed: 10 psf

7. Roof Collateral: 0.5 psf
 8. Roof Live Load: 20 psf, reduction allowed
 9. Wind Importance Factor: 1
 10. Internal Pressure Coefficients: + / - 0.18
 11. Building Envelope: Open
 12. Roof Pitch: As shown on the Contract Drawings.
 13. Bay spacing as shown on the Contract Drawings.
 14. Deflections shall be limited as shown on the Contract Drawings for 10-year mean occurrence wind load on walls and roof.
 15. Total HHW Building Roofline Area: As shown on the Contract Drawings.
 16. Roof System and Endwalls and Sidewalls
 - a. Preformed metal panels, with sub-girt framing/anchorage assembly; wind bracing for specified sections as shown on the Contract Drawings; and all associated accessory components.
- B. The HHW building shall be constructed in accordance with the applicable Building Code, national standards, and local requirements for Orange County Florida. These shall include, but are not limited to the following:
1. Latest Edition of the Florida Building Code
 2. Orange County Building Department
 3. American Institute of Steel Construction (AISC)
 4. American Iron and Steel Institute (AISI)
 5. Metal Building Manufacturer's Association (MBMA)
 6. American Society for Testing Materials (ASTM)
 7. American National Standards Institute (ANSI)
 8. American Welding Society (AWS)

1.05 PERFORMANCE REQUIREMENTS

- A. Conform to the Contract Drawings, Specifications, notes and the Latest Edition of the Florida Building Code for submission of design calculations, shop drawings and erection drawings as required by the Contractor for acquiring permits.
- B. The Contractor shall cooperate with regulatory agencies or authority having jurisdiction and provide data as requested.
- C. The Contractor shall provide components compatible with adjacent materials.

1.06 SUBMITTALS

- A. Manufacturer drawings and design calculations shall bear the professional seal and signature of a licensed professional engineer registered in the state of Florida.
- B. Shop/Erection Drawings: The Contractor shall submit shop/erection drawings that indicate at a minimum assembly dimensions, locations of structural members, connections, attachments, openings, wall and roof system dimensions, general construction details, anchorages and method of anchorage, method of installation, framing anchor bolt settings, sizes, locations from datum and welded connections with AWS A2.4 welding symbols.
- C. Structural Design Calculations: The Contractor shall submit design calculations that demonstrate the strength and serviceability requirements of this specification have been met including but not limited to the criteria, codes, design loads, and load combinations used for the building design, deflection and drift calculations, crane/hoist supporting members, and foundation reactions.
- D. Manufacturer's Instructions: The Contractor shall submit the manufacturer's instructions for installation that indicate preparation requirements, assembly sequence, etc.
- E. Gutters and Downspouts: The Contractor shall submit the manufacturer's instructions for installation that indicate preparation requirements, assembly sequence, etc.
- F. Overhead rolling doors: The Contractor shall submit the manufacturer's drawings and instructions for installation of the overhead rolling doors.
- G. Paint: The Contractor shall submit manufacturer information regarding prime and finishing painting.
- H. Welding certification: Submit welding certification if requested.

1.07 QUALITY ASSURANCE

- A. The metal building manufacturer and manufacturer's professional engineer shall have a minimum of five years' experience in the successful design and fabrication

of pre-engineered metal buildings of the size and complexity specified in the Contract Documents.

- B. Perform Work in accordance with MBMA Low Rise Building Systems Manual and, for items not covered, AISC - Specification for Structural Steel Buildings.
- C. The Contractor shall verify that the field measurements are as indicated on the shop/erection drawings.

1.08 WARRANTY

- A. Finish five year manufacturer warrant for pre-engineered building systems and components.
- B. Special warranty on metal panel finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within 20 years from date of substantial completion.
- C. Special weather-tightness 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 leak or otherwise fail to remain water-tight within 10 years of date of substantial completion.

1.09 PRE-INSTALLATION MEETING

- A. The Contractor, Owner and Engineer shall convene a minimum of one week prior to erection of the HHW building to conduct a pre-installation meeting.

PART 2 - PRODUCTS

2.01 HHW BUILDING

- A. Designer/Manufacturer:
 - 1. Vulcraft Steel Structures, Inc.
 - 2. Nucor Building Systems
 - 3. Butler Manufacturing

2.02 COMPONENTS - FRAMING

- A. Material properties of steel bar, plate and sheet used in the fabrication of primary and secondary structural framing members shall conform to ASTM A529, ASTM

A572, ASTM A1011 SS or ASTM A1011 HSLAS with a minimum yield point of 50 ksi. All material and Work shall conform to the latest AISC Specifications for Design, Fabrication, and Erection of Structural Steel for Buildings.

- B. Material properties of hot rolled structural shapes shall conform to ASTM A992, ASTM A529 or ASTM A572 with a minimum specified yield point of 50 ksi. Hot rolled angles, other than flange braces, shall conform to ASTM A36 minimum.
- C. Hollow structural shapes shall conform to ASTM A500 Grade B. Minimum yield point is 42 ksi for round HSS and 46 ksi for rectangular HSS.
- D. Material properties of cold-formed light gage steel members shall conform to the requirements of ASTM A1011 SS Grade 55, or ASTM A1011 HSLAS Class 1 Grade 55, with a minimum yield point of 55 ksi.
- E. Anchor Bolts: ASTM F1554, unprimed galvanized to ASTM A153/A153M.
- F. Bolts, Nuts, and Washers: ASTM A325, ASTM A325M.
- G. All welding is to be performed in accordance with AWS D1.1; type required for materials being welded.
- H. Framing Members Primary and Secondary and Accessories: Clean, prepare and shop prime. Prime to SSPC Manual requirements. Do not prime surfaces to be field welded.
- I. Interior Surfaces of Roof Components and Accessories: Clean, prepare, and shop prime. Prime to SSPC Manual requirements.

2.03 COMPONENTS - ROOF SYSTEM AND ENDWALLS AND SIDEWALLS

- A. Shall consist of preformed metal panels, with sub-girt framing/anchorage assembly; wind bracing for specified sections as shown on the Contract Drawings; and all associated accessory components.
- B. Sheet Steel Stock: 26 gauge steel preformed metal panels as indicated on the Contract Drawings as required by manufacturer's design.
- C. All washers, fasteners shall be per the manufacturer's standard type as indicated on the Contract Drawings. Size and design to maintain load and weather tightness requirements.
- D. The complete assembled roof system shall be leak-tight.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify foundation, mechanical, electrical utilities, and placed anchors are in correct position.
- B. Install materials according to manufacturer's written instructions.
- C. The HHW building exposed steel columns, rafters, flange braces, bottoms of preformed metal roof panels, bird slopes, etc. shall be final painted by the Contractor prior to building erection. Paint with metal building system manufacturer's standard primer with surface preparation. The color will be determined by the Owner prior to the time of application.

3.02 ERECTION - FRAMING

- A. Erect framing in accordance with MBMA Metal Building Systems Manual, Common Industry Practices.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing.
- C. Do not field cut or alter structural members without approval of manufacturer and Consultant.
- D. After erection, prime welds, abrasions, and surfaces not shop primed or needing touch-up.

3.03 ERECTION - ROOFING SYSTEMS

- A. Install all wall and roofing systems in accordance with manufacturer's instructions and details.
- B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
- C. Fasten cladding system to structural supports, aligned level and plumb.
- D. Install gaskets to prevent weather penetration where required by the manufacturer.
- E. Coating shall be painted/primed in accordance with SSPC Painting Manual.

3.04 ERECTION - GUTTER AND DOWNSPOUTS

- A. Provide Gutters and Downspouts. Rigidly support and secure components. Joint lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.
- B. Install splash pads under each downspout.

3.05 OVERHEAD ROLL UP DOORS

- A. Complete overhead roll up door assemblies including door curtain, guides, counterbalance, hardware, operators and installation accessories shall be provided as specified.
- B. Overhead doors shall be the manufacturer's standard construction, fabricated on 0.034 inch minimum uncoated thickness galvanized steel or aluminum-zinc alloy coated steel. All hardware and accessories necessary for the complete installation for the door including galvanized steel track, brackets, lifting handles, torsion sprung mechanism, ball bearing rollers, cylinder locks, and weather stripping shall be furnished.
- C. Doors and frames shall be designed for wind-loading as indicated on the Drawings.
- D. Doors shall be manually operated unless otherwise specified. Doors greater than 144 ft² shall be chain hoist operated.

3.06 WALL LOUVERS

- A. Louvers shall be provided in accordance with the drawings and AMCA 500-L. The louvers shall be wind-driven louver effectiveness "A". Louvers shall be fabricated of aluminum zinc-alloy coated steel. The minimum uncoated thickness of materials shall be 0.048 inch for steel and 0.064 inch for aluminum and withstand the design seismic and wind loads.
- B. Blades shall be secured to frames by riveting or welding
- C. Louvers shall be primed and finished to match wall panels.
- D. Inlet screens in re-wireable frames shall be provided on exterior face of louvers. The screens shall be secured with clips that facilitate removal for cleaning and rewiring. Screens may be made of aluminum, galvanized steel, or stainless steel.

3.07 ERECTION - TOLERANCES

- A. All Work shall be performed by experienced workmen in a workmanlike manner to published tolerances.

- B. Framing Members: Install framing and roofing in accordance with MBMA Metal Building Systems Manual, Common Industry Practices.

3.08 DELIVERY STORAGE AND HANDLING

- A. Deliver components and materials in manufacturer's standard protective packaging.
- B. Store all materials in accordance with manufacturer's storage and handling instructions.
- C. Unload, store, and handle materials in a manner to prevent bending, warping, twisting and surface damage.

END OF SECTION

SECTION 13121

SCALEHOUSE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish all of the necessary supervision, labor, tools, materials and equipment to perform all of the Work required to construct and install the proposed scalehouse building and all associated appurtenances to the foundation system in accordance with the Contract Drawings and Specifications. The scalehouse shall be an elevated mobile office trailer type structure that is air conditioned, heated and well-lighted. The scalehouse shall have a total area of 32' x 8', include a unisex one-half bath (toilet and sink).

1.02 DESIGN REQUIREMENTS

- A. Members shall be designed to withstand design loads due to pressure and suction of wind calculated in accordance with applicable code and design load schedule on the Contract Drawings and shall include, but are not limited to, the following:
1. Building Code: Latest Edition of the Florida Building Code
 2. Building End Use: Community
 3. Occupancy Category: Standard (Category II)
 4. Wind Exposure Category: C
 5. Wind Speed: 135 mph, three-second gust
 6. Roof Dead Load Superimposed: 8 psf
 7. Roof Collateral: 0.5 psf
 8. Roof Live Load: 20 psf, reduction allowed
 9. Wind Importance Factor: 1
 10. Internal Pressure Coefficients: + / - 0.18
 11. Building Envelope: Closed
 12. Roof Pitch: As shown on the Contract Drawings.

13. Deflections shall be limited as shown on the Contract Drawings for 10-year mean occurrence wind load on walls and roof.
 14. Total Roofline Area: As shown on the Contract Drawings.
 15. Roof System and Endwalls and Sidewalls
 - a. Sidewalls and endwall comprised of aluminum siding
- B. The scalehouse shall be constructed in accordance with the applicable Building Code, national standards, and local requirements for Orange County Florida. These shall include, but are not limited to the following:
1. Latest Edition of the Florida Building Code
 2. Orange County Building Department
 3. American Institute of Steel Construction (AISC)
 4. American Society for Testing Materials (ASTM)
 5. American National Standards Institute (ANSI)

1.03 PERFORMANCE REQUIREMENTS

- A. Conform to the Contract Drawings, Specifications, notes and the Latest Edition of the Florida Building Code for submission of design calculations, shop drawings and erection drawings as required by the Contractor for acquiring permits.
- B. The Contractor shall cooperate with regulatory agencies or authority having jurisdiction and provide data as requested.
- C. The Contractor shall provide components compatible with adjacent materials.

1.04 SUBMITTALS

- A. Mobile Office Trailer: Submit all relevant product information for mobile office trailer, floor plan showing window, doors, restroom, openings, wall and roof system dimensions, general construction and installation details, anchorages and method of anchorage. All manufacturer drawings and design calculations shall bear the professional seal and signature of a licensed professional engineer registered in the state of Florida.
- B. HVAC System: Submit all relevant information for the air conditioning and heat system.

- C. Gutters and Downspouts: The Contractor shall submit the manufacturer's instructions for installation that indicate preparation requirements, assembly sequence, etc.
- D. Stair and Landing: The Contractor shall submit information for stairs, handrails and landings.
- E. Scalehouse Window: The Contractor shall submit Manufacturer's information on the scalehouse windows.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with all regulatory and industry standards for mobile trailers and office buildings including the Florida Building Code.
- B. The Contractor shall verify that the field measurements are as indicated on the shop/erection drawings.

1.06 PRE-INSTALLATION MEETING

- A. The Contractor, Owner and Engineer shall convene a minimum of one week prior to erection of the scalehouse foundation to conduct a pre-installation meeting.

PART 2 - PRODUCTS

2.01 SCALEHOUSE

- A. Scalehouse Designer/Manufacturer:
 - 1. Acton Mobile Model 836.
 - 2. Or approved equal.
- B. Scalehouse attendant window:
 - 1. Flush mount pass-thru-sliding windows-600 Energy Saver with series single panel manual open/self-closing as shown on the Drawings and window schedule.
 - 2. Size: 47.5 inches by 43.5 inches high increased with transom for rough opening of 60 inches high.
 - 3. See Elevations for position of opening window.
 - 4. Operation: Manual.
 - 5. Close: Self closing.

6. Finish: Dark Bronze or Clear Anodized as selected by Architect.
7. Frame: Extruded Aluminum, ASTM B221, Alloy 6063-T6 and 6063 T52.
8. Aluminum Sheet: ASTM B209, Alloy 5005-AQ-H34.
9. Galvanized Sheet Steel: ASTM A653, G90.
10. Bottom Sill: Angled downward, track free.
11. Security: Automatically locks each time door closes, with security bar set.
12. Security Lock: Aluminum bar extrusion with sliding spring-loaded locking clip.
13. Fasteners: stainless steel rivets and hex-head zinc plated self-threading machine screws.
14. Handle: Black Delrin handle with pressed-in stainless steel spring pins. Stainless steel handle mounting bracket. Stainless steel spring-loaded mounting base.
15. Glazing: Manufacturer's Miami-Dade Impact rated, insulated glass to match Storefront Aluminum windows. See Section 08 41 13, Aluminum Framed Entrances.
16. Silicone Glazing Sealant: Dow Corning 999A, to match finish.
17. Provide aluminum extension sill as shown in the details.
18. Aluminum Finish: As selected by Architect from standard manufacturer's finishes.
19. Units to be certified by testing to withstand design pressures as stated on Window Schedule.
20. Manufacturer: Ready Access Inc., Chicago, Illinois or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. The Contractor shall be responsible for installing the trailer on a prepared earthen pad that is level and is surfaced as shown on the construction plans. The Contractor shall provide all permanent, supplemental support and/or leveling devices under the corners and midpoints of the trailer frame, as recommended by the manufacturer, to provide a level and solid platform that does not shift or rock.

- B. The Contractor shall install the scale instrumentation hardware (screen, computer, power and signal cabling, etc.) from the scale interface into the trailer, including making all neat conduit entrances and sealing them after installation against moisture and insect penetration. The Contractor shall provide all work tables or work surfaces, and shelving indicated on the floor plan to accommodate the scale instrumentation at a convenient height, location and orientation for the cashier to operate. All internal to the trailer wiring runs shall be supported as needed with permanent support straps and bundled together neatly with plastic ties so that it does not get accidentally caught by personnel or induces stress on the wiring so that it could break or tear away from the mountings.
- C. The Contractor shall be responsible for securing the trailer to the ground and installing all hurricane hold-down straps and ground anchors to the trailer manufacturer's specifications and to meet the requirements of the Florida Building Code.
- D. The Contractor shall provide and install rigid, plastic mesh skirting (with openings for air exchange) around the entire perimeter of the trailer, from the pad to the underside of the trailer, including providing secure connections of the skirt to the trailer. Skirting is available at The Home Depot or Lowes.
- E. The trailer shall be equipped with Code-compliant stairs and landings, including handrails.
- F. The Contractor shall provide a concrete pad at the landings of all stairs for the trailer. The pad shall be steel reinforced and a minimum of 4-inches thick that extends 6 inches wider than the stairs and extends at least 4 feet from the lowest tread on the stair. The pad shall extend under the stair to provide a firm anchor and support for the staircase.
- G. The Contractor shall be responsible for bringing in electrical power (either overhead or buried as specified by the Owner) to the site, including making the connection to the trailer electrical distribution. The Contractor is responsible for providing all Code-required master shut-off breaker switch, utility metering conduit and can, and grounding rod and wiring. All conduits above grade shall have a Code-compliant and UL listed explosion-proof gas/vapor block fitting installed before any switch, junction box, or panel where there can be sparking.
- H. The Contractor shall provide and install all Code-compliant sanitary piping, fittings and specialty connectors, as needed, from the trailer sanitary outlet to the holding tank or sanitary sewer. The Contractor shall provide a sewage holding tank and hook-up as above, if one is indicated on the construction plans.
- I. The Contractor shall provide the potable water service pipe from the existing source to the connection point on the trailer, including all piping, valves, and specials required or needed, including reduced pressure zone backflow preventer, meter and a shut-off valve at the trailer, in a plastic utility box set at grade.

- J. The trailer shall be equipped, by the Contractor, as needed, with gutters along the entire leading lowest edge of the roof and downspouts and splash pads to direct flow away from the trailer.
- K. The Contractor is required to seal all penetrations made on-site on the underside, topside, or sides of the trailer, not including windows and doors.
- L. Verify foundation, mechanical, electrical utilities, and placed anchors are in correct position
Install.
- M. Install materials according to manufacturer's written instructions.
- N. All Work shall be performed by experienced workmen in a workmanlike manner to published tolerances.
- O. Deliver components and materials in manufacturer's standard protective packaging.
- P. Store all materials in accordance with manufacturer's storage and handling instructions.
- Q. The Contractor shall unload, store, and handle materials in a manner to prevent bending, warping, twisting and surface damage.
- R. Provide certification that installation was in conformance with the Manufacturer's instructions.

END OF SECTION

DIVISION 26

Electrical

SECTION 260500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For sleeve seals.

1.5 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches thickness shall be 0.052 inch
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 3. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

4. Pressure Plates: Stainless steel. Include two for each sealing element.
5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.

- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- C. Aluminum and Copper Conductors: Comply with NEMA WC 70.
- D. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN.
- E. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.

5. Tyco Electronics Corp.

- C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Advance Products & Systems, Inc.
 2. Calpico, Inc.
 3. Metraflex Co.
 4. Pipeline Seal and Insulator, Inc.
- D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 2. Pressure Plates: Stainless steel. Include two for each sealing element.
 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway; Metal-clad cable, type MC.
- C. Feeders concealed in Ceilings, Walls, Partitions, and Crawlspace: TYPE THHN-THWN, single conductors in raceway; Metal-clad cable, type AC
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway
- E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- F. Feeders in Cable Tray: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- G. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- J. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- K. Branch Circuits in Cable Tray: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

- M. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- N. Class 2 Control Circuits: Type THHN-THWN, in raceway

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

- D. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
 - 2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both wall surfaces.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.

- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections and prepare test reports.
- C. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- D. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.
 - 2. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Ground rings.
 - 4. Grounding arrangements and connections for separately derived systems.
 - 5. Grounding for sensitive electronic equipment.
- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
 - 1. Instructions for periodic testing and inspection of grounding features at test wells based on NETA MTS
 - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
 - b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Bare Grounding Conductor and Conductor Protector for Wood Poles:
 - 1. No. 4 AWG minimum, soft-drawn copper.
 - 2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.
- D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet in diameter.
- B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
 - 1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
 - 2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch minimum, from wall 6 inches above finished floor, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING OVERHEAD LINES

- A. Comply with IEEE C2 grounding requirements.
- B. Install 2 parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.
- C. Drive ground rods until tops are 12 inches below finished grade in undisturbed earth.
- D. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.
- E. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.
- F. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.
- G. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

- C. **Grounding Connections to Manhole Components:** Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
- D. **Pad-Mounted Transformers and Switches:** Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. **Busway Supply Circuits:** Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - 9. **Computer and Rack-Mounted Electronic Equipment Circuits:** Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. **Air-Duct Equipment Circuits:** Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. **Water Heater, Heat-Tracing, and Antifrost Heating Cables:** Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. **Isolated Grounding Receptacle Circuits:** Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from

raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

- I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
 - 1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
 - 2. Bury ground ring not less than 24 inches from building foundation.
- J. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
 - 1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
 - 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
- C. Perform the following tests and inspections and prepare test reports:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 - 3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and

other phenomena that may affect test results. Describe measures taken to improve test results.

- D. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
 5. Substations and Pad-Mounted Equipment: 5 ohms.
 6. Manhole Grounds: 10 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

- A. Product Data: For the following:

1. Steel slotted support systems.
 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
1. Trapeze hangers. Include Product Data for components.
 2. Steel slotted channel systems. Include Product Data for components.
 3. Nonmetallic slotted channel systems. Include Product Data for components.
 4. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.

- f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 6. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. Fabco Plastics Wholesale Limited.
 - d. Seasafe, Inc.
 3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 4. Fitting and Accessory Materials: Same as channels and angles except metal items may be stainless steel.
 5. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 6. Toggle Bolts: All-steel springhead type.
 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 7. To Light Steel: Sheet metal screws.
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 260533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Custom enclosures and cabinets.
 - 2. For handholes and boxes for underground wiring, including the following:

- a. Duct entry provisions, including locations and duct sizes.
 - b. Frame and cover design.
 - c. Grounding details.
 - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - e. Joint details.
- C. Samples for Initial Selection: For nonmetallic wireways and surface raceways with factory-applied texture and color finishes.
- 1. Size: 12”
- D. Samples for Verification: For each type of exposed finish required for nonmetallic wireways and surface raceways, prepared on Samples of size indicated below.
- 1. Size: 12”
- E. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
- 1. Structural members in the paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflex Inc.
 - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.

5. Electri-Flex Co.
 6. Manhattan/CDT/Cole-Flex.
 7. Maverick Tube Corporation.
 8. O-Z Gedney; a unit of General Signal.
 9. Wheatland Tube Company.
- C. Rigid Steel Conduit: ANSI C80.1.
- D. Aluminum Rigid Conduit: ANSI C80.5.
- E. IMC: ANSI C80.6.
- F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch minimum.
- G. EMT: ANSI C80.3.
- H. FMC: Zinc-coated steel.
- I. LFMC: Flexible steel conduit with PVC jacket.
- J. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 2. Fittings for EMT: Steel, set-screw type.
 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.
- K. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
 2. Anamet Electrical, Inc.; Anaconda Metal Hose.

3. Arco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

C. ENT: NEMA TC 13.

D. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

E. LFNC: UL 1660.

F. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

G. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

E. Wireway Covers: Screw-cover type.

F. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hoffman.
 - 2. Lamson & Sessions; Carlon Electrical Products.
- C. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
- D. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- E. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.5 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Butler Manufacturing Company; Walker Division.
- b. Enduro Systems, Inc.; Composite Products Division.
- c. Hubbell Incorporated; Wiring Device-Kellems Division.
- d. Lamson & Sessions; Carlon Electrical Products.
- e. Panduit Corp.
- f. Walker Systems, Inc.; Wiremold Company (The).
- g. Wiremold Company (The); Electrical Sales Division.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Hoffman.
 - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 6. O-Z/Gedney; a unit of General Signal.
 - 7. RACO; a Hubbell Company.
 - 8. Robroy Industries, Inc.; Enclosure Division.
 - 9. Scott Fetzer Co.; Adalet Division.
 - 10. Spring City Electrical Manufacturing Company.
 - 11. Thomas & Betts Corporation.
 - 12. Walker Systems, Inc.; Wiremold Company (The).
 - 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- C. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- D. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- F. Metal Floor Boxes: Sheet metal, fully adjustable rectangular.
- G. Nonmetallic Floor Boxes: Nonadjustable, round.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

- J. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

- K. Cabinets:
 - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Description: Comply with SCTE 77.
 - 1. Color of Frame and Cover: Gray.
 - 2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering, "ELECTRIC."
 - 6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 - 7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

- a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation.
 - d. NewBasis.
- C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Christy Concrete Products.
 - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
- D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete.
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Carson Industries LLC.
 - b. Christy Concrete Products.
 - c. Nordic Fiberglass, Inc.

2.8 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.9 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. Calpico, Inc.
 - 3. Metraflex Co.
 - 4. Pipeline Seal and Insulator, Inc.
- D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 2. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.10 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by a independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: PVC coated Rigid steel conduit .
 2. Concealed Conduit, Aboveground: Rigid steel conduit, EMT
 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4x.
 6. Application of Handholes and Boxes for Underground Wiring:
 - a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
 - b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
 - c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4x, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 1/2-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
 - 1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
 - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
 - 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- P. Set metal floor boxes level and flush with finished floor surface.
- Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align planks along the width and along the centerline of conduit.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
 - 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch .
 - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.8 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Identification for raceway and metal-clad cable.
 - 2. Identification for conductors and communication and control cable.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by

codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
 - 1. Power Circuits: Black letters on an orange field.
 - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

- C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch , with stamped legend, punched for use with self-locking nylon tie fastener.
- E. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
- E. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.
- C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch.
 - 2. Tensile Strength: 50 lb, minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F.
 - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
 - 1. Exterior Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):
 - a. Semigloss Acrylic-Enamel Finish: One finish coat over a primer.

- 1) Primer: Exterior concrete and masonry primer.
 - 2) Finish Coats: Exterior semigloss acrylic enamel.
2. Exterior Concrete Unit Masonry:
 - a. Semigloss Acrylic-Enamel Finish: One finish coat over a block filler.
 - 1) Block Filler: Concrete unit masonry block filler.
 - 2) Finish Coats: Exterior semigloss acrylic enamel.
3. Exterior Ferrous Metal:
 - a. Semigloss Alkyd-Enamel Finish: One finish coat over a primer.
 - 1) Primer: Exterior ferrous-metal primer.
 - 2) Finish Coats: Exterior semigloss alkyd enamel.
4. Exterior Zinc-Coated Metal (except Raceways):
 - a. Semigloss Alkyd-Enamel Finish: One finish coat over a primer.
 - 1) Primer: Exterior zinc-coated metal primer.
 - 2) Finish Coats: Exterior semigloss alkyd enamel.
5. Interior Concrete and Masonry (Other Than Concrete Unit Masonry):
 - a. Semigloss Alkyd-Enamel Finish: One finish coat over a primer.
 - 1) Primer: Interior concrete and masonry primer.
 - 2) Finish Coats: Interior semigloss alkyd enamel.
6. Interior Concrete Unit Masonry:
 - a. Semigloss Acrylic-Enamel Finish: One finish coat over a block filler.
 - 1) Block Filler: Concrete unit masonry block filler.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
7. Interior Gypsum Board:
 - a. Semigloss Acrylic-Enamel Finish: One finish coat over a primer.
 - 1) Primer: Interior gypsum board primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
8. Interior Ferrous Metal:

- a. Semigloss Acrylic-Enamel Finish: One finish coat over a primer.
 - 1) Primer: Interior ferrous-metal primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
- 9. Interior Zinc-Coated Metal (except Raceways):
 - a. Semigloss Acrylic-Enamel Finish: One finish coat over a primer.
 - 1) Primer: Interior zinc-coated metal primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
 - 1. Fire Alarm System: Red.
 - 2. Fire-Suppression Supervisory and Control System: Red and yellow.
 - 3. Combined Fire Alarm and Security System: Red and blue.
 - 4. Security System: Blue and yellow.
 - 5. Mechanical and Electrical Supervisory System: Green and blue.
 - 6. Telecommunication System: Green and yellow.
 - 7. Control Wiring: Green and red.
- C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.

- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Limit use of underground-line warning tape to direct-buried cables.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connection.
 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- I. Instruction Signs:
1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
 2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer.
- J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where 2 lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Access doors and panels for concealed electrical items.
 - c. Electrical switchgear and switchboards.
 - d. Transformers.
 - e. Electrical substations.
 - f. Emergency system boxes and enclosures.
 - g. Motor-control centers.
 - h. Disconnect switches.
 - i. Enclosed circuit breakers.
 - j. Motor starters.
 - k. Push-button stations.
 - l. Power transfer equipment.
 - m. Contactors.
 - n. Remote-controlled switches, dimmer modules, and control devices.
 - o. Battery inverter units.
 - p. Battery racks.
 - q. Power-generating units.
 - r. Voice and data cable terminal equipment.
 - s. Master clock and program equipment.
 - t. Intercommunication and call system master and staff stations.
 - u. Television/audio components, racks, and controls.
 - v. Fire-alarm control panel and annunciators.
 - w. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
 - x. Monitoring and control equipment.
 - y. Uninterruptible power supply equipment.
 - z. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.

- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

- J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION

SECTION 260923

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Time switches.
 - 2. Outdoor photoelectric switches.
 - 3. Lighting contactors.
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" for wall-box dimmers and manual light switches.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details.
 - 1. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Area Lighting Research, Inc.; Tyco Electronics.
 - 2. Grasslin Controls Corporation; a GE Industrial Systems Company.
 - 3. Intermatic, Inc.
 - 4. Leviton Mfg. Company Inc.
 - 5. Lightolier Controls; a Genlyte Company.
 - 6. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 7. Paragon Electric Co.; Invensys Climate Controls.
 - 8. Square D; Schneider Electric.
 - 9. TORK.
- D. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
 - 1. Contact Configuration: SPST .
 - 2. Contact Rating: 20-A ballast load, 120/240-V ac.
 - 3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
 - 4. Program: 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
 - 5. Programs: 8 channels; each channel shall be individually programmable with 8 on-off set points on a 24-hour schedule.
 - 6. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
 - 7. Astronomic Time: Selected channels.
 - 8. Battery Backup: For schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Area Lighting Research, Inc.; Tyco Electronics.
 - 2. Grasslin Controls Corporation; a GE Industrial Systems Company.
 - 3. Intermatic, Inc.
 - 4. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 5. Novitas, Inc.
 - 6. Paragon Electric Co.; Invensys Climate Controls.
 - 7. Square D; Schneider Electric.
 - 8. TORK.
- E. Description: Solid state, with SPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.
 - 1. Light-Level Monitoring Range: 1.5 to 10 fc with an adjustment for turn-on and turn-off levels within that range.
 - 2. Time Delay: 30-second minimum, to prevent false operation.
 - 3. Lightning Arrester: Air-gap type.
 - 4. Mounting: Twist lock complying with IEEE C136.10, with base.

2.3 LIGHTING CONTACTORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Allen-Bradley/Rockwell Automation.
 - 2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
 - 3. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 4. GE Industrial Systems; Total Lighting Control.
 - 5. Grasslin Controls Corporation; a GE Industrial Systems Company.
 - 6. Hubbell Lighting.
 - 7. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 8. MicroLite Lighting Control Systems.
 - 9. Square D; Schneider Electric.

- D. Description: Electrically operated and mechanically held, combination type with fusible switch, complying with NEMA ICS 2 and UL 508.
 - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 - 3. Enclosure: Comply with NEMA 250.
 - 4. Provide with control and pilot devices as scheduled, matching the NEMA type specified for the enclosure.

- E. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.
 - 1. Monitoring: On-off status
 - 2. Control: On-off operation

2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.

- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
 - 3. Load centers.

1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.

- C. Qualification Data: For qualified testing agency.
- D. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. 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.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

- B. Handle and prepare panelboards for installation according to NECA 407.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.

- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.8 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

1.10 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. Keys: Two spares for each type of panelboard cabinet lock.
 - 2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
 - 3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1
 - b. Outdoor Locations: NEMA 250, Type 4x, stainless steel.
 - c. Kitchen Areas: NEMA 250, Type 4X, stainless steel
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 6. Finishes:

- a. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel..
 - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
- 7. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Bottom.
- C. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 - 4. Split Bus: Vertical buses divided into individual vertical sections.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Compression type.
 - 3. Ground Lugs and Bus-Configured Terminators: Compression type.
 - 4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 - 6. Gutter-Tap Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. Panelboards: NEMA PB 1, power and feeder distribution type.
- D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inches high, provide two latches, keyed alike.
- E. Mains: Lugs only.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- D. Mains: lugs only.
- E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

- F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 LOAD CENTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. Load Centers: Comply with UL 67.
- D. Mains: Circuit breaker.
- E. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- F. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - g. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
 - h. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
 - i. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - j. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
 - k. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
 - l. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

- m. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
 - 1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."
 - 2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
 - 3. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.6 PANELBOARD SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Current Technology; a subsidiary of Danahar Corporation.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 4. Liebert Corporation.
 - 5. Siemens Energy & Automation, Inc.
 - 6. Square D; a brand of Schneider Electric.
- C. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
 - 1. Accessories:
 - a. LED indicator lights for power and protection status.
 - b. Audible alarm, with silencing switch, to indicate when protection has failed.
 - c. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
- D. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:

1. Accessories:
 - a. Fuses rated at 200-kA interrupting capacity.
 - b. Fabrication using bolted compression lugs for internal wiring.
 - c. Integral disconnect switch.
 - d. Redundant suppression circuits.
 - e. Redundant replaceable modules.
 - f. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 - g. LED indicator lights for power and protection status.
 - h. Audible alarm, with silencing switch, to indicate when protection has failed.
 - i. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 - j. Four-digit, transient-event counter set to totalize transient surges.
2. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.
3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
 - a. Line to Neutral: 70,000 A.
 - b. Line to Ground: 70,000 A.
 - c. Neutral to Ground: 50,000 A.
4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
5. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120-V, three-phase, four-wire circuits shall be as follows:
 - a. Line to Neutral: 400 V for 208Y/120.
 - b. Line to Ground: 400 V for 208Y/120.
 - c. Neutral to Ground: 400 V for 208Y/120.
6. Protection modes and UL 1449 SVR for 240/120-V, single-phase, three-wire circuits shall be as follows:
 - a. Line to Neutral: 400 V.
 - b. Line to Ground: 400 V.
 - c. Neutral to Ground: 400 V.

2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NECA 407.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407.
- B. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- C. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- D. Install filler plates in unused spaces.
- E. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- F. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- E. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.

c. Instruments and Equipment:

- 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 262713

ELECTRICITY METERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes equipment for utility company's electricity metering.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Describe electrical characteristics, features, and operating sequences, both automatic and manual. Include the following:
 - 1. Electricity-metering equipment.
- B. Shop Drawings for Electricity-Metering Equipment:
 - 1. Dimensioned plans and sections or elevation layouts.
 - 2. Wiring Diagrams: Power, signal, and control wiring specific to this Project. Identify terminals and wiring designations and color codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.
 - 3. Mounting and anchoring devices recommended by manufacturer.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Receive, store, and handle modular meter center as specified in NECA 400.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to

facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.7 COORDINATION

- A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:
1. Comply with requirements of utilities providing electrical power and communication services.
 2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include manufacturers specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

- A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
- B. Meter Sockets: Comply with requirements of electrical power utility company.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.

- B. Install equipment for utility company metering. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

END OF SECTION

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Receptacles with integral surge suppression units.
 - 4. Wall-box motion sensors.
 - 5. Isolated-ground receptacles.
 - 6. Hospital-grade receptacles.
 - 7. Snap switches and wall-box dimmers.
 - 8. Solid-state fan speed controls.
 - 9. Wall-switch and exterior occupancy sensors.
 - 10. Communications outlets.
 - 11. Pendant cord-connector devices.
 - 12. Cord and plug sets.
 - 13. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Service/Power Poles: One for every 10, but no fewer than one.
 - 2. Floor Service Outlet Assemblies: One for every 10, but no fewer than one .
 - 3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
 - 4. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 3. Leviton Mfg. Company Inc. (Leviton).
 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 8300 (duplex).
 - b. Hubbell; HBL8310 (single), HBL8300H (duplex).
 - c. Leviton; 8310 (single), 8300 (duplex).
 - d. Pass & Seymour; 9301-HG (single), 9300-HG (duplex).
- C. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; CR 5253IG.

- b. Leviton; 5362-IG.
 - c. Pass & Seymour; IG6300.
 - 3. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- D. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; TR8300.
 - b. Hubbell; HBL8300SG.
 - c. Leviton; 8300-SGG.
 - d. Pass & Seymour; 63H.
 - 3. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.
- C. Hospital-Grade, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL 498 Supplement SD.
- 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; HGF20.

- b. Hubbell; HGF8300.
- c. Leviton; 6898-HG.
- d. Pass & Seymour; 2091-SHG.

2.4 TVSS RECEPTACLES

- A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.
 - 1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
 - 2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
- B. Duplex TVSS Convenience Receptacles:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5362BLS.
 - b. Hubbell; HBL5362SA.
 - c. Leviton; 5380.
 - 3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.
- C. Isolated-Ground, Duplex Convenience Receptacles:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; IG5362BLS.
 - b. Hubbell; IG5362SA.
 - c. Leviton; 5380-IG.
 - 3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- D. Hospital-Grade, Duplex Convenience Receptacles: Comply with UL 498 Supplement SD.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 8300BLS.
 - b. Hubbell; HBL8362SA.
 - c. Leviton; 8380.
3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.

E. Isolated-Ground, Hospital-Grade, Duplex Convenience Receptacles:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; IG8300HGBLS.
 - b. Hubbell; IG8362SA.
 - c. Leviton; 8380-IG.
3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Comply with UL 498 Supplement SD. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

- A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Crouse-Hinds.
 - b. EGS/Appleton Electric.
 - c. Killark; a division of Hubbell Inc.

2.6 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; L520R.
 - b. Hubbell; HBL2310.
 - c. Leviton; 2310.
 - d. Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; IG2310.
 - b. Leviton; 2310-IG.
3. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.7 PENDANT CORD-CONNECTOR DEVICES

- A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
 2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.8 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Pilot Light Switches, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221PL for 120 V and 277 V.
 - b. Hubbell; HPL1221PL for 120 V and 277 V.
 - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
 - d. Pass & Seymour; PS20AC1-PLR for 120 V.
 - 3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- D. Key-Operated Switches, 120/277 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221L.
 - b. Hubbell; HBL1221L.
 - c. Leviton; 1221-2L.
 - d. Pass & Seymour; PS20AC1-L.
 - 3. Description: Single pole, with factory-supplied key in lieu of switch handle.

- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995.
 - b. Hubbell; HBL1557.
 - c. Leviton; 1257.
 - d. Pass & Seymour; 1251.

- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 1995L.
 - b. Hubbell; HBL1557L.
 - c. Leviton; 1257L.
 - d. Pass & Seymour; 1251L.

2.10 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
 - 1. 600 W; dimmers shall require no derating when ganged with other devices.
- D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.11 FAN SPEED CONTROLS

- A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.

1. Continuously adjustable slider, 5 A.
2. Three-speed adjustable slider, 1.5 A.

2.12 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting thick anodized aluminum.
 3. Material for Unfinished Spaces: Galvanized steel.
 4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.13 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

2.14 MULTIOUTLET ASSEMBLIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Hubbell Incorporated; Wiring Device-Kellems.
 2. Wiremold Company (The).
- C. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- D. Raceway Material: Metal, with manufacturer's standard finish.
- E. Wire: No. 12 AWG.

2.15 SERVICE POLES

- A. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
1. Poles: Nominal 2.5-inch square cross section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
 2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
 3. Finishes: Manufacturer's standard painted finish and trim combination.
 4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.
 5. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6 configuration 5-20R units.

2.16 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
1. Wiring Devices Connected to Normal Power System: Grey
 2. Wiring Devices Connected to Emergency Power System: Red.
 3. TVSS Devices: Blue.
 4. Isolated-Ground Receptacles: Orange.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, $2/3$ to $3/4$ of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

- G. Dimmers:
 - 1. Install dimmers within terms of their listing.
 - 2. Verify that dimmers used for fan speed control are listed for that application.
 - 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
 - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

SECTION 262813

FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches and enclosed controllers.
 - 2. Spare-fuse cabinets.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 3. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit on translucent log-log graph paper.
 - 5. Coordination charts and tables and related data.
 - 6. Fuse sizes for elevator feeders and elevator disconnect switches.
- B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit on translucent log-log graph paper.
4. Coordination charts and tables and related data.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. 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.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Comply with UL 248-11 for plug fuses.

1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.7 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers

offering products that may be incorporated into the Work include the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 2. Finish: Gray, baked enamel.
 3. Identification: "SPARE FUSES" in 1-1/2-inch high letters on exterior of door.
 4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
 1. Service Entrance: Class L, fast acting.

2. Feeders: Class L, fast acting.
3. Motor Branch Circuits: Class RK1, time delay.
4. Other Branch Circuits: Class RK1, time delay.
5. Control Circuits: Class CC, fast acting.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 262816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Receptacle switches.
 - 4. Shunt trip switches.
 - 5. Molded-case circuit breakers (MCCBs).
 - 6. Molded-case switches.
 - 7. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of NRTL listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 1. Wiring Diagrams: For power, signal, and control wiring.
 - C. Qualification Data: For qualified testing agency.
 - D. Field quality-control reports.
 1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
 - E. Manufacturer's field service report.
 - F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Type HD, Heavy Duty, Six Pole, Single Throw, 240-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- F. Type HD, Heavy Duty, Double Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- G. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 6. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 7. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 8. Service-Rated Switches: Labeled for use as service equipment.

9. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- C. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Type HD, Heavy Duty, Six Pole, Single Throw, 240-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- F. Type HD, Heavy Duty, Double Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- G. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 5. Hookstick Handle: Allows use of a hookstick to operate the handle.
 6. Lugs: Mechanical type, suitable for number, size, and conductor material.
 7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.3 RECEPTACLE SWITCHES

- A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. **Basis-of-Design Product:** Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. **Type HD, Heavy-Duty, Single-Throw Fusible Switch:** 240-V ac, 30, 60, 100 A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate specified fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. **Type HD, Heavy-Duty, Single-Throw Nonfusible Switch:** 240-V ac, 30, 60, 100 A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- E. **Interlocking Linkage:** Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.
- F. **Receptacle:** Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

2.4 SHUNT TRIP SWITCHES

- A. **Manufacturers:** Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. **Basis-of-Design Product:** Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Ferraz Shawmut, Inc.
 - 3. Littelfuse, Inc.
- C. **General Requirements:** Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.

- D. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- E. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- F. Accessories:
 - 1. Oiltight key switch for key-to-test function.
 - 2. Oiltight red ON pilot light.
 - 3. Isolated neutral lug; 100 percent rating.
 - 4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 - 5. Form C alarm contacts that change state when switch is tripped.
 - 6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.
 - 7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.5 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- D. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- E. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- F. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.

2. Long- and short-time pickup levels.
 3. Long- and short-time time adjustments.
 4. Ground-fault pickup level, time delay, and I^2t response.
- G. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- H. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- I. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- J. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- K. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 8. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
 9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 10. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 11. Electrical Operator: Provide remote control for on, off, and reset operations.
 12. Accessory Control Power Voltage: Integrally mounted, self-powered.

2.6 MOLDED-CASE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- D. Features and Accessories:
 - 1. Standard frame sizes and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - 6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
 - 7. Alarm Switch: One NO contact that operates only when switch has tripped.
 - 8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
 - 9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
 - 10. Electrical Operator: Provide remote control for on, off, and reset operations.
 - 11. Accessory Control Power Voltage: Integrally mounted, self-powered.

2.7 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 4X, stainless steel..
 - 3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including

connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".

END OF SECTION

SECTION 264113

LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes lightning protection for buildings.

1.3 DEFINITIONS

- A. LPI: Lightning Protection Institute.
- B. NRTL: National recognized testing laboratory.

1.4 SUBMITTALS

- A. Product Data: For air terminals and mounting accessories.
- B. Shop Drawings: Detail lightning protection system, including air-terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.
- C. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include data on listing or certification by an NRTL or LPI.
- D. Certification, signed by Contractor, that roof adhesive for air terminals is approved by manufacturers of both the terminal assembly and the single-ply membrane roofing material.
- E. Field inspection reports indicating compliance with specified requirements.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is an NRTL or who is certified by LPI as a Master Installer/Designer.

- B. Listing and Labeling: As defined in NFPA 780, "Definitions" Article.

1.6 COORDINATION

- A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.
- B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Automatic Lightning Protection.
 - 2. ERICO International Corporation.
 - 3. Harger Lightning Protection, Inc.
 - 4. Heary Bros. Lightning Protection Co. Inc.
 - 5. Independent Protection Co.
 - 6. Robbins Lightning Inc.
 - 7. Thompson Lightning Protection, Inc.

2.2 LIGHTNING PROTECTION SYSTEM COMPONENTS

- A. Comply with UL 96.
- B. Roof-Mounting Air Terminals: NFPA Class I copper, solid, unless otherwise indicated.
 - 1. Single-Membrane, Roof-Mounting Air Terminals: Designed for single-membrane roof materials.
- C. Stack-Mounting Air Terminals: Solid copper.
- D. Ground Rods, Ground Loop Conductors, and Concrete-Encased Electrodes: Comply with Division 26 Section "Grounding and Bonding for Electrical Systems" and with standards referenced in this Section.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lightning protection components and systems according to UL 96A and NFPA 780.
- B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops.
- C. Conceal the following conductors:
 - 1. System conductors.
 - 2. Down conductors.
 - 3. Interior conductors.
 - 4. Conductors within normal view from exterior locations at grade within 200 feet of building.
 - 5. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.
- D. Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing.
- E. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.
- F. Bond extremities of vertical metal bodies exceeding 60 feet in length to lightning protection components.
- G. A counterpoise installation based on requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" may be used as a ground loop required by NFPA 780, provided counterpoise conductor meets or exceeds minimum requirements in NFPA 780.
 - 1. Bond ground terminals to counterpoise conductor.
 - 2. Bond grounded metal bodies on building within 12 feet of ground to counterpoise conductor.
 - 3. Bond grounded metal bodies on building within 12 feet of roof to counterpoise conductor.
- H. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot intervals.
- I. Incorporate UL listed assemblies for bonding when cold formed steel trusses are assembled with sheet metal screws.

3.2 CORROSION PROTECTION

- A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.
- B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.3 FIELD QUALITY CONTROL

- A. UL Inspection: Provide inspections as required to obtain a UL Master Label for system.
- B. Provide an inspection by an inspector certified by LPI to obtain an LPI certification.

END OF SECTION

SECTION 264313

TRANSIENT-VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes TVSSs for low-voltage power, control, and communication equipment.
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" for devices with integral TVSSs.
 - 2. Division 26 Section "Panelboards" for factory-installed TVSSs.

1.3 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. SVR: Suppressed voltage rating.
- C. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.
- B. Product Certificates: For transient voltage suppression devices, signed by product manufacturer certifying compliance with the following standards:
 - 1. UL 1283.
 - 2. UL 1449.
- C. Qualification Data: For testing agency.
- D. Field quality-control test reports, including the following:
 - 1. Test procedures used.

2. Test results that comply with requirements.
 3. Failed test results and corrective action taken to achieve requirements.
- E. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.
- F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- F. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."
- G. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449, "Transient Voltage Surge Suppressors."

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
- B. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - 2. Operating Temperature: 30 to 120 deg F.
 - 3. Humidity: 0 to 85 percent, noncondensing.
 - 4. Altitude: Less than 20,000 feet above sea level.

1.7 COORDINATION

- A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Substantial Completion.
- B. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Replaceable Protection Modules: One of each size and type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advanced Protection Technologies, Inc.
 - 2. Atlantic Scientific.
 - 3. Current Technology, Inc.
 - 4. Cutler-Hammer, Inc.; Eaton Corporation.
 - 5. Entelec International.
 - 6. General Electric Company.
 - 7. Innovative Technology, Inc.
 - 8. Intermatic, Inc.
 - 9. LEA International.
 - 10. Leviton Mfg. Company Inc.
 - 11. Liebert Corporation; a division of Emerson.
 - 12. Northern Technologies, Inc.
 - 13. Siemens Energy & Automation, Inc.
 - 14. Square D; Schneider Electric.
 - 15. Surge Suppression Incorporated.
 - 16. Sutton Designs Inc.
 - 17. Transtector Systems, Inc.
 - 18. Tycor; Cutler-Hammer, Inc.
 - 19. United Power Corporation.
 - 20. Zero Surge Inc.

2.2 SERVICE ENTRANCE SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
 - 1. LED indicator lights for power and protection status.
 - 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 - 3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
- B. Surge Protection Device Description: Modular design with field-replaceable modules, sine-wave-tracking type with the following features and accessories:
 - 1. Fuses, rated at 200-kA interrupting capacity.
 - 2. Fabrication using bolted compression lugs for internal wiring.
 - 3. Integral disconnect switch.
 - 4. Redundant suppression circuits.
 - 5. Redundant replaceable modules.

6. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
 7. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 8. LED indicator lights for power and protection status.
 9. Audible alarm, with silencing switch, to indicate when protection has failed.
 10. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
 11. Surge-event operations counter.
- C. Peak Single-Impulse Surge Current Rating: 320 kA per phase.
- D. Connection Means: Permanently wired.
- E. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 400 V for 208Y/120.
 2. Line to Ground: 400 V for 208Y/120.
 3. Neutral to Ground: 400 V for 208Y/120.
- F. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 400 V.
 2. Line to Ground: 400 V.
 3. Neutral to Ground: 400 V.

2.3 PANELBOARD SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
- B. Surge Protection Device Description: Modular design with field-replaceable modules, sign-wave-tracking type with the following features and accessories:
1. Fuses, rated at 200-kA interrupting capacity.
 2. Fabrication using bolted compression lugs for internal wiring.
 3. Integral disconnect switch.
 4. Redundant suppression circuits.
 5. Redundant replaceable modules.

6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 7. LED indicator lights for power and protection status.
 8. Audible alarm, with silencing switch, to indicate when protection has failed.
 9. One set of dry contacts rated at 5 A and 250-V, ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
 10. Surge-event operations counter.
- C. Peak Single-Impulse Surge Current Rating: 160 kA per phase.
- D. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 400 V for 208Y/120
 2. Line to Ground: 400 V for 208Y/120
 3. Neutral to Ground: 400 V for 208Y/120
- E. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 400 V.
 2. Line to Ground: 400 V.
 3. Neutral to Ground: 400 V.

2.4 SUPPRESSORS FOR ELECTRONIC-GRADE PANELBOARDS

- A. Surge Protection Device Description: Sine-wave-tracking type, panel-mounted design with the following features and accessories:
1. LED indicator lights for power and protection status.
 2. Audible alarm, with silencing switch, to indicate when protection has failed.
 3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
 4. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
- B. Peak Single-Impulse Surge Current Rating: 160 kA per phase.
- C. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 400 V for 208Y/120
 2. Line to Ground: 400 V for 208Y/120
 3. Neutral to Ground: 400 V for 208Y/120.
- D. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:

1. Line to Neutral: 400 V.
2. Line to Ground: 400 V.
3. Neutral to Ground: 400 V.

2.5 PLUG-IN SURGE SUPPRESSORS

- A. Description: Non-modular, plug-in suppressors with at least four 15-A, 120-V ac, NEMA WD 6, Configuration 15-15R receptacles, suitable to plug into a NEMA WD 6, Configuration 15-15R receptacle; with the following features and accessories:
1. LED indicator lights for power and protection status.
 2. LED indicator lights for reverse polarity and open outlet ground.
 3. Circuit breaker and thermal fusing. When protection is lost, circuit opens and cannot be reset.
 4. Circuit breaker and thermal fusing. Unit continues to supply power if protection is lost.
 5. Cord connected with 15-foot line cord.
 6. Rocker-type on-off switch, illuminated when in the on position.
 7. One RJ11/12C telephone line protector, suitable for modem connection. Maximum clamping voltage 220 peak on pins No. 3 and No. 4.
- B. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
- C. Protection modes and UL 1449 SVR shall be as follows:
1. Line to Neutral: 475 V.
 2. Line to Ground: 475 V.
 3. Neutral to Ground: 475 V.

2.6 ENCLOSURES

- A. NEMA 250, with type matching the enclosure of panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

- A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.
- B. Install devices for panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

1. Provide multipole, 30-A circuit breaker as a dedicated disconnect for suppressor, unless otherwise indicated.

3.2 PLACING SYSTEM INTO SERVICE

- A. Do not energize or connect service entrance equipment to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust equipment installation, including connections, and to assist in field testing. Report results in writing.
 1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. Testing: Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports:
- C. Testing: Perform the following field tests and inspections and prepare test reports:
 1. After installing surge protection devices, but before electrical circuitry has been energized, test for compliance with requirements.
 2. Complete startup checks according to manufacturer's written instructions.
 3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
- D. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 265100

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. LED lighting fixtures.
 - 3. Emergency lighting units.
 - 4. Exit signs.
 - 5. Lighting fixture supports.
 - 6. Retrofit kits for fluorescent lighting fixtures.
- B. Related Sections include the following:
 - 1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - 2. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CRI: Color-rendering index.
- C. CU: Coefficient of utilization.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Luminaire: Complete lighting fixture, including ballast housing if provided.
- G. RCR: Room cavity ratio.

1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
1. Physical description of lighting fixture including dimensions.
 2. Emergency lighting units including battery and charger.
 3. Ballast.
 4. Energy-efficiency data.
 5. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Submittals" Article in Division 23 Section "Diffusers, Registers, and Grilles."
 6. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to industry level standards.
 7. Life, output, and energy-efficiency data for lamps.
 8. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
 - b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
 9. For LED lighting fixtures, submit US DOE LED Lighting Facts label and IES ratedlife.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
1. Wiring Diagrams: Power and control wiring.
- C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Lighting fixtures.
 2. Suspended ceiling components.
 3. Structural members to which suspension systems for lighting fixtures will be attached.
 4. Other items in finished ceiling including the following:
 - a. Air outlets and inlets.

- b. Speakers.
 - c. Sprinklers.
 - d. Smoke and fire detectors.
 - e. Occupancy sensors.
 - f. Access panels.
5. Perimeter moldings.
- D. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:
- 1. Lamps: Specified units installed.
 - 2. Accessories: Cords and plugs.
- E. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.
- F. Qualification Data: For agencies providing photometric data for lighting fixtures.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
- I. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.
- E. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
 - 2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.
- B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.
 - 2. Warranty Period for Electromagnetic Ballasts: Three years from date of Substantial Completion.
- C. Special Warranty for T5 and T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: One year from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

3. Battery and Charger Data: One for each emergency lighting unit.
4. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
5. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
- B. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include manufacturers specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 3. Basis-of-Design Product: The design for each lighting fixture is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- I. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.
- J. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.
- K. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Division 23 Section "Diffusers, Registers, and Grilles."
 - 1. Air Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.
 - 2. Heat Removal Units: Air path leads through lamp cavity.
 - 3. Combination Heat Removal and Air Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air supply units.
 - 4. Dampers: Operable from outside fixture for control of return-air volume.
 - 5. Static Fixture: Air supply slots are blanked off, and fixture appearance matches active units.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. Electronic Ballasts: Comply with ANSI C82.11; instant -start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Sound Rating: A
 2. Total Harmonic Distortion Rating: Less than 10 percent.
 3. Transient Voltage Protection: IEEE C62.41, Category A or better.
 4. Operating Frequency: 20 kHz or higher.
 5. Lamp Current Crest Factor: 1.7 or less.
 6. BF: 0.85 or higher.
 7. Power Factor: 0.95 or higher.
 8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
- B. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:
1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: A.
 4. Total Harmonic Distortion Rating: Less than 20 percent.
 5. Transient Voltage Protection: IEEE C62.41, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. BF: 0.95 or higher, unless otherwise indicated.
 9. Power Factor: 0.98 or higher.
- C. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
1. Ballast Manufacturer Certification: Indicated by label.
- D. Single Ballasts for Multiple Lighting Fixtures: Factory-wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.
- E. Ballasts for Low-Temperature Environments:
1. Temperatures 0 Deg F and Higher: Electronic or electromagnetic type rated for 0 deg F starting and operating temperature with indicated lamp types.
 2. Temperatures Minus 20 Deg F and Higher: Electromagnetic type designed for use with indicated lamp types.
- F. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.
- G. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

H. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.
 - b. Low-Level Operation: 30 percent of rated lamp lumens.
2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.95 or higher.
10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
11. Ballast Case Temperature: 75 deg C, maximum.

B. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within

lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate 1 fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Night-Light Connection: Operate one fluorescent lamp continuously.
 3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 6. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.
- B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.
1. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Night-Light Connection: Operate one fluorescent lamp in a remote fixture continuously.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type.
 5. Housing: NEMA 250, Type 1 enclosure.
 6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.6 BALLASTS FOR HID LAMPS

- A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:
 1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 2. Minimum Starting Temperature: Minus 22 deg F for single-lamp ballasts.
 3. Normal Ambient Operating Temperature: 104 deg F.
 4. Open-circuit operation that will not reduce average life.
 5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

- B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
 1. Lamp end-of-life detection and shutdown circuit.
 2. Sound Rating: A.
 3. Total Harmonic Distortion Rating: Less than 15 percent.
 4. Transient Voltage Protection: IEEE C62.41, Category A or better.
 5. Lamp Current Crest Factor: 1.5 or less.
 6. Power Factor: .90 or higher.
 7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
 8. Protection: Class P thermal cutout.
 9. Retain subparagraph and associated subparagraphs below for bi-level ballasts.

- C. Auxiliary Instant-On Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent light output.

- D. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter-starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
 1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
 - a. Restrike Range: 105- to 130-V ac.
 - b. Maximum Voltage: 250-V peak or 150-V ac RMS.

2. Minimum Starting Temperature: Minus 40 deg F.
3. Open-circuit operation shall not reduce average lamp life.

2.7 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
 1. Lamps for AC Operation: Fluorescent, 2 for each fixture, 20,000 hours of rated lamp life.
 2. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
 3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.
 4. Master/Remote Sign Configurations:
 - a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
 - b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.8 EMERGENCY LIGHTING UNITS

- A. Description: Self-contained units complying with UL 924.
1. Battery: Sealed, maintenance-free, lead-acid type.
 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
 7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
 8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.9 LED LIGHT FIXTURES

- A. General:
1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
 2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
 3. LED drivers shall include the following features unless otherwise indicated:
 - a. Minimum efficiency: 85% at full load.
 - b. Minimum Operating Ambient Temperature: -20° C. (-4° F.)
 - c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
 - d. Integral short circuit, open circuit, and overload protection.
 - e. Power Factor: ≥ 0.95 .
 - f. Total Harmonic Distortion: $\leq 20\%$.

- g. Comply with FCC 47 CFR Part 15.
- 4. LED modules shall include the following features unless otherwise indicated:
 - a. Comply with IES LM-79 and LM-80 requirements.
 - b. Minimum CRI 80 and color temperature 3000 K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
 - c. Minimum Rated Life: 50,000 hours per IES L70.
 - d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.
- B. LED Downlights:
 - 1. Housing, LED driver, and LED module shall be products of the same manufacturer.
- C. LED Troffers:
 - 1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.
 - 2. Housing, LED driver, and LED module shall be products of the same manufacturer.

2.10 FLUORESCENT LAMPS

- A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.
- B. T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3000 K, and average rated life 20,000 hours, unless otherwise indicated.
- C. T8 rapid-start low-mercury lamps, rated 17 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3000 K, and average rated life of 20,000 hours, unless otherwise indicated.
- D. T5 rapid-start low-mercury lamps, rated 28 W maximum, nominal length of 45.2 inches 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3000 K, and average rated life of 20,000 hours, unless otherwise indicated.
- E. T5HO rapid-start, high-output low-mercury lamps, rated 54 W maximum, nominal length of 45.2 inches, 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 3000 K, and average rated life of 20,000 hours, unless otherwise indicated.

- F. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 80 (minimum), color temperature 3000 K, average rated life of 10,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.
 - 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
 - 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
 - 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
 - 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
 - 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
 - 6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).

2.11 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.
 - 1. Dual-Arc Tube Lamps: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.
- B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.
- C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.
- D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

2.12 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.13 RETROFIT KITS FOR FLUORESCENT LIGHTING FIXTURES

- A. Comply with UL 1598 listing requirements.
 - 1. Reflector Kit: UL 1598, Type I. Suitable for two- to four-lamp, surface-mounted or recessed lighting fixtures by improving reflectivity of fixture surfaces.
 - 2. Ballast and Lamp Change Kit: UL 1598, Type II. Suitable for changing existing ballast, lamps, and sockets.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
 - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
 - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
 - 4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- C. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.
- E. Adjust aimable lighting fixtures to provide required light intensities.
- F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

SECTION 265600

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior luminaires with lamps and ballasts.
 - 2. Luminaire-mounted photoelectric relays.
 - 3. Poles and accessories.
- B. Related Sections include the following:
 - 1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS

- A. CRI: Color-rendering index.
- B. HID: High-intensity discharge.
- C. Luminaire: Complete lighting fixture, including ballast housing if provided.
- D. Pole: Luminaire support structure, including tower used for large area illumination.
- E. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.
- B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4.
- C. Ice Load: Load of 3 lbf/sq. ft. (143.6 Pa), applied as stated in AASHTO LTS-4.

- D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.
 - 1. Wind speed for calculating wind load for poles exceeding 50 feet in height is 110 mph.
 - 2. Wind speed for calculating wind load for poles 50 feet or less in height is 110 mph.

1.5 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - 2. Details of attaching luminaires and accessories.
 - 3. Details of installation and construction.
 - 4. Luminaire materials.
 - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - a. For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
 - b. Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - 6. Photoelectric relays.
 - 7. Ballasts, including energy-efficiency data.
 - 8. Lamps, including life, output, and energy-efficiency data.
 - 9. Materials, dimensions, and finishes of poles.
 - 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 - 11. Anchor bolts for poles.
 - 12. Manufactured pole foundations.
- B. Shop Drawings:
 - 1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
 - 2. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
 - 3. Wiring Diagrams: Power and control wiring.

- C. Samples for Verification: For products designated for sample submission in Exterior Lighting Device Schedule. Each sample shall include lamps and ballasts.
- D. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.
- E. Qualification Data: For agencies providing photometric data for lighting fixtures.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.
- H. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C2, "National Electrical Safety Code."
- E. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch deep. Do not apply tools to section of pole to be installed below ground line.

- D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.
- E. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 - 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
 - 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
 - 4. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion.
 - 5. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Ballasts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 4. Globes and Guards: 10 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
- B. In Exterior Lighting Device Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
 - 3. Basis of Design Product: The design of each item of exterior luminaire and its support is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

- J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
1. White Surfaces: 85 percent.
 2. Specular Surfaces: 83 percent.
 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- M. Factory-Applied Finish for Steel luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.
 - b. Color: Match Architect's sample of manufacturer's standard color.
 - c. Color: As selected by Architect from manufacturer's full range.
- N. Factory-Applied Finish for Aluminum luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
 3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating:

Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

- a. Color: Black.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
 1. Relay with locking-type receptacle shall comply with NEMA C136.10.
 2. Adjustable window slide for adjusting on-off set points.

2.4 FLUORESCENT BALLASTS AND LAMPS

- A. Low-Temperature Ballast Capability: Rated by its manufacturer for reliable starting and operation of indicated lamp(s) at temperatures 0 deg F (minus 18 deg C) and higher.
- B. Ballast Characteristics:
 1. Power Factor: 90 percent, minimum.
 2. Sound Rating: A.
 3. Total Harmonic Distortion Rating: Less than 10 percent.
 4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
 5. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
 6. Transient-Voltage Protection: Comply with IEEE C62.41 Category A or better.
- C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures 0 deg F (minus 18 deg C) and higher.
- D. Fluorescent Lamps: Low-mercury type. Comply with the EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

2.5 BALLASTS FOR HID LAMPS

- A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features, unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
 3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
 4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.
- B. Auxiliary, Instant-On, Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent of light output.
- C. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
 - a. Restrike Range: 105- to 130-V ac.
 - b. Maximum Voltage: 250-V peak or 150-V ac RMS.
 2. Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).

2.6 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.
1. Dual-Arc Tube Lamp: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.
- B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.
- C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.
- D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

2.7 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4.
 - 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
 - 2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 - 1. Materials: Shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
 - 3. Anchor-Bolt Template: Plywood or steel.
- D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."
- E. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.
- F. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4.

2.8 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); 1-piece construction up to 40 feet in height with access handhole in pole wall.
 - 1. Shape: Square, straight.
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

- B. Steel Mast Arms: Single-arm type, continuously welded to pole attachment plate. Material and finish same as pole.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - 1. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
 - 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
 - 3. Match pole material and finish.
- D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- E. Steps: Fixed steel, with nonslip treads, positioned for 15-inch vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet above finished grade.
- F. Intermediate Handhole and Cable Support: Weathertight, 3-by-5-inch handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.
- G. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- H. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- I. Platform for Lamp and Ballast Servicing: Factory fabricated of steel with finish matching that of pole.
- J. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- K. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.
- L. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove

- mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected by Architect from manufacturer's full range.

2.9 ALUMINUM POLES

- A. Poles: Seamless, extruded structural tube complying with ASTM B 429, Alloy 6063-T6 with access handhole in pole wall.
- B. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.
 1. Shape Square, straight.
 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- D. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
 1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
 2. Finish: Same as luminaire.
- F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- G. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - a. Color: As selected by Architect from manufacturer's full range.

2.10 FIBERGLASS POLES

- A. Poles: Comply with ANSI C136.20, with access handhole in pole wall.
 1. Mounting: Embedded.
 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- B. Resin Color: provide uniform coloration throughout entire wall thickness.
- C. Surface Finish: Pigmented polyurethane, with a minimum dry film thickness of 1.5 mils.

2.11 PRESTRESSED CONCRETE POLES

- A. Poles: Manufactured by centrifugal spin-casting process.
 1. Shape: Square, straight.
 2. Mounting Provisions: Embedded.
 3. Finishing: Capped at top and plugged at bottom. Seat each steel reinforcing strand with epoxy adhesive.
 4. Grounding: Continuous copper ground wire cast into pole. Terminate at top of pole and attach to 24-inch lightning rod.
- B. Cure with wet steam and age for a minimum of 15 days before installation.
- C. Fabricate poles with a hard, nonporous surface that is resistant to water, frost, and road and soil chemicals and that has a maximum water-absorption rate of 3 percent.
- D. Cast aluminum nameplate into pole wall at approximately 5 feet above ground line, listing name of manufacturer, Project identifier, overall height, and approximate weight.

- E. Pole Brackets: Comply with ANSI C136.13.
- F. Finish Color: Provided by color material complying with ASTM C 979, uniformly impregnated throughout the pole concrete. Color material shall provide a uniform, stable, permanent color and be as follows:
 - 1. Inert, and carbon free.
 - 2. Unaffected by environmental conditions and contaminants including, but not limited to, UV solar radiation, salts, and alkalis.
- G. Finish Texture: Etched exposed aggregate.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
 - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

3.2 POLE INSTALLATION

- A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:
 - 1. Fire Hydrants and Storm Drainage Piping: 60 inches.
 - 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
 - 3. Trees: 15 feet.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 3. Install base covers, unless otherwise indicated.
 4. Use a short piece of 1/2-inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
1. Dig holes large enough to permit use of tampers in the full depth of hole.
 2. Backfill in 6-inch layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.
- F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
1. Make holes 6 inches in diameter larger than pole diameter.
 2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
 3. Use a short piece of 1/2-inch diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
 4. Cure concrete a minimum of 72 hours before performing work on pole.
- G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.
- H. Raise and set poles using web fabric slings (not chain or cable).

3.3 BOLLARD LUMINAIRE INSTALLATION

- A. Align units for optimum directional alignment of light distribution.
- B. Install on concrete base with top 4 inches above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.4 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

- A. Install on concrete base with top 4 inches above finished grade or surface at luminaire

location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.5 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.6 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole, unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole.
 - 2. Install grounding conductor and conductor protector.
 - 3. Ground metallic components of pole accessories and foundations.

3.7 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
 - 1. Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
 - a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting."

- b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
 - c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
 - d. IESNA LM-64, "Photometric Measurements of Parking Areas."
 - e. IESNA LM-72, "Directional Positioning of Photometric Data."
- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.8 DEMONSTRATION

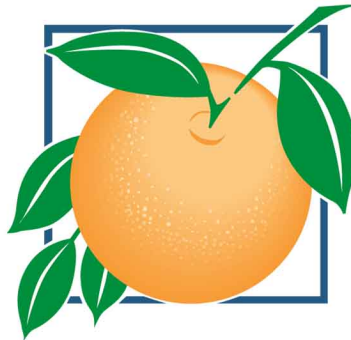
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SUPPLEMENTAL REPORTS

ATTACHMENT A

Select Specifications from the Orange County Utilities
Standards and Construction Specifications Manual, February
11, 2011



ORANGE COUNTY UTILITIES

Standards and Construction Specifications Manual

February 11, 2011



CHAPTER 3 SPECIFICATIONS

Section 3114: Installation of Pipe

February 11, 2011

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. These specifications cover the pipe installation for potable water mains, wastewater force mains, reclaimed water mains and wastewater gravity mains.
- B. The CONTRACTOR shall be responsible for all materials furnished and storage of same, until the date of project completion. The CONTRACTOR shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by UTILITIES, furnish certificates, affidavits of compliance, test reports, samples or check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

1.02 PIPE STORAGE AND HANDLING

- A. Pipe shall be covered with plastic for protection against contamination. PVC pipe shall be covered up with black plastic with a minimum of 15-mil thick. Pipe shall be handled in such manner as will prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of UTILITIES or be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on properly prepared ground, graded to eliminate all rock points and to provide uniform support along the full length. When being transported, the pipe shall be supported at all times in a manner which will not permit distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of UTILITIES, is damaged beyond repair by the CONTRACTOR shall be removed from the site of the WORK and replaced with another unit.
- B. Joint gaskets shall be stored in clean, dark, dry location until immediately before use.

PART 2 - PRODUCTS

2.01 Technical and Engineering Support

Manufacturers of Pipe that are approved in Appendix D shall be members in good standing with the respective engineering support trade organizations for purposes of providing technical & engineering support, ongoing research, regulatory coordination and training to the community including but not limited to Manufacturers, Suppliers, ENGINEERS, CONTRACTORS and the COUNTY.

- A. PVC Pipe – Uni-Bell PVC Pipe Association (Uni-Bell)
- B. DIP Pipe – Ductile Iron Pipe Research Association (DIPRA)
- C. HDPE - Plastic Pipe Institute (PPI)

2.02 PIPE COLOR CODING

- A. Pipe shall have color coding equal to the following table.

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Table 3114-1. Pipe Color.

Pipe Use	Color Coding
Potable Water	Safety Blue
Wastewater	Safety Green
Reclaimed Water	Pantone Purple (522-C)

2.03 PIPE MATERIALS AND APPURTENANCES

- A. Potable Water Mains:
Refer to Section 3210, “Water Pipes, Valves, and Appurtenances”.
- B. Gravity Mains:
Refer to Section 3310, “Wastewater Pipes, Valves, and Appurtenances”.
- C. Wastewater Force Mains:
Refer to Section 3310, “Wastewater Pipes, Valves, and Appurtenances”.
- D. Reclaimed Water Mains:
Refer to Section 3510, “Reclaimed Water Pipes, Valves, and Appurtenances”.

2.03 FITTINGS AND RESTRAINTS

- A. Fittings for Water Mains, Wastewater Force Mains and Reclaimed Water Mains:
 - 1. Cast ductile iron fittings 4-inch through 24-inch shall be pressure rated at 350 psi minimum (except flange-joint shall be rated at 250 psi minimum). All 30-inch and larger fittings shall be pressure rated to 250 psi minimum. All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron only. All fittings shall be cast and machine allowing the bolt holes to straddle the vertical centerline. All fittings shall be designed to be capable to withstand, without bursting, hydrostatic tests of three times the rated water working pressure. All fittings shall have a date code cast (not printed or labeled), with identification of date and factory and unit it was cast and machined. Fittings shall have distinctly cast on them the pressure rating, nominal diameter of openings, manufacturer’s name, the country where cast, and number of degrees or fraction of the circle. Ductile iron fittings shall have the letter “DI” or “Ductile” cast on them.
 - 2. All potable water main fittings shall have NSF certification, and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications.
 - 3. Interior and Exterior coatings shall be as specified by Sections 3119, 3210, 3310 and 3510.

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- B. Hardware for Fittings and Restraints. All flanged: pipe, valves and appurtenances shall have 316 stainless steel hardware. Shall meet ANSI/AWWA C111/A21.11 and the attached ASTM Standards:

Table 3114-2. Hardware ASTM Standards

Hardware	Carbon Steel	AISI 316 Stainless Steel
Heavy Hex Bolts	ASTM A307 Grade B	ASTM A193 Grade B8M
Heavy Hex Nuts	ASTM A563	ASTM A194 Grade 8M,
Tee-Bolts	ASTM A242	NA
Rods (all-thread, tie, anchor)	ASTM A242	ASTM A193 Grade B8M.

- ASTM A193 / A193M - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications
- ASTM A194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
- ASTM A307 Standard Specification for Carbon Steel Bolts and Studs.
- ASTM A563 Standard Specification for Carbons and Alloy Steel Nuts
- ASTM A242 Standard Specification for High-Strength Low-Alloy Structural Steel.
- ANSI/AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

PART 3 - EXECUTION

3.01 SURVEY LINE AND GRADE

- A. Pressure Mains:

Pipe shall be laid to the lines and grades shown on the PLANS. The CONTRACTOR shall provide line and grade stakes at a 100-foot maximum spacing and at all line and/or grade change locations. The CONTRACTOR shall provide temporary bench marks at a maximum of 1,000-foot intervals. The minimum pipe cover shall be 30 inches below the finished grade surface or 30 inches below the elevation of the edge of pavement of the road surface whichever is greater. Offsite utilities shall require a minimum of 36 inches of cover.

- B. Gravity Mains:

The CONTRACTOR shall set temporary bench marks at a maximum of 500-foot intervals. The CONTRACTOR shall constantly check line and grade of the pipe by laser beam method. In the event line and grade do not meet specified limits described hereinafter, the WORK shall be immediately stopped, UTILITIES notified and the cause remedied before proceeding with the WORK.

3.02 PIPE PREPARATION AND HANDLING

- A. All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked,

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- broken or otherwise defective materials are being used. All homing marks shall be checked for the proper length so as to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked on pipe shall result in rejection of pipe and removal from site. The CONTRACTOR shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.
- B. Proper implements, tools and facilities shall be used for the safe and proper protection of the WORK. Pipe shall be lowered into the trench in such a manner as to avoid any physical damage to the pipe. Pipe shall not be dropped or dumped into trenches under any circumstances.

3.03 PIPE INSTALLATION

- A. Trench Preparation and Pipe Bedding:
Refer to Section 3113 “Excavation, Backfill, Compaction and Grading” and STANDARD DRAWINGS.
- B. Trench Dewatering and Drainage Control
Specifications from Section 3.12, “Excavation, Backfill, Compaction and Grading”, shall apply. CONTRACTOR shall prevent water from entering trench during excavation and pipe-laying operations to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.
- C. Pipe Laying in Trench:
Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and re-laid. Pigging of pipe may be used to remove foreign materials in lieu of flushing. At times when pipe laying is not in progress; the open ends of the pipe shall be closed by a watertight plug or by other means approved by UTILITIES to ensure absolute cleanliness inside the pipe. The color stripe and pipe text shall be located on the top of pipe when installed. When installing PVC pipe, no additional joints will be installed until the preceding pipe joint has been completed and the pipe carefully embedded and secured in place.
- D. Locating Wire:
Locating wire, for electronically locating pipe after it is buried, or installed by trenchless technology shall be attached along the length of and installed with the pipe. This is applicable to all sizes and types of pressure mains. At a minimum, the tracing wire shall be attached to the pipe with nylon wire -ties, as shown in the STANDARD DRAWINGS. The wire itself shall be 10-gauge single strand solid core copper wire with non-metallic insulation. The insulation shall be color coded for the type of pipe being installed. Continuity must be maintained in the wire along the entire length of the pipe run. Permanent splices must be made in the length of the wire using wire connectors approved for underground applications as listed in the uniform electric

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- code handbook. The coiled wire shall extend a minimum 12 inches above the surface at valve locations.
- E. **PVC Pressure Pipe Installation and Training:**
PVC pipe shall be installed in accordance with standards set forth in the UNI-BELL “Handbook of PVC Pipe”, AWWA C605, and AWWA Manual M-23. The pipe shall be laid by inserting the spigot end into the bell flush with the insertion line or as recommended by the manufacturer. At no time shall the spigot end be allowed to go past the “insertion line” or “homing mark” for pressure pipe applications and homing mark shall be visible. A gap between the end of the spigot and the adjoining pipe is necessary to allow for expansion and contraction.
Field Cutting: PVC pipe can be cut with a handsaw or power driven abrasive disc. Be sure to make a square cut. Bevel the end with a beveling tool, wood rasp or power sander to the same angle as provided on the factory-finished pipe. Remark the insertion line on the spigot using a factory marked spigot as a guide.
All CONTRACTOR pipe crews utilizing PVC pressure pipe in the COUNTY shall be trained on an annual basis by Uni-Bell in coordination with the COUNTY and attended by the manufacturer’s representative of the respective approved Manufacturers in Appendix D. The Uni-Bell PVC training session will consist of proper handling, storage, installation, and compaction as well as COUNTY requirements regarding PVC pipe and deflection. Every person handling, installing or backfilling PVC pipe shall not be permitted to install COUNTY owned and / or maintained pipe without training.
Approved Appendix D manufacturers representatives not present at the hosted Uni-Bell training session or individuals of pipe crews not in attendance shall be trained on every project site. Onsite project training shall be for each manufacturer of pipe utilized onsite, per crew and per project. Specifically each crew member shall be trained on every project by every pipe manufactures representative regardless of previous onsite training. Every person handling, installing or backfilling PVC pipe shall not be permitted to install COUNTY owned and / or maintained pipe without training.
- F. **PVC Gravity Pipe Installation:**
Gravity sewer pipe shall be installed such that a separation of connected pipe shall not be greater than one inch and gravity sewer exceeding the maximum separation shall be removed and reinstalled. The homing mark may be disregarded to meet the maximum of 1” separation between bell and spigot requirement.
- G. **Ductile Iron Pipe Installation:**
Ductile iron pipes shall be installed in accordance with AWWA C600 and AWWA Manual M-42. When a restraining type gasket is used, the bell shall be painted red.
- H. **HDPE pipe installation:**
HPDE pipe installation shall follow the methods described in the “Plastic Pipe Institute Handbook” most current revision.

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I. Installation of Pipes on Curves:

1. Except for PVC pipe, long radius curves, either horizontal or vertical, may be installed with standard pipe by deflections at the joints. Except for PVC pipe, maximum deflections at pipe joints, fittings and laying radius for the various pipe lengths shall not exceed 75 percent of the pipe manufacturer's recommendation.
2. No joint deflection or pipe bending is allowed in PVC pipe. The maximum allowable tolerance in the joint due to variances in installation is 0.75 degrees (3-inches per joint per 20 ft stick of pipe). No bending tolerance in the pipe barrel shall be acceptable. Alignment change shall be made only with sleeves and fittings.

3.04 INSTALLATION OF APPURTENANCES:

A. Appurtenances:

Valves, fire hydrant assemblies, blow-off assemblies, line markers and combination or universal air release assemblies are to be installed at the locations shown on the plans and as shown in the STANDARD DRAWINGS. Valves and fire hydrant assemblies shall be restrained to the pipeline they are connected to. In addition the pipeline shall be restrained by the use of an approved material from a manufacturer listed in the Appendix D, "List of Approved Products". The distance of pipeline restraint shall not be less than shown in the STANDARD DRAWINGS.

B. Service Lines:

Service lines shall be installed to service intended properties as shown on the PLANS and as shown in the STANDARD DRAWINGS. Etch the letter "W", "S", or "R" in the curb at each service location as applicable.

C. Valve Boxes:

Valve boxes in non-paved areas shall be installed with a valve collar as shown in the STANDARD DRAWINGS. Etch the letter "V" in the curb at each valve location.

D. Fittings:

Fittings installed in a pressure pipeline shall require that both the pipe and fitting be restrained by the use of approved materials from manufacturers listed in the Appendix D, "List of Approved Products". The distance of pipeline restraint shall be not less than as shown in the STANDARD DRAWINGS.

E. Pressure and Non-Pressure Connections:

Any connection to the existing piping system shall be scheduled by submitting a "System Connection" form, found in Appendix B.

3.05 SUBAQUAEUS CROSSINGS

- A. The method of crossing bodies of waters shall be by subaqueous means. UTILITIES may approve other construction means or methods addressing special conditions.

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- B. A minimum cover of five feet shall be maintained over the pipe. Restrained joint pipe shall be used.
- C. Valves shall be provided at both ends of the water crossings so that the section can be isolated for testing or repair. The valves shall be easily accessible and installed, as shown in the STANDARD DRAWINGS, at locations not subject to flooding.
- D. An air or combination air/vacuum release valve shall be installed at the upstream high point prior to the subaqueous crossing. The air release valve shall be capable of expelling large quantities of air from the main during filling, allow air into the main during shutdown and expelling air during operation.
- E. It shall be the responsibility of the CONTRACTOR/DEVELOPER to obtain all applicable regulatory permits, including dredge and fill permits to perform the WORK.

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PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The WORK specified in this section consists of furnishing and installing underground utilities using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring or guided horizontal boring for pressure pipe. This WORK shall include all piping services, equipment, materials and labor for the complete and proper installation testing, restoration of underground utilities and environmental protection and restoration.

1.02 QUALITY ASSURANCE

- A. Qualifications:
1. Directional drilling CONTRACTOR (or SUBCONTRACTOR) shall have a minimum of four years experience constructing water, wastewater, or reclaimed water experience to include pipelines of the same or larger diameter and the same or greater lengths. All pipe and appurtenances of similar type and material shall be furnished by a single manufacturer.
 2. The CONTRACTOR's operations shall be in conformance with the Directional Crossing Contractors Association (DCCA) published guidelines (latest edition) and pipe manufacturer's guidelines and recommendations.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The directional drilling equipment shall consist of the following:
1. A directional drilling rig of sufficient capacity to perform the bore and pull-back the pipe;
 2. A drilling fluid mixing, delivery and recovery system of sufficient capacity to complete the crossing;
 3. A drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be reused;
 4. A magnetic guidance system to accurately guide boring operations,
 5. A vacuum truck of sufficient capacity to handle the drilling fluid volume; and
 6. Trained and competent personnel to operate the system.
- B. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in proper working order.

2.02 DRILLING SYSTEM

- A. The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating

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pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pullback pressure during pullback operations. The rig shall be grounded during drilling and pullback operations. There shall be a system to detect electrical current from the drilling string and an audible alarm that automatically sounds when an electrical current is detected.

2.03 PIPE

- A. Pipe shall be PVC or HDPE pipe with ductile iron pipe outside diameters in accordance with AWWA C900 (C905) or C906 respectively. The dimension ratio shall be verified by the CONTRACTOR based on the pipe, joint and material pull strength required for the directional drilling.
- B. PVC Pipe
 - 1. PVC restrained joint pipe shall have maximum dimension ratios equal to the following table.

Table 3115-1. Maximum Dimension Ratios for PVC Pipe.

Type of Pipe System	Maximum Dimension Ratio
Wastewater	18
Reclaimed Water	18
Water	18

- 2. PVC pipe shall meet the requirements of AWWA C900 (C905). The pipe shall be joined using separate couplings that have beveled edges, built-in sealing gaskets and restraining grooves or steel ring-and-pin gasketed joints. The restraining splines shall be square and made from Nylon 101. Pipe and couplings shall be Underwriters Laboratory and Factory Mutual approved.
- 3. Installation Curvature: The pipeline curvature shall not have a radius less than as shown in Table 3115-2.

Table 3115-2. PVC Pipe Deflection Information.

Pipe Diameter (inches)	Minimum Radius of Curvature (feet)	Offset per 20-ft Length (inches)	Deflection per 20-ft Length (degrees)
4	133	17.25	8.6
6	200	12.00	5.7
8	266	9.00	4.3
10	333	6.75	3.5
12	400	6.00	2.9
16	532	4.50	1.5

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C. HDPE Pipe

1. HDPE pipe and related fittings shall be made with prime virgin resins exhibiting a minimum cell classification as defined in ASTM D3350 and meeting the PE 3408 code designation with maximum dimension ratios equal to the following.

Table 3115-3. Maximum Dimension Ratios for HDPE Pipe.

Type of Pipe System	Maximum Dimension Ratio
Wastewater	11
Reclaimed Water	11
Water	11

2. HDPE pipe 4-inch and larger nominal diameter shall be joined by means of zero leak-rate butt (thermal heat) fusion welds and/or approved flanged joints. Joints shall provide axial pullout resistance. Pipe shall meet the requirements of ANSI/AWWA C906, and have an outside diameter dimension of ductile iron pipe. Flanged joints shall not be used below finished grade for horizontal directional drilling applications.
3. HDPE pipe shall have been continuously marked by the manufacturer with permanent printing indicating at a minimum the following.
 - a. Nominal size (inches);
 - b. Dimension ratio (DR);
 - c. Pressure rating (psi);
 - d. Trade name;
 - e. Material classification (PE 3408);
 - f. Plant, extruder and operator codes;
 - g. Resin supplier code;
 - h. Date produced; and
 - i. HDPE pipe used for portable water mains shall bear the NSF Seal of Approval.
4. HDPE pipe shall be black in color with permanent colored stripes extruded into the pipe length or shall be one solid color, per the applicable service.

Table 3115-4. Pipe Color.

Pipe Use	Color Coding
Potable Water	Blue
Wastewater	Green
Reclaimed Water	Purple

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5. Installation Curvature:

The pipeline curvature shall not have a radius less than as shown in Table 3115-5.

Table 3115-5. HDPE Pipe Deflection Information.

Pipe Diameter (inches)	Minimum Radius of Curvature (feet)	Offset per 20-ft Length (inches)
4	23	9.3
6	34	6.1
8	44	4.6
10	56	3.5
12	67	3.0
16	88	2.3

2.04 DRILLING FLUIDS

- A. Drilling fluids shall consist of a mixture of potable water and gel-forming colloidal material, such as bentonite or a polymer surfactant mixture producing slurry of custard-like consistency.

PART 3 - EXECUTION

3.01 PERSONNEL REQUIREMENTS

- A. Responsible representatives of the CONTRACTOR and SUBCONTRACTOR(s) shall be present at all times during directional drilling operations. A responsible representative as specified herein is defined as a person experienced in the type of WORK being performed and who has the authority to represent the CONTRACTOR in a routine decision making capacity concerning the manner and method of carrying out the WORK.
- B. The CONTRACTOR and SUBCONTRACTOR(s) shall have sufficient number of competent workers on the project at all times to ensure the utility placement is made in a timely, satisfactory manner. Adequate personnel for carrying out all phases of the directional drilling operation (where applicable: tunneling system operators, operator for removing spoil material, and laborers as necessary for various related tasks) must be on the job site at the beginning of WORK. A competent and experienced supervisor representing the CONTRACTOR or SUBCONTRACTOR that is thoroughly familiar with the equipment and type of WORK to be performed, must be in direct charge and control of the operation at all times. In all cases, the supervisor must be continually present at the project site during the directional drilling operation.

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3.02 WORK PLAN

- A. Prior to beginning WORK, the CONTRACTOR must submit a WORK plan to UTILITIES detailing the procedure and schedule to be used to execute the project. The WORK plan should include the following.
 - 1. A description of all equipment to be used;
 - 2. Down-hole tools;
 - 3. A list of personnel and their qualifications and experience;
 - 4. List of SUBCONTRACTORS;
 - 5. A schedule WORK activity;
 - 6. A safety plan, traffic control plan (if applicable);
 - 7. An environmental protection plan and;
 - 8. Contingency PLANS for possible problems.
- B. WORK plan should be comprehensive, realistic and based on actual working conditions for this particular project. Plan should document the requirements to complete the project
- C. Equipment:
 - 1. The CONTRACTOR will submit specifications on directional drilling equipment to be used to ensure that the equipment will be adequate to complete the project. Equipment shall include but not be limited to the following.
 - a. Drilling rig;
 - b. Mud system;
 - c. Mud motors (if applicable);
 - d. Down-hole tools;
 - e. Guidance system and;
 - f. Rig safety systems.
 - 2. Calibration records for guidance equipment shall be included. Specifications for any drilling fluid additives that the CONTRACTOR intends to use or might use shall be submitted.

3.03 COORDINATION OF THE WORK

- A. The CONTRACTOR shall notify UTILITIES at least three days in advance of starting WORK. In addition, the actual crossing operation shall not begin until UTILITIES is present at the project site and agrees that proper preparations for the crossing have been made. UTILITIES' approval for beginning the crossing shall in no way relieve the CONTRACTOR from the ultimate responsibility for the completion of the WORK.
- B. The CONTRACTOR and UTILITIES shall select a mutually convenient time for the crossing operation to begin in order to avoid schedule conflicts.

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3.04 PROCEDURE

- A. The installation of appropriate safety and warning devices in accordance with the “FDOT Manual on Traffic Control and Safe Practices” shall be completed prior to beginning WORK.

3.05 INSTALLATION

- A. Erosion and sedimentation control measures and on-site containers shall be installed to prevent drilling mud from spilling out of entry and/or exit pits. Drilling mud will be disposed of off-site in accordance with local, state and federal requirements and/or permit conditions.
 - 1. No other chemicals or polymer surfactant shall be used in the drilling fluid without written consent of UTILITIES and after a determination is made that the chemicals to be added are not harmful or corrosive to the facility and are environmentally safe.
- B. Pilot Hole :

Pilot hole shall be drilled on bore path with no deviations greater than two percent of depth over a length of 100 feet. In the event that pilot does deviate from bore path more than two percent of depth in 100 feet, the CONTRACTOR will notify ENGINEER. The ENGINEER may require the CONTRACTOR to pull-back and re-drill from the location along bore path before the deviation.
- C. Reaming:

Upon successful completion of pilot hole, the CONTRACTOR will ream borehole to a minimum of 25 percent greater than outside diameter of pipe using the appropriate tools. CONTRACTOR will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.
- D. Pullback:

After successfully reaming borehole to the required diameter, CONTRACTOR will put the pipe through the borehole. In front of the pipe will be a swivel and barrel reamer to compact bore hole walls. Once pullback operations have commenced, operations must continue without interruption until pipe is completely pulled into borehole. During pullback operations, the CONTRACTOR shall not apply more than the maximum safe pipe pull pressure at any time. A break away head rated at the maximum safe pull pressure shall be utilized.
- E. As-built variance from the designed bore path shall not exceed plus or minus one foot in the vertical plane and plus or minus two feet in the horizontal plane. The CONTRACTOR shall submit any proposed deviations from the design bore path with SHOP DRAWINGS.
- F. The pipe entry area shall be graded to provide support for the pipe to allow free movement into the borehole. The pipe shall be guided in the borehole to avoid deformation of, or damage to, the pipe.

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- G. If unexpected subsurface conditions are encountered during the bore, the procedure shall be stopped. The installation shall not continue until the OWNER and ENGINEER have been consulted.
- H. The pipe shall be pulled back through the borehole using the wet insertion construction technique. The pipe shall be installed full of water.
- I. The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, movement or distortion of surface features.
- J. A boring log shall be kept with horizontal and vertical location every 10 feet. In addition, horizontal location of the bore shall be marked in the field during the bore. The SURVEYOR shall locate these marks and include this information with the bore depths in the Record Drawings. The Surveyor may make a note on the drawing page containing the directional drill and provide an exception for the directional drill only, as the directional drill route cannot be uncovered and physically located.
- K. Locating wire in accordance with Section 3114 shall be attached to the pipe. A minimum of three (3) locating wires shall be attached at different radial locations around the pipe to ensure continuity in at least one wire subsequent to installation. Failure of continuous continuity in the locating wire, at the discretion of the UTILITY representative, shall result in abandonment and reinstallation of the directional drill.
- L. The pipe shall be installed at a depth of no more than 15 feet below pavement, measured from the top of pipe.

3.06 FIELD TESTING

- A. PVC Pipe:
Perform hydrostatic testing for leakage following installation in accordance with the applicable test sections.
- B. HDPE Pipe:
 - 1. After installation the pipe shall be tested in accordance with the MANUAL with the following modifications:
 - a. Test Duration: The total test time including initial pressurization, initial expansion and time at test pressure, must not exceed eight hours. If the test is not completed due to leakage, equipment failure, etc., the test section shall be depressurized and allowed to “relax” for a minimum of eight hours before it is brought back up to test pressure. The test procedure consists of initial expansion phase and leakage test phase.
 - b. Initial Expansion Phase: During the initial expansion phase, the test section is pressured to the test pressure and enough make-up liquid is added each hour for three hours to return to test pressure.
 - c. Leakage Test Phase: The leakage test phase follows immediately and shall be either two or three hours in duration. At the end of the time test, the test section shall be returned to test pressure by adding a measured amount of liquid. The amount of make-up liquid added shall not exceed the values provided in Table 3.15-6 plus allowable leakage.

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Table 3115-6. Allowance for Make-up Water Under Test Pressure*

Test Duration (hours)	Pipe Diameter (inches)							
	2	4	6	8	12	16	20	24
Allowance/100 feet of Pipeline (gallons)								
2	0.11	0.25	0.60	1.00	2.30	3.30	5.50	8.90
3	0.19	0.40	0.90	1.50	3.40	5.50	8.00	13.30

**Applies to test period and not to initial expansion phase*

C. Pressure Testing:

The test pressure for the pipe shall be 150 psi for water and reclaimed water and 100 psi for wastewater.

D. Mandrel Testing:

Perform mandrel testing through the entire length of the installed pipe. The mandrel size shall be 90 percent of the inside diameter of the pipe.

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Section 3116: Jack and Bore

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PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The installation of a casing pipe by the method of boring and jacking shall be covered by these specifications. The overall scope of WORK shall include, but not be limited to, boring and jacking pits and equipment, sheeting, steel casing pipe, casing spacers, coatings, location signs as required, miscellaneous appurtenances to complete the entire WORK as shown on the STANDARD DRAWINGS and restoration. Applicable provisions of PARTS 1 and 2 shall apply concurrently with this MANUAL. Boring and jacking operations shall be performed within the right-of-way and/or easements shown on the PLANS.

1.02 QUALITY ASSURANCE

- A. Jurisdiction:
For casing pipe crossing under roadways or other installations not within the jurisdiction of the OWNER, the CONTRACTOR shall comply with regulations of said authority. State highway casing installations shall conform to the FDOT, "Utility Accommodation Guide".
- B. The CONTRACTOR shall verify existing utility location prior to constructing drilling and receiving pits.
- C. Subaqueous crossings shall also adhere to the requirements in Section 3114, "Installation of Pipe".

PART 2 - PRODUCTS

2.01 PIPE MATERIAL

- A. Steel Casing:
Steel casings shall conform to the requirements of ASTM Designation A139 (straight seam pipe only) Grade "B" with minimum yield strength of 35,000 psi. The casing pipes shall have the minimum nominal diameter and wall thickness as shown in Table 3116-1. Field and shop welds of the casing pipes shall conform to the American Welding Society (AWS) standard specifications. Field welds shall be complete penetration, single-bevel groove type joints. Welds shall be airtight and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more than 3/4-inch.
- B. Carrier Pipe:
The carrier pipe shall be as specified by Section 3210, "Water Pipe, Valves, and Appurtenances", Section 3310, "Wastewater Pipe, Valves, and Appurtenances" and ~~Section 3510, "Reclaimed Water Pipe, Valves, and Appurtenances"~~ with restrained joints, with the following exceptions: water and reclaimed water carrier pipe shall be ductile iron pipe and wastewater force mains shall be DR-18 PVC.

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Table 3116-1. Casing Pipe Minimal Nominal Diameter and Wall Thickness.

Carrier Pipe Nominal Diameter (in.)	Casing Outside Diameter (in.)	Casing Wall Thickness (in.)
4	16	.250"
6	16	.250"
8	18	.250"
10	20	.250"
12	24	.250"
16	30	.312"
20	36	.375"
24	42	.500"
30	48	.500"
36	54	.500"
42	60	.500"

C. Carrier Pipe Spacers:

1. Stainless Steel Casing Spacers:

Carrier pipes, inside of steel casing pipe, shall be supported by casing spacers at no more than 6-1/2 feet between spacers with double spacers on each end of the casing and spacers at a maximum of 2 feet behind the bell. Each spacer shall be a minimum 8-inches wide for pipe 12-inch diameter or less or minimum 12 inches wide for pipe 16-inch or greater and manufactured of minimum 14-gauge Type 304 stainless steel. All nuts, bolts and washers shall be 304 stainless steel and compatible with the respective 304 stainless steel shell / band. Each spacer shall have a minimum of four runner supports manufactured of an ultra high molecular weight polyethylene or glass reinforced polymer. The runner supports shall be of adequate height to position the carrier pipe in the center of casing with a minimum top clearance of 1-1/2-inch. All casing spacers larger than 36-inch diameter (carrier pipe) shall be factory designed, taking in consideration the weight of the carrier pipe filled with water. All calculations and drawings shall be submitted to UTILITIES for review.

D. Casing End Seals:

Casing ends shall be sealed with brick and cement in the annular space and casing end seals shall be used to completely close both openings on either side of the casing. These end seals shall be pull on (seamless) or wrap around with stainless steel straps for securing to the carrier pipe and the casing. End seals shall be constructed of specially compounded synthetic rubber a minimum thickness of 1/8-inch.

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PART 3 - EXECUTION

3.01 INSPECTION

- A. Casing pipe to be installed may be inspected for compliance with this MANUAL by an independent laboratory selected and paid for by UTILITIES. The manufacturer's cooperation shall be required in these inspections.
- B. All casing pipe shall be subjected to a careful inspection prior to being installed. If the pipe fails to meet the specifications it shall be removed and replaced with a satisfactory replacement at no additional expense to UTILITIES.

3.02 PIPE HANDLING

- A. Care shall be taken in loading, transporting, and unloading to prevent damage to the pipe or coatings. Pipe shall not be dropped. All pipes shall be examined before lying and no piece shall be installed which is found to be defective. Any damage to the pipe or coatings shall be repaired or replaced to the satisfaction of UTILITIES.

3.03 CONSTRUCTION REQUIREMENTS

A. WORK Coordination:

It shall be the CONTRACTOR's responsibility to perform the boring and jacking work in strict conformance with the requirements of the agency in whose right of way or easement the WORK is being performed. Any special requirements of the agency such as insurance, flagmen, etc., shall be strictly adhered to during the performance of WORK. The special requirements shall be performed by the CONTRACTOR at no additional cost to UTILITIES.

B. Dewatering:

Dewatering through the casing during construction shall not be permitted. UTILITIES shall approve all dewatering methods before construction work begins.

C. Carrier Pipe Support:

The carrier pipes shall be supported within the casing pipes so that the pipe bells do not rest directly on the casing. The load of the carrier pipes shall be distributed along the casing spacers. Casing spacers shall be bolt on style split shells made of T-304 stainless steel. All nuts and bolts shall be high strength, low alloy meeting AWWA C111. Runners shall be made of a high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction.

D. Jacking Pits:

Excavation adjacent to the roads shall be performed in a manner to adequately support the roads. Bracing, shoring, sheeting or other supports shall be installed as needed. The CONTRACTOR shall install suitable reaction blocks for the jacks as required. Jacking operations shall be continuous and precautions shall be taken to avoid interruptions that might cause the casing to "freeze" in place. Upon completion of jacking operations, the reaction blocks, braces and all other associated construction

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materials shall be completely removed from the site. Appropriate barricades will be provided if pits are open overnight. Excavation shall be completely enclosed with barricades.

E. Miscellaneous Requirements:

Correct line and grade shall be carefully maintained. Earth within the casing shall not be removed too close to the cutting edge in order to prevent the formation of voids outside the casing. If voids are formed, they shall be satisfactorily filled with grout by pumping.

1. The sections of steel casing shall be field welded in accordance with the applicable portions of AWWA C206 and AWS D7.0 for field welded pipe joints. The CONTRACTOR shall wire brush the welded joints and paint with an approved material. After completion of jacking, the CONTRACTOR shall clean the interior of the casing of all excess material.
2. The annular space between the carrier pipe and casing shall be filled with clean sand, if required in the bore and jack permit. Masonry plugs or end seals are to be installed at each open end of the casing. Plugs shall be suitable for restraining the earth load.
3. The pipe shall be installed at a depth of no more than 15 feet below pavement measured from the top of pipe.

CHAPTER 3 SPECIFICATIONS

Section 3119: Coatings and Linings

February 11, 2011

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. These specifications pertain to the coating and lining including but not limited to manholes and lift stations as well as the coating of above ground assets including but not limited to: steel, ductile iron pipe, ductile iron fittings, valves, hydrants, hardware and all appurtenances. Brass, bronze and 316 Stainless Steel shall not be coated.
- B. Precast concrete rehabilitation and new structures. The work shall include the furnishing and installation of an interior protective lining / coating corrosion protection system including all necessary materials, equipment and tools as required for a complete installation in accordance with the manufacturers recommendations. The completed system shall provide a waterproof, corrosion protection system to prevent any deterioration of concrete surfaces from hydrogen sulfide and other corrosive gases/acids produced by wastewater and to prevent infiltration. To ensure total unit responsibility, all materials and installation thereof shall be furnished by, and coordinated with, one supplier/manufacturer.

1.02 QUALITY ASSURANCE

- A. All work shall be proved to be in first class condition and constructed in accordance with the drawings and specifications. All defects disclosed by tests and inspections shall be remedied immediately by the Contractor at no expense to the COUNTY.
- B. Fiberglass liner manufacturers shall certify that the liner has been manufactured, sampled, tested, and inspected in accordance with ASTM D 3753.
- C. Polyethylene liner manufacturers shall certify that the liner has been designed and manufactured in accordance with ASTM F 1759 and these specifications.
- D. Holiday Testing: Each coat shall be holiday tested at the recommended 100-125 volts DC per mil in accordance with the latest edition of the following standards: NACE SP0188-2006, NACE Standard RP0490, ASTM G62

1.03 COVERAGE

- A. The protective lining / coating corrosion protection shall cover all concrete surfaces within the wet well or manhole including the adjustment ring area.
- B. Coatings and lining surfaces shall be holiday free and all defects shall be repaired in accordance with the manufacturers recommendations prior to the next coat being applied.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill

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2. ASTM D3299 Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
 3. ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings
 4. ASTM D3753 Glass-Fiber-Reinforced Polyester Manholes and Wetwells
 5. ASTM D6365 Nondestructive Testing of Geomembrane Seams using the Spark Test.
 6. ASTM F1759 Design of High-Density Polyethylene (HDPE) Manholes for Subsurface Applications
 7. ASTM F1869 Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 8. ASTM G62 Standard Test Methods for Holiday Detection in Pipeline Coatings.
- B. NACE INTERNATIONAL (Formerly The National Association of Corrosion Engineers)
1. NACE SP0188-2006 (formerly RP0188), Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
 2. NACE Standard SP0490-2007 (formerly RP0490), Holiday Detection of Fusion-Bonded Epoxy External Pipeline Coating of 250 to 760 μm (10 to 30 mil).
 3. NACE Standard SP0178-2007 (formerly RP0178), Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service

PART 2 - PRODUCTS

2.01 HDPE LINERS

- A. The work shall include the furnishing and installation of an interior protective liner system including all necessary labor, materials, equipment and tools as required for a complete installation. Liner shall be high density polyethylene (HDPE). This liner shall provide a waterproof, corrosion resistant liner to prevent any deterioration of concrete surfaces from hydrogen sulfide and other corrosive gases/acids produced by wastewater and to prevent infiltration. To ensure total unit responsibility, all materials and installation thereof shall be furnished by, and coordinated with, one supplier/manufacturer.
- B. Manhole HDPE Liner shall have a minimum thickness of 2 mm (78 mil) and Wetwell HDPE shall have a minimum thickness of 5 mm (195 mil). All HDPE liner sheets shall be extruded with a large number of anchoring studs, a minimum of (420/m², 39 ft²), manufactured during the extrusion process in one piece with the sheet so there is no welding and no mechanical finishing work to attach the studs to the sheet. The liner shall have a pull out of 112.5 lbs/anchoring stud. A manufacturer certified fabricator shall custom fit the liner to the form work in order to protect the concrete surfaces from sewer gases.

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- C. All welding shall be performed in accordance with the published directives and procedures of the manufacturer and by welders certified by the manufacturer and documentation shall be provided to the COUNTY prior to the work. Completion of welding will provide a one piece monolithic concrete protective liner system that will provide excellent resistance to hydrogen sulfide attack and will not pull off the wall in the event that infiltration occurs. Flat liner sheet, not anchored, used for overlapping joints, shall have a minimum thickness of 3 mm for manholes or 5 mm for wetwells and shall contain a co-extruded bottom surface layer of conductive polyethylene. Conductive cap strip material shall have a free path from the back side of the sheet to a portion of the concrete surface.
- D. Field welding of the liner at the riser joints shall be completed only after vacuum testing (ASTM C1244) of the new structure has been completed and any concrete joint deficiencies have been rectified. Vacuum testing is not required on rehabilitation of existing structures.
- E. Testing and supervision of the installation and welding shall be performed by qualified staff only and must be checked when completed by visually checking and by Spark Testing all welded joints per ASTM D6365. Holiday testing 20,000 to 35,000 volts. All high voltage discontinuity (spark) testing shall be performed using a Tinker & Rasor model AP/W Holiday Detector or equal.
- F. Penetrations (Forcemain, conduit, etc) shall have an internal boot comprising of minimum of 3/8" 316SS band clamp compressing a 2" wide neoprene with full circumferential welded boot around each penetration in accordance with the manufacturer's details.

2.02 PREFORMED POLYPROPYLENE (PP) LINERS

- A. The work shall include the furnishing and installation of an interior protective liner system including all necessary labor, materials, equipment and tools as required for a complete installation. This liner shall provide a waterproof, corrosion resistant liner to prevent any deterioration of concrete surfaces from hydrogen sulfide and other corrosive gases/acids produced by wastewater and to prevent infiltration. To ensure total unit responsibility, all materials and installation thereof shall be furnished by, and coordinated with, one supplier/manufacturer. Manholes shall be leak free.
- B. All joints shall be field welded by hot air extrusion welding with PP welding bead. Field welding of the PP liner at the riser joints shall be completed only after vacuum testing (ASTM C1244) of the new structure has been completed and any concrete joint deficiencies have been rectified. Vacuum testing is not required on rehabilitation of existing structures.
- C. Testing and supervision of the installation and welding shall be performed by qualified staff only and must be checked when completed by visually checking and by Spark Testing all welded joints per ASTM D6365. Holiday testing 20,000 to 35,000 volts. All high voltage discontinuity (spark) testing shall be performed using a Tinker & Rasor

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model AP/W Holiday Detector or equal.

- D. Penetrations (Forcemain, conduit, etc) shall be gasketed PP pipe bell connectors or PP sleeves for boot type connectors and shall be attached to the PP liner by hot air extrusion welding with PP welding bead in accordance with the manufacturer's details.

2.03 FIBERGLASS LINERS

- A. Fiberglass liners shall be used for new or existing precast manholes and wetwells. Fiberglass liners shall meet or exceed ASTM D 3753 and shall with stand ASSHTO H-20 Loading.
- B. FRP liner shall be one piece with no vertical or horizontal seams allowed. The FRP shall be fabricated in accordance with NBS PS 15-69, and shall consist of commercial grade polyester resin, UV inhibitor, chopped strand, woven roving, and continuous reinforcement. Minimum liner thickness shall be 1/2-inch for all diameter wells, and shall not have external ribs. Liner size shall be field verified by liner manufacturer's representative. Tolerance of the inside diameter shall be +/- 1% of the required liner diameter.
- C. Exterior Surface: The exterior surface shall be relatively smooth with no sharp projections and shall be free of blisters larger than 1/2 inch in diameter, delamination and fiber show. Hand work finish is acceptable if enough resin is present to eliminate fiber show.
- D. Interior Surface: The interior surface shall be resin rich with no exposed fibers. The surface shall be free of crazing, delamination, and blisters larger than 1/2 inch in diameter, and wrinkles of 1/8 inch or greater in depth. Surface pits shall be permitted up to 6 square feet if they are less than 3/4 inch in diameter and less than 1/16 inch deep. Voids that cannot be broken with finger pressure and that are entirely below the resin surface shall be permitted if they are less than 1/2 inch in diameter and less than 1/16 inch thick.

- E. Physical Properties:

Property	Hoop Direction	Axial Direction
a. Tensile Strength (psi)	18,000	5,000
b. Tensile Modules (psi)	0.6 x 10e	0.7 x 10e
c. Flexural Strength (psi)	26,000	4,500
d. Flexural Modules (psi)	1.4 x 10e	0.7 x 10e
e. Compressive Strength (psi)	18,000	12,000

- F. Stiffness

Liner Length in FT.	PSI
3 – 6.5	0.75
7 – 12.5	1.26
13 – 20.5	2.01
21 – 25.5	3.02
26 – 35	5.24

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- G. **TESTING:** All tests shall be performed as specified in ASTM D3753 latest edition, Section 8. Test method D-790 (note 5) and test method D695. Each completed liner shall be examined for dimensional requirements, hardness and workmanship. All required ASTM D3753 testing shall be completed and records of all testing provided to the COUNTY. As a basis of acceptance, the manufacturer shall provide an independent certification which shall consist of a copy of the manufacturer's test report, and be accompanied by a copy of the test results that the liner has been sampled, tested and inspected in accordance with the provisions of this specification and meets all its requirements. The independent certification and manufacturer's test report shall be provided to the COUNTY prior to delivery of the Liner.
- H. **Connections:** Openings for pipe connections will be core drilled in the field. Pipes shall be placed through concrete wet well and fiberglass liner in the locations indicated on the drawings. Pipes shall then be grouted in place with the grout filling the entire void and being as thick as the concrete wet well. The pipe on the interior of the wet well shall be fiberglassed to the fiberglass liner. To fiberglass the PVC or Ductile Iron pipe to the fiberglass liner, the surface to be fiberglassed must first be sanded. In the case of Ductile Iron pipe, the protective coating on the exterior of the pipe must be removed and then the pipe sanded. After sanding and cleaning the area to be fiberglassed, apply a coat of primer resin. When the resin becomes tacky, begin normal installation of the fiberglass, taking care to roll out all of the air pockets. All field fiberglassing must be accomplished by a manufacturer certified installer. Submit certification to the COUNTY.
- I. **Fiberglass Reinforced Top:** The fiberglass manhole liner top shall be fabricated using fiberglass material as above. Material and installation to meet all physical requirements as above. Top to be attached to wetwell liner pipe with fiberglass layup to comply with ASTM-D3299. When reinforcement is necessary for strength, the reinforcement shall be fiberglass channel laminated to the inside of the liner top and shall comply with ASTM.-D3299. 4000 psi concrete shall be poured around the entire manhole fiberglass cone section. Lift station top slabs shall be re-poured with HDPE interior liner. CONTRACTOR shall ensure an air tight connect between the Pump Station HDPE lined top slab and interior wetwell liner.
- J. PVC stub-outs shall be factory installed for new installations to accept approved boots for gravity lines or compression seals for force mains.

2.04 FERROUS METAL SURFACES (Inclusive of Steel and DIP, Hydrants, Fittings and Appurtenances)

Cleaning, surface preparation, coating application, and thickness shall be as specified herein and shall meet or exceed the coating manufacturer's recommendations. When the manufacturer's minimum recommendations exceed the specified requirements, Contractor shall comply with the manufacturer's minimum recommendations. All cleaning, surface preparation, coating application, thickness, testing, and coating materials (where available) shall be in accordance with the referenced standards of the following AWWA, ANSI, NACE, SSPC, NSF, and ASTM. Color coding shall be

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Safety Blue, Safety Green and Pantone Purple 522-C for water, wastewater and reclaimed water respectfully. Surfaces shall be holiday detected in accordance with ASTM G 62. Areas found to have holidays shall be marked and repaired in accordance with the paint manufacturer's instructions. The COUNTY shall be notified of time of testing so that he might be present to witness testing.

A. Procedures for Coating Exterior of DIP, Hydrants, Fittings and Appurtenances

1. Surface Preparation. Do not abrasive blast or prepare more surface area than can be coated in the same day; prepare surfaces and apply prime coatings within an 8-hour period.
 - a. Steel: Shall require NACE-1 / SSPC-SP5 White Metal Blast Cleaning minimum angular anchor profile of 1.5 mils. White metal blast cleaning removes all of the coating, mill scale, rust, oxides, staining, corrosion products, and other foreign matter from the surface.
 - b. DIP, DIP with asphaltic seal coat, Hydrants, FBE (Valves and appurtenances): Shall require NACE-3 / SSPC-SP6 Commercial Blast Cleaning minimum angular anchor profile of 1.5 mils. Commercial blast cleaning removes all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter from all surfaces and allows stains to remain on 33 percent of each unit area of surface.

Note: Primer Option - Hydrants, FBE (Valves and appurtenances), existing factory coatings: Where specifically called out in the Coating System Table below, NACE-4 / SSPC-SP7 may be substituted for the commercial blast for hydrants and factory applied FBE (Valves and appurtenances) where the coating manufacturer has specifically provided compatible coatings with existing coatings including urethane, epoxy, alkyd and water-based coatings. Under no circumstances shall DIP with asphaltic seal coat be over-coated. NACE-4 / SSPC-SP7 Brush-Off Blast Cleaning shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose coating. Tightly adherent mill scale, rust, and coating may remain on the surface. Mill scale, rust, and coating are considered tightly adherent if they cannot be removed by lifting with a dull putty knife after abrasive blast cleaning has been performed.

2. Contaminants: Remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating in accordance with SSPC-SP1 for the substrate and between each coating layer.
3. Temperature: Surface temperature of substrate shall be a minimum of 5 degrees above the dew point and rising and generally between 40°F to 100°F. Temperatures shall not exceed manufacturer's recommendations.
4. Stripping: Edges, corners, crevices, welds, and bolts shall be given a brush coat / stripe coat for each material / layer. The stripe coat shall be applied by a brush and worked in both directions.

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5. Coatings Systems. Two options for coating systems are provided. Each coat shall be a distinctive color or shade to verify each coating in the system.
6. Prime coat: DIP, DIP with asphaltic seal coat, Hydrants, FBE (Valves and appurtenances) prime coat shall be zinc-rich. Zinc-rich shall only be used on bare metal. Factory applied FBE / Asphaltic / Mastic coatings on valves and appurtenances shall be completely removed per NACE 3 / SSPC-SP6.

Note: Where specifically called out in the Coating System Table for factory applied FBE (Valves and appurtenances) surface preparation may be NACE-4 / SSPC-SP7 and the prime coat shall be an **Inorganic water based epoxy**. Asphaltic seal coats and mastics shall not be overcoated with Inorganic water based epoxy.
7. Intermediate coat. Varies per coating system.
8. Final Coat. Varies per coating system.
9. Holiday Testing: Each coating layer shall be holiday tested at the recommended 100-125 volts DC per mil in accordance with the latest edition of the following standards: NACE SP0188-2006, NACE Standard RP0490, ASTM G62 and per the manufacturers recommendations. All low voltage holiday testing shall be performed using a Tinker & Rasor model M-1 Holiday Detector or equal.
10. Coating Systems – Either System 1 or System 2 shall be used for above ground, non-immersion ferrous metal surfaces (Inclusive of Steel, DIP, Hydrants, Fittings and Appurtenances)

Table 3119-1 Color Codes

Generic Name	Application	Tnemec	Carboline	PPG / Ameron
Safety Blue	Water Master Meters	True Blue / Safety 11SF	9122	BL Safety Blue
Safety Green	Pump Station Piping	Hunter Green 08SF	V358	GN Safety Green
Pantone Purple 522C	Reclaimed Master Meters	Purple Rain / Safety 14 SF	7528	PL Safety Purple
Safety Green	Hydrant Bonnet & Caps	Hunter Green 08SF	V358	GN Safety Green
Safety Orange	Hydrant Bonnet & Caps	Tangerine Orange / Safety 04 SF	1420	OR 2Safety Orange
Safety Red	Hydrant Bonnet & Caps	Candy Apple Red / Safety 06SF	7573	RD 2 Safety Red
TBD	Hydrant Barrel	TBD	TBD	TBD

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Table 3119-2 System 1 - Zinc / Urethane / Fluoropolymer

Description	Generic Coating Name	Tnemec	DFT	Carboline	DFT
			mils		mils
Prime Coat all materials. Surface Prep NACE 1 or NACE 3	Zinc-Rich	Zinc Series 90-97	2.5 - 3.5	Carbozinc 621	3.0 - 8.0
Prime Coat - option for FBE or Hydrants only. Surface Prep NACE 4	Inorganic water based epoxy – overcoat existing coatings	Typoxy Series 27WB	4.0 - 14.0	NA	NA
Intermediate Coat.	Aliphatic Acrylic Polyurethane	Endura-Shield Series 73	2.0 - 3.0	Carbothane 133 HB	3.0 - 5.0
Final Coat.	Advanced Thermoset Fluoropolymer Polyurethane	Hydroflon Series 700	2.0 - 3.0	Carboxane 950	2.0 - 3.0

Table 3119-3 System 2 - Zinc / Epoxy / Urethane

Description	Generic Coating Name	Tnemec	DFT	Carboline	DFT	PPG / Ameron	DFT
			mils		mils		mils
Prime Coat all materials. Surface Prep NACE 1 or NACE 3	Aromatic Urethane, Zinc-Rich	Zinc Series 90-97	2.5 - 3.5	Carbozinc 621	3.0 - 8.0	Amercoat 68HS	3
Prime Coat option for FBE, Hydrants. Surface Prep NACE 4	Inorganic water based epoxy – overcoat existing coatings	Typoxy Series 27WB	4.0 - 14.0	NA	NA	NA	NA
Intermediate Coat.	Polyamidoamine Epoxy	Color Hi-Build Epoxoline II Series N69	4.0 - 10.0	Carboguard 60	4.0 - 6.0	Amerlock 2/400	4.0 - 6.0
Final Coat.	Aliphatic Acrylic Polyurethane	Endura-Shield Series 73	2.0 - 3.0	Carboxane 950	2.0 - 3.0	Amercoat 450H	2.0 - 3.0

B. Procedures for Coating Interior of DIP and Fittings

1. Wastewater DIP and Fittings.

- a. Interior coatings shall be Protecto 401 (amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment) for all fittings. All ductile iron pipe and fittings shall be delivered to the manufacturer certified applicator without asphalt, cement lining, or any other lining on the interior surface and no coating shall have been applied to the first six inches of the exterior of the DIP spigot ends. Minimum surface preparation shall be SSPC-SP 1 Solvent Cleaning method to remove oil and grease followed by NACE-4 / SSPC-SP7 Brush-Off Blast Cleaning. Protecto 401 shall be applied within 12 hours of surface preparation to the interior of the pipe / fittings so as to obtain a continuous and

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relatively uniform and smooth integral lining with a total minimum dry film thickness of 40 mils for the complete system. No lining shall take place when the substrate or ambient temperature is below 40°F. The lining shall not be used on the face of the flange of fittings or flanged pipe. The system shall be holiday free and holiday testing (Minimum 2000 volts) shall be conducted and pinhole repaired prior to shipping.

- b. Exterior buried fittings shall be asphaltic coating. Exterior flanged fittings shall be specified per 3119 2.04. A.
2. Water and Reclaimed Fittings. Interior coating shall be FBE or Cement Mortar lined.
 - a. FBE for Fittings - Fittings shall be supplied with a fusion applied epoxy coating (FBE), both inside and outside for total protection including flanged and buried fittings. The exterior of Flange fittings for above ground assemblies shall adhere to final exterior coating requirements per 3119 2.04 A. The FBE coating system shall meet or exceed ANSI/AWWA C-550 and C116/A21.116 requirements and shall have NSF 61 certification. FBE coatings thickness shall be 6 to 8 mils dry film thickness and shall be applied for secure adhesion and shall have a smooth surface and shall be holiday free.
 - b. Cement-mortar lining for ductile iron pipe and ductile and gray iron fittings for water service shall be in accordance with ANSI/AWWA C104/A21.4 and the exterior surface of buried DIP shall be asphaltic coating.
 - c. Exterior flanged fittings shall be specified per 3119 2.04. A.

2.05 Specialty Coatings

The Specialty Coatings are for rehabilitation of existing precast concrete manholes. New precast structures shall be lined only. All specialty coatings applicators shall follow the procedure as outlined below:

A. GENERAL

1. Pre-Inspection. Applicator shall take appropriate action to comply with all local, state and federal regulations including those set forth by OSHA, EPA, the COUNTY and any other applicable authorities. Prior to conducting any work, perform inspection of structure to determine need for protection against hazardous gases or oxygen depleted atmosphere and the need for flow control or flow Diversion.
2. Bypass plan. Bypass plan for flow control or bypass shall be submitted to the COUNTY for approval prior to conducting the work. Any active flows shall be dammed, plugged, or diverted as required to ensure all liquids are maintained below or away from the surfaces to be coated until final applications are cured as recommended by the corrosion protection system manufacturer.
3. Surface Preparation. NACE 6 / SSPC-SP13 "Surface Preparation of Concrete". Dry

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required of original installation. All high voltage discontinuity (spark) testing shall be performed using a Tinker & Razor model AP/W Holiday Detector or equal and at 100-125 volts DC per mil or per the manufacturers recommendations.

9. Destructive Testing. Destructive testing may be performed as directed by the COUNTY to verify coating adhesion and coating DFT. Repairs to areas tested by destructive means shall be repaired by the certified applicator at the CONTRACTORS expense.
 10. Reporting. Provide final written report to the COUNTY detailing the location, date of report, description of repair or original installation and manufacturer data and cut sheets of the corrosion protection system and applicable testing results as per sections 7, 8 and 9
 11. Warranty: The report shall contain a copy of the warranty.
- B. **System SC-1** –Sauereisen Sewergard 210 (Trowelable), 210FS (Trowelable Fast Set), 210S (Sprayable) or 210RS (Rotary Spray) shall be applied and then shall be finished with a coat of Sauereisen Sewergard Glaze 210G. The lining system to be utilized shall be an epoxy mortar or aggregate filled epoxy. Material furnished under this specification shall be a pre-packaged from the manufacturer. Materials shall be trowel applied or sprayed and shall conform to the Manufactures product data sheet as supplied by the manufacturer.
1. Additional Preparation. To ensure a good bond, the newly blasted surface shall be thoroughly vacuumed to remove all sand and debris and surface shall be dry prior to application.
 2. Surfacer for Rehabilitation / repair: Substrate in requiring repairs in excess of 1/8” shall be repaired with Sauereisen Underlayment No F-120, F-121 or F-209 Filler prior to application of protective lining / coating corrosion protection system.
 3. Thickness:
 - i. Sewergard 210 / 210FS / 210RS- The material shall be applied in one or more layers for a total thickness of minimum of 125 mils DFT (1/8-inch). After application, the material shall be damp rolled with excess water shaken off prior to back-rolling.
 - ii. Sprayable 210S – The material shall be applied in one or more layers such A minimum of 60 mils shall be required for the Spray applied 210S.
 4. Finishing Glaze: After application, and curing of either the 210, 210FS, 210RS or 210S, the material shall be coated with a minimum of 20 mils of Sauereisen Sewergard Glaze 210G by roller or spray application in accordance with the manufacturers recommendations.
 5. Holiday Testing: The protective lining / coating protection system shall be cured in accordance with the manufacturer’s recommendations prior to holiday testing at a

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minimum of 14,500 volts.

C. System SC-2 – Tnemec Perma-Shield Coating System.

1. Additional Preparation. To ensure a good bond, the newly blasted surface shall be thoroughly vacuumed to remove all sand and debris and surface shall be dry prior to application and surface shall be minimum 5 degrees above the dew point. Moisture content not to exceed three pounds per 1,000 sq ft in a 24 hour period verify dryness a “plastic film tape-down test” ASTM D 4263 perform Anhydrous Calcium Chloride ASTM F 1869.
2. Surfacer for Rehabilitation / repair: Substrate in requiring repairs in excess of 1/8” shall be repaired Series 217 or 218 Filler prior to application of protective lining / coating corrosion protection system. Concrete surface shall be pre-wet or dampened with potable water prior to surfacer application.
3. Thickness: Lining Series 434 - The material shall be applied in one or more layers for a total thickness of minimum of 125 mils DFT (1/8-inch).
4. Finishing Glaze: After application, and curing, the material shall be coated with a 15- 20 mils of Series 435 in accordance with the manufacturers recommendations.
5. Holiday Testing: The protective lining / coating protection system shall be cured in accordance with the manufacturers recommendations prior to holiday testing at a minimum 14,500 volts.

D. System SC-3 – SEWPERCOAT (PG and 2000 HS). Calcium aluminate mortar. The lining system to be utilized shall be 100% calcium aluminate cement with 100% calcium aluminate aggregate. Materials shall be sprayed applied by either a wet gunning (low pressure spray) or dry gunning (shotcrete) method and shall conform to the Manufactures product data sheet as supplied by the manufacturer. The equipment shall be clean and free of any hydrated or unhydrated Portland Cement.

1. Additional Preparation. To ensure a good bond, the newly blasted surface shall be fully saturated with water prior to application.
2. Thickness: The material shall be applied in one or more layers to such total thickness as required. A minimum of one inch (1”) shall be applied.
3. Finishing: After spraying, the material shall be brushed or trowel finished.
4. Curing: Curing by appropriate methods (curing compound, water mist, etc.) should be implemented as the surface begins to harden and dry (as early as one hour after application).

E. System SC-4. Raven 405 System shall be 100% solids epoxy. Thinning with solvents shall not be permitted. Surface preparation, mixing, pot life, ambient conditions,

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application, film thickness per coat, cure time, and recoat time shall be in accordance the manufacturer's recommendations.

1. Applicator / installer shall be certified by the Manufacturer.
 2. Surfacer / Repair – Raven 710, 705CA or Raven 700 shall be spray applied or troweled to repair / fill minor surface defected or applied as an underlayment.
 3. Primer – Concrete exhibiting a moisture vapor emission rate greater than 3 lbs/1,000ft²/24 hours, when tested according to ASTM F1869, shall be primed with Raven 155. Raven 155 primer (2 component waterborne epoxy) shall be applied at a maximum of 8 mil WFT (3 mil DFT). Recoat window minimum 2-4 hours @ 72°F with maximum 72 hours at 72°F.
 4. Top Coat - Raven 405 shall be applied with an approved plural component airless spray system. Coating thickness shall be in relation to the profile of the surface to be coated as recommended by the coating product manufacturer. In all cases the coating shall be applied with minimum of 2 coats applied at 40-80 mils WFT / DFT each for minimum final film thickness at 125 mils DFT. Subsequent topcoating or additional coats of the coating product(s) shall occur within the product's recoat window: minimum cure to a tacky state; maximum cure of 18 hrs at 72° F substrate temperature. Additional surface preparation procedures will be required if this recoat window is exceeded including inspection for and removal of amine blush and/or other potential contaminates.
 5. Holiday Testing: The protective lining / coating protection system shall be cured in accordance with the manufacturer's recommendations prior to holiday testing at a minimum of 12,500 volts.
- F. **System SC-5** Spectrashield multi-component stress panel liner system composed of moisture barrier (modified polymer), surfaces (polyurethane/polymeric blend foam) and final barrier coat (modified polymer). The system is applied in three-steps and the applicator / installer shall be certified by the Manufacturer.
1. Application.
 - i. Moisture barrier – Silicone Modified Polyurea Minimum 40 mils DFT
 - ii. Surfacer - Polyurethane/Polymeric blend foam
 - iii. Final corrosion barrier - Silicone Modified Polyurea Minimum 60 mils DFT
 2. Film Thickness. Final installation shall be a minimum of 500 mils. A permanent identification and date of work performed shall be affixed to the structure in a readily visible location.
 3. Holiday Testing: The protective lining / coating protection system shall be cured in accordance with the manufacturer's recommendations prior to holiday testing at a minimum of 50,000 volts.

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2.06 ANTI-GRAFFITI COATINGS

Anti-graffiti coatings shall be used for all porous masonry vertical surfaces including block, split faced block, or concrete walls. Cleaning, surface preparation, coating application, and thickness shall be as specified herein and shall meet or exceed the coating manufacturer's recommendations.

- A. **Surface Preparation.** Surfaces must be clean, dry, and free from oil, dirt, grease, efflorescence or any other coatings. New surfaces shall cure a minimum of 28 days (including grout, filler, etc) and caulking applications shall be fully cured prior to application. After pressure washing allow 72 hours to dry and after rain allow 48 hours to dry prior to application. Do not apply if precipitation is expected within 12 hours.
- B. **Protection of Surfaces.** Shield all surfaces not intended to be treated from overspray including landscaping, asphalt and painted surfaces.
- C. **Surface Temperatures.** Surface should be dry and at least 5°F above the dew point and between 40°F to 100°F.
- D. **Test Application.** A test application shall be performed to determine the exact coverage rates prior to full scale application.
- E. **Application.** Apply using low-pressure sprayer with fan tip for an application of 20-40 psi or roller. Apply with a saturating coat allowing for 4" to 6" rundown. Two flood coats required for graffiti protection. All coats should be examined for areas of over application and such areas should be brushed or backrolled to avoid excessive film build and unsightly darkening. Avoid excess overlapping. Allow the first coat to dry approximately 2 hours before applying second coat.
- F. **Coverage.** Estimated coverage is 65-85 square feet per gallon for CMU. Holiday testing is not required.
- G. **Graffiti Removal.** Surfaces treated with Anti-Graffiti coating shall only be maintained using Manufacturer approved product for graffiti removal. Use of other products may damage the coating. Reapply 2 coats of Anti-Graffiti coating to affected areas.

PART 3 - EXECUTION

3.01 QUALITY ASSURANCE

- A. All materials shall be delivered to the job in original sealed and labeled containers of the coating manufacturer, and shall be subject to inspection by the Engineer. Labels shall show name of manufacturer, type of coating, formulation, date, color and manufacturers recommendations. Coatings manufacturer date shall not exceed the manufacturers recommendations for storage and useful life and Coatings manufactured in excess of 1 year prior to application shall be rejected.
- B. Oil and grease shall be completely removed in accordance with SSPC-SP1 before beginning any other surface preparation method. Surfaces of welds shall be scraped and ground as necessary to remove all slag and weld spatter.
- C. All components of equipment that can be properly prepared and coated after installation

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- shall be installed prior to surface preparation. Components that will be inaccessible after installation shall have the surfaces prepared and coated before installation.
- D. All ferrous metal surfaces shall free of all defects and have all sharp edges, welds, slag, defects and weld splatter ground smooth in accordance with NACE Standard RPO178, Appendix C.
 - E. Edges, corners, crevices, welds, and bolts shall be given a brush coat (stripe coat) of for each coating. The stripe coat shall be applied by a brush and worked in both directions. Special attention shall be given to filling all crevices with coating.
 - F. Coating shall be applied in a neat manner that will produce an even film of uniform and proper thickness, with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be carefully examined and faulty material, poor workmanship, holidays, damaged areas and other imperfections shall be touched up prior to applying succeeding coats. Each coat shall be thoroughly dry and hard before the next coat is applied in accordance with the coating manufacturer's recommendations for drying time between coats. In no case shall coating be applied at a rate of coverage greater than the maximum rate recommended by the coating manufacturer. Each coat shall be uniform in coverage and color. Successive coats shall perceptibly vary in color.
 - G. Coating failures will not be accepted and shall be entirely removed down to the substrate and the surface recoated. Failures include but are not limited to holidays, sags, checking, cracking, teardrops, fat edges, fisheyes, or delamination.
 - H. Surfaces not required to be coated: Brass, Bronze, Stainless steel (Not including SS bolts and nuts)

3.05 INSPECTION FOR ACCEPTANCE

- A. The quality of materials, the process of manufacture and the finished sections shall be subject to inspection and approval by UTILITIES. Such inspection may be made at the place of manufacture, at the site after delivery or at both places and the sections shall be subject to rejection at any time due to failure to meet any of the specification requirements; even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. Sections that have been damaged after delivery will be rejected and if already installed, removed and replaced, entirely at the CONTRACTOR's expense.
- B. At the time of inspection, the sections will be carefully examined for compliance with the specified ASTM designation and with the approved manufacturer's drawings. Sections shall be inspected for general appearance, dimension, "scratch-strength" blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.
- C. Precast concrete structures shall be inspected by UTILITIES and defective materials shall replaced by the CONTRACTOR at the CONTRACTORS expense.

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- D. Any repairs made on surfaces shall be holiday detected in accordance Areas found to have holidays shall be marked and repaired in accordance with the coating manufacturer's instructions. The COUNTY shall be notified of time of testing so that he might be present to witness testing.

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Section 3210: Water Pipes, Valves, and Appurtenances

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PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. These specifications cover the pipes, fittings and appurtenances used for water distribution systems.
- B. The CONTRACTOR shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by UTILITIES, furnish certificates, affidavits of compliance, test reports, or samples for analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.
- C. Pipe and fitting interior linings shall conform to ANSI/NSF 61 list of approved materials standard.

PART 2 - PRODUCTS

2.01 PIPE MATERIALS

A. PVC Pipe:

PVC water distribution mains shall be manufactured in accordance with AWWA standard C900 or C909, latest edition. Pipe shall have a minimum pressure rating of 150 psi and have a maximum dimension ratio of 18. Pipe shall be blue in color.

B. Ductile Iron Pipe:

Ductile iron pipe shall conform to ANSI/AWWA A21.51/C151. Pipe shall be pressure class of 350 for pipe 4 to 12 inches in diameter. Pipes 16 to 24 inches in diameter shall be pressure class 250. Pipes 30 to 64 inches in diameter shall be pressure class 200. Pipe shall be color coded blue with tape. The tape (min 2") shall be permanently affixed to the top and each side of the pipe (three locations parallel to the axis of the pipe). For pipes less than 24 inches in diameter, a single tape may be used along the top of the pipe.

C. HDPE Pipe:

HDPE pipe shall be in accordance with AWWA C906 and shall have an outside diameter equal to ductile iron pipe for the same size. Pipe shall have a minimum dimension ratio of 11 for use with ductile iron pipe fittings and have a working pressure of 150 psi.

2.02 JOINT MATERIALS

A. PVC Pipe Joints:

PVC pipe shall have integral bell push on type joints conforming to ASTM D3139.

B. Ductile Iron Pipe Joints:

Joints for ductile iron pipe shall be push-on or mechanical joints conforming to ANSI/AWWA A21.11/C111., Restrained or flanged joints shall be provided where

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called for in the PLANS. Flanged points shall conform to ANSI Standard B 16.1-125 pounds.

- C. HDPE Pipe Joints:
HDPE joints shall conform to AWWA C906.

2.03 FITTINGS

- A. Ductile Iron and PVC Pipe:
Fittings shall be in accordance with Section 3114 Installation of Pipe. All potable water main fittings shall have NSF 61 certification, and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications.
- B. HDPE Pipe:
 - 1. HDPE mechanical joint adapter shall be joined to the HDPE pipe by butt fusion. HDPE mechanical joint adapter shall be molded or fabricated conforming to AWWA C906. Molded fittings shall conform to ASTM D2683 for socket-type fittings, ASTM D3261 for butt-type fittings or ASTM F1055 for electro fusion-type fittings.
 - 2. On a case by case basis as approved by the COUNTY, mechanical bolt-on fittings may be used as an alternative to butt fusion adapters. Stainless steel pipe stiffeners shall be installed for internal circumferential support of the pipe ends when mechanical bolt-on fittings are used.

2.04 COATINGS AND LININGS FOR DUCTILE IRON PIPE AND FITTINGS

- A. Fittings
Ductile iron fittings shall have fusion-bonded epoxy coating in accordance with ANSI/AWWA C116 or cement-mortar with a seal coat in accordance with ANSI/AWWA A21.4/C104. Fusion-bonded epoxy shall be holiday free and tested in accordance with ASTM G62 method A or method B. Testing method at the discretion of the applicator. Any holidays indicated by the detector shall be repaired in accordance with the manufacturer's repair procedures.
- B. Pipe
Ductile iron pipe shall have an interior protective lining of cement-mortar with a seal coat of asphaltic material in accordance with ANSI/AWWA A21.4/C104. Exterior ductile iron pipe shall be coated with asphaltic material in accordance with a minimum one mil thick in accordance with ANSI/AWWA A21.51/C151 for below ground piping only.
- C. Additional Applied Exterior Coatings for Above Ground Pipe and Fittings
Pipe, fittings and valves for above ground applications shall be accordance with the Section 3119 Coatings and Linings Primer and field coats shall be compatible and

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shall be applied in accordance with the manufacturer's recommendations. Refer to Appendix D, "List of Approved Products". Final field coat shall be blue for finished water. Asphaltic seal coat applied to the exterior of above ground piping / fittings shall be blasted and completely removed prior to coating per Section 3119 Coatings and Linings..

2.05 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement shall be in accordance with ANSI/AWWA A21.51/C105, wrapping colors to be blue. Polyethylene encasements are required in accordance with AWWA C105 and when crossing, or adjacent to, power easements, gas easements, any location where induced currents may be present and in areas where aggressive soils exist

2.06 SERVICE PIPE, STOPS, FITTINGS, AND SERVICE SADDLES

- A. Service Connections at Main:
 - 1. One-inch service connections shall be brass body reduced port type corporation stops, equipped with connections compatible with the polyethylene tubing and threaded in accordance with specifications in AWWA C800, AWWA C901 and shall comply with NSF-61.
 - 2. Service connections, 2-inch through 12-inch, shall be iron body resilient seat gate valves. Two-inch services at the water main shall have connections for female iron pipe by female iron pipe thread, conforming to AWWA C509.
 - 3. Service taps for air release valve installations shall utilize a 2-inch brass ball type corporation stop.
- B. Service Pipe:
 - 1. One-inch and two-inch service lines shall be blue polyethylene tubing, conforming to specifications in AWWA C800, SDR 9 and AWWA C901.
 - 2. Services 4-inch and larger shall be DIP from the point of connection to the existing main to the meter assembly, if the existing main is on the same side of the street as the property. If the existing main is on the opposite side of the street, as a minimum, the segment of the pipe immediately upstream from the meter assembly shall be DIP.
- C. Service Control Valves:
 - 1. One-inch and two-inch size service control valves shall be reduced port ball valves, made of brass, cast and machined in accordance with specifications in AWWA C800, AWWA C901, compliant with NSF-61 and compatible polyethylene tubing connections.
 - 2. For metered connections four-inch and greater, UTILITIES shall provide the valves with the meter.

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3. For non-metered connections four-inch and greater, the CONTRACTOR shall provide resilient seat OS&Y gate valves.
- D. Service Fittings:
1. One-inch and two-inch fittings shall be brass, cast and machined in accordance with specifications in AWWA C800, AWWA C901, compliant with NSF-61 with compatible polyethylene tubing connections.
 2. Fittings, 4, 6, 8 and 12 inches in size shall be the same as water main fittings, as per this Section.
- E. Service Tapping Saddles:
1. Stainless Steel Service Saddles:

Epoxy or nylon coated ductile iron body with stainless steel, 18-8 type 304 straps, AWWA tapered threads for 1-inch and two-inches to be iron pipe threads. Controlled OD saddles to be used on C905 PVC pipe, double straps to be 2-inch minimum width each, single strap to be minimum of three inches wide.
 2. Service Connections:
 - a. PVC Pipe Service Saddle:
 - i. One-inch and two-inch services utilize brass body saddle with controlled OD for 12-inches and smaller pipe.
 - ii. One-inch and two-inch taps on existing pipes larger than 12-inches shall use controlled OD epoxy or nylon coated ductile iron body with stainless steel 18-8 type 304 straps.
 - iii. Four-inch or larger services shall be mechanical tapping sleeves.
 - b. Ductile Iron Pipe Service Saddle:
 - i. One-inch services shall be direct tapped.
 - ii. Two-inch services shall use a controlled OD service tapping saddle with stainless steel straps and a ductile iron body that is either nylon or epoxy coated.
 - iii. Four-inch or larger services shall be mechanical tapping sleeves.
 - c. Concrete Pressure Pipe Service Saddle:
 - i. Tapped concrete pressure pipe shall be in accordance with AWWA M-9, using a strap-type saddle made specifically for concrete cylinder pressure pipe.
 - d. HDPE Pipe Service Saddle:
 - i. One-inch and two-inch shall utilize controlled O.D. tapping saddle with epoxy or nylon coated stainless steel 18-8-type 304 double straps, Taps to HDPE pipe shall be approved on a case by case basis.
 - ii. Taps, 4-inch and larger, shall use wide body tapping sleeves with a broad cross section gasket set in a retaining groove that increases sealing capability as pressure increases.

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e. Steel Pipe Service Saddle:

Welded-on steel sleeves shall be used for all sizes and applications.

2.07 RESILIENT SEAT GATE VALVES

- A. Gate valves shall be resilient seat gate valves, manufactured to meet or exceed the requirements of AWWA C509 / C515, latest revision, and in accordance with these specifications. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve. Valves shall have a minimum pressure rating of 250 psi.
- B. Gate valves shall be installed vertically per the design drawings and with minimum depth of cover per Table 2210-1. Vertical valves 16" and larger shall be AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a spur gear actuator unless noted by the engineer. The valve body, bonnet and bonnet cover shall be ductile iron ASTM A536. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating in accordance with AWWA C 550. A two-inch wrench nut shall be provided for operating the valve. All valves are to be tested in strict accordance with AWWA C515.
- C. Directional Opening:
All valves shall open left or counter clockwise.
- D. The valves shall be non-rising stems with the stem made of cast, forged, or rolled bronze as specified in AWWA C509. Two stem seals shall be provided and shall be of the o-ring type. The stem nut must be independent of the gate.
- E. The resilient sealing mechanism shall provide zero leakage at test and normal working pressure when installed with the line flow from either direction.
- F. Tapping Valves with Alignment Lip shall be placed vertical where possible for Water & Reclaimed Water. Tapping Valves 16" and larger AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a spur gear actuator unless noted by the engineer. When tapping existing mains, valves 24" and above shall be furnished with NPT pipe plugs for flushing the tracks.

2.08 BUTTERFLY VALVES

- A. Valves 42inches and larger may be butterfly valves, as approved by UTILITIES. Butterfly valves and operators shall conform to the "AWWA Standard Specifications for Rubber Seated Butterfly Valves", Designation C504, latest version, except as hereinafter specified, shall be Class 150.
- B. The valve body materials shall be epoxy coated inside and out per AWWA C550. The valve body shall be constructed of close grain cast iron per ASTM A126, Class B or equivalent material. All retaining segments and adjusting devices shall be of corrosion resistant material. Valves shall have the manufacturer's name and valve rating cast in body

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- C. Valve seats shall be EPDM. Valve seats 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. Valve seats shall be designed to be leak-tight in both directions at differential pressures up to, and including, the rated pressure of the valve class.
- D. Valve disc shall be designed to withstand full differential pressures across the closed valve disc without exceeding a stress level equivalent to one fifth of the tensile strength of the material.
- E. The face-to-face dimensions of valves shall be in accordance with above-mentioned AWWA specification for short-body valve.
- F. The valve shaft shall be turned, ground and polished constructed of 18-8 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.
- G. Valve Actuator:
- H. Actuators shall be designed for input torques based on 150 psi valve pressure and 16 ft/s. velocity with a maximum input of 80 ft-lb on 2" nuts and shall withstand 250 ft-lbs. In general, the butterfly valve actuators shall conform to the requirements of AWWA standard specifications for "Rubber Seated Butterfly Valves, Designation C504", insofar as applicable. All valve and actuators, shall be installed, adjusted, and tested as an assembly by the valve manufacturer at the manufacturing plant. An affidavit of compliance signed by the actuator manufacturer shall be required stating the provisions of ANSI/AWWA C504 have been met. The rated torque capability of each actuator shall be sufficient to seat, unseat, and rigidly hold, in any intermediate position, the valve disc it controls. Directional opening and Extension Stem
All valves shall open left or counterclockwise and a ground level position indicator and extension stem / shaft for the 2" nut shall be provided for buried valves.

2.09 VALVE BOXES

- A. Standard Two-Piece Cast Iron Valve Box:
Cast-iron two-piece valve boxes are required for mains less than six feet below finished grade and less than or equal to 12 inches in diameter. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by UTILITIES. The barrel shall be screw type only, having 5-1/4-inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with Locking cast iron covers. Covers shall have "WATER" cast into the top for all water mains.
- B. Valve Box Assembly:
Valve box assemblies are required for any size main that is six feet or greater below finished grade or if mains are greater than 12 inches in diameter. Valve boxes shall be one complete assembled unit composed of the valve box and extension stem that

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- attaches and locks to the two-inch wrench nut. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. A valve box centering device designed to eliminate the shifting of the valve box against the operating nut of the valve shall be used. Valve box assembly shall be adjustable to accommodate variable trench depths six feet and greater as shown in the STANDARD DRAWINGS.
- C. Valve box insert shall be one complete assembled unit with a self-adjusting extension stem system that fits inside a standard valve box that will accommodate variable trench depths six-feet and greater as shown in the STANDARD DRAWINGS.
 - D. Valve boxes shall have locking lids utilizing a five sided nut with a special wrench needed to open. Valve lids to be made as shown in the STANDARD DRAWINGS.
 - E. Valve collars shall be 24" X 24" round or square and poured in place with 3000psi concrete or made out of a fiberglass re-enforced concrete polymer material manufactured to the specifications as shown in the STANDARD DRAWINGS.
 - F. Locating wire shall be 10-gauge single strand solid core copper wire with insulation. The color of the insulation shall be the same color as the color code for the pipe being installed.
 - G. Valve markers are to be made of schedule 80 PVC and have a decal applied containing information as shown in the STANDARD DRAWINGS. The marker must be the same color as the pipe being marked.

2.10 AIR RELEASE VALVES

- A. The air release valves for use in water mains shall be single body combination air release valves designed to release large quantities of air at start up, admit air on shut down and release air in operation. Air release valves shall be 316 stainless steel, 316 stainless steel float, bronze water diffuser Buna-N or Viton seat and stainless steel trim. Air release valves must be installed in an enclosure as shown on the STANDARD DRAWINGS. Fittings from the main to the air release valve in the enclosure shall be threaded and made of brass.

2.11 FIRE HYDRANTS

- A. General:
- B. Fire hydrants shall have a minimum of 5-1/4-inch valve opening and shall comply with AWWA Standard C502 for fire hydrants for water works service, unless in conflict with this MANUAL, in which case this MANUAL shall apply. Each hydrant shall have 6-inch mechanical joint ends and shall open by turning to the left (counter-clockwise). Fire hydrants shall be of ample length for bury of 30 inches, to match main installation. Hydrants shall be provided with two 2-1/2-inch hose nozzles and one, 4-1/2-inch pumper nozzle, all having National Standard hose threads. Nozzles shall have caps attached by chains. Operating nuts shall be AWWA Standard pentagonal, measuring 1-1/2-inch point to flat. Fire hydrants shall be equipped with o-ring packing. Fire hydrants shall be supplied without drain holes or with permanently plugged drain holes.

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B. Coating and painting:

All non-brass parts of the hydrant both inside and outside shall be painted, in accordance with AWWA C-502. The shoe of the hydrant below the ground line shall have a fusion bonded epoxy coating and the barrel of the hydrant below ground shall be coated with a mastic material by the manufacturer. The above ground portion of the hydrant shall be coated in accordance with Section 3119 Coatings & Linings. The paint used shall be from the manufacturers and type as listed in Appendix D, "List of Approved Products".

PART 3 - EXECUTION

3.01 MATERIAL IDENTIFICATION AND TESTING

A. Pipe Identification:

1. Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant, and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel. Pipe, which is not clearly marked, is subject to rejection. The CONTRACTOR shall remove all rejected pipe from the project site within five NORMAL WORKING DAYS.
2. All pipe not factory color-coded shall have a field applied, three inch wide blue stripe down the length of the pipe.

B. Material Testing Requirements:

1. If requested by UTILITIES, a sample of pipe to be tested shall be selected at random by UTILITIES or the testing laboratory hired by UTILITIES.
2. When the samples tested conform to applicable standards, all pipe represented by such samples shall be considered acceptable based on the test parameters measured. Copies of test reports shall be available before the pipe is installed on the project.
3. In the event that any of the test samples fail to meet the applicable standards, all pipe represented by such tests shall be subjected to rejection. The CONTRACTOR may furnish two additional test samples from the same shipment or delivery, for each sample that failed and the pipe will be considered acceptable if all of these additional samples meet the requirements of the applicable standards. All such retesting shall be at the CONTRACTOR's expense.
4. Pipe that has been rejected by UTILITIES shall be removed from the site of the work by the CONTRACTOR and replaced with pipe that meets these specifications.

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PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. These specifications cover wastewater pipes, valves and appurtenances used for the wastewater collection and pumping systems.
- B. The CONTRACTOR shall be responsible for all stored material furnished for the project. The CONTRACTOR shall, if requested by UTILITIES, furnish certificates, affidavits of compliance, test reports or samples for any of the materials specified herein. All materials delivered to project site for installation are subject to random testing for compliance with the designated specifications.

PART 2 - PRODUCTS

2.01 PIPE MATERIALS

- A. PVC Gravity Pipe and Fittings:
 - 1. PVC gravity pipe (6-inch to 15-inch), shall conform to ASTM D3034, maximum SDR 35. Uniform minimum “pipe stiffness” at five percent deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-4.
 - 2. PVC gravity pipe (18-inch to 30-inch), shall conform to ASTM F679, maximum SDR 35. Uniform minimum “pipe stiffness” at five percent deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-7.
 - 3. All PVC pipe shall bear the NSF-DW seal. The minimum standard length of pipe shall be 13 feet.
 - 4. Joints:
PVC gravity pipe joints shall be flexible elastomeric seals per ASTM D 3212.
 - 5. Fittings:
Unless otherwise specified, wye branches shall be provided in the gravity main for service lateral connections. Wyes shall be six inches inside diameter. All fittings shall be of the same material as the pipe.
 - 6. Plugs for stub outs shall be of the same material as the pipe, and gasketed with the same gasket material as the pipe joint, or be of material approved by UTILITIES. The plug shall be secured to withstand specified test pressures.
 - 7. Locator balls shall be placed under all sanitary sewer service cleanouts.
- B. PVC Pressure Pipe and Fittings:
 - 1. All PVC pipe of nominal diameter 4 to 12 inches shall be manufactured in accordance with AWWA Standard C900 and greater than 12 inches shall be manufactured in accordance with AWWA Standard C905. The PVC pipe shall

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have a minimum working pressure rating of 100 psi and shall have a maximum dimension ratio of 18. Pipe shall be the same outside diameter as ductile iron pipe.

2. Joints:

PVC pipe shall have integral bell push on type joints conforming to ASTM D3139.

3. Fittings:

Fittings shall be restrained mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ANSI/AWWA A21.53/C153. Interior and exterior coatings of ductile iron pipe fittings shall be as specified in Appendix D, "List of Approved Products".

4. Restrained Joints:

Restrained joint devices shall be made specifically for PVC pipe and meet or exceed the requirements in ASTM F-1674.

C. Joints for Dissimilar Pipe:

Joining of dissimilar pipe and pipe between pump station wet well and valve vault shall conform to the following table.

Table 3310-1. Joints for Dissimilar Pipe.

Type of Line	Material	Material	Use
Gravity	C-900	SDR-35	PVC Adapter
Force Main	PVC	Ductile iron	Restrained MJ Sleeve
Force Main	PVC	HDPE	Restrained MJ Sleeve to Fused HDPE Adapter
Force Main	PVC	AC	Coupler
Pump Station Wet Well to Valve Box	Ductile iron	Ductile iron	MJ Sleeve

D. Pipe Markings:

Pipes shall have a manufacturer's home-mark on the spigot. On field cut pipe, the CONTRACTOR shall provide home-mark on the spigot in accordance with manufacturers recommendations.

E. Ductile Iron Pipe and Fittings for Pump Stations (pump discharge through valve vault):

1. Ductile Iron Pipe:

Ductile iron pipe of nominal diameter 4 through 54 inches shall conform to ANSI/AWWA A21.51/C151. A minimum of Class 200 pipe shall be supplied for all sizes of pipe unless a higher-class pipe is specifically called out in the PLANS or required by UTILITIES.

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2. Fittings:
Shall be in accordance with Section 3114 Installation of Pipe..
 3. Joints:
Joints shall be flanged conforming to ANSI/AWWA A21.11/C111, unless otherwise called for on the PLANS. Restrained or flanged joints shall be provided where called for on the PLANS. Flanged joints shall conform to ANSI Standard B16.1-125 LB.
 4. Exterior Coatings:
Ductile iron pipe and fittings shall be coated as specified in Appendix D, "List of Approved Products". Primer and field coats shall be compatible and shall be applied in accordance with the manufacturer's recommendations. Final field coat color shall be green for wastewater. Exterior coatings in pipe or fittings above grade or in pump station shall be holiday free and holiday tested in accordance with ASTM G-62 and ASTM D5262. Asphaltic seal coat applied to the exterior of above ground piping / fittings shall be blasted and completely removed prior to coating per Section 3119 Coatings and Linings.
 5. Interior Coatings and Linings:
Ductile iron pipe and fittings shall have an interior protective coating of Protecto 401 in accordance with the manufacturers recommendations and per Section 3119 Coatings and Linings. . Interior coating shall be holiday free and holiday tested in accordance with ASTM G-62 and ASTM D5162.
- F. HDPE Pipe and Fittings:
1. HDPE Pipe:
Materials used for the manufacture of high-density polyethylene pipe and fittings shall comply with all requirements of ASTM D1248 and Plastic Pipe Institute (PPI) designation PE3408. Manufacturer shall be a member in good standing of the Plastic Pipe Institute. HDPE pipe and fittings shall comply or exceed AWWA Standards C901/C906, ASTM D2513, ASTM D3035 and ASTM F714. The manufacturer shall supply a letter of certification stating compliance to all the above standards prior to shipping any material to project site. The HDPE material shall have required ultraviolet inhibitors to resist degradation by direct and prolong sunlight. The design of HDPE materials shall be based on the hydrostatic design basis (HDB) of 1,600 psi at 73.4 degrees Fahrenheit. Pipe shall be designed and produced to ductile iron diameters and to a maximum dimension ratio of 11.
 2. Fittings:
Fittings shall be HDPE molded and shall be made, at a minimum, to the same pressure rating as the pipe. All fabricated HDPE fittings shall be manufactured to a minimum thickness of DR 13.5. Ductile iron pipe fittings, with mechanical joint adapters, may be used when required for special connections but must by

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supplied by a pre-approved manufacturer. Manufacturers of the electrofusion coupling and fittings shall be an ISO 9001 certified company with product having Canada Standards Association (CSA) certification.

2.02 AIR VALVES

A. General:

Wastewater force mains shall be equipped with combination air release valves located as shown on the PLANS. Valves shall be located in an enclosure as detailed on the STANDARD DRAWINGS.

B. Wastewater Combination Air Release Valve:

The valve body shall be conical in shape and shall be 316 stainless steel with a funnel shape lower body to automatically drain sewage back into the system. All internal parts shall be corrosion resistant 316 stainless steel or non-metallic plastic materials.

C. On flanged connections 316 stainless steel bolts, nuts and washers are to be used along with the proper sized gasket.

2.03 PLUG VALVES

A. General:

Wastewater force mains shall have plug valves as shown on the PLANS. Valves shall be installed as detailed on the STANDARD DRAWINGS.

1. Plug valves shall be eccentric, ballcentric, or full port.
2. Plug valves shall be installed complete with operating hand wheels, extension stems, buried gear actuators, 2-inch operating nuts as required for normal operation.
3. Valves shall have the name of the manufacturer and the size of the valve cast or molded onto the valve body. A permanent plate shall be attached to the valve or operator indicating serial number, order number, accessories, operator model and manufacturer, etc.
4. Ballcentric / Eccentric plug valves shall be of the non-lubricated type with 80 percent port areas. The port area for valves 4 to 20 inches shall have a minimum 80 percent nominal pipe diameter. Valves 24 inches and larger shall have a minimum port area of 70 percent of nominal pipe diameter.
5. Minimum pressure rating of valves 4 to 12 inches shall be 175 psi; valves 14 to 72 inches shall be 150 psi. Valve bodies shall be cast iron ASTM A 126, Class B and fusion bonded epoxy coated. Valve ends shall be screwed, flanged or mechanical joint as indicated on the drawings. Plugs shall be cast iron or ductile iron with neoprene facing and shall be of the single piece design. The plug shall be of the same configuration for all valves and shall require no stiffening member opposite the plug for balance or support. Valve body seats shall have a welded in overlay of not less than 90 percent nickel. Packing shall be adjustable and safely

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replaceable. Bushing shall be 316 stainless steel in both upper and lower journals and be protected from foreign matter with the use of a grit seal or similar. The valve should be capable of drip tight shut off with flow in either direction at the full pressure of the valve. All exposed nuts, bolts, springs and washers on buried service valves shall be 304 stainless steel. All above grade valves shall have 316 stainless steel hardware.

- 6. Face to face dimensions shall be in conformance to ASME B16.10 and the following dimensions:

Table 3310-2. Pump Station Plug Valve Flange Face to Face Dimensions.

Valve Size (inches)	Face to Face (inches)
4	9.0
6	10.5
8	11.5
12	14.0
16	17.75
20	23.5
24	42.0

B. Valve Testing:

Plug valves shall be tested in accordance with AWWA C504. Each valve shall meet the performance, leakage, and hydrostatic tests described in AWWA C504. The leakage test shall be applied to the face of the plug tending to unseat the valve. The manufacturer shall furnish certified copies of reports covering proof of design testing as described in AWWA C504.

C. Actuators:

Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floor stands, etc. as indicated on the PLANS. All valves 6-inch and larger shall be equipped with buried service rated gear actuators. All buried valves shall have a 2 inch square operating nut. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. All actuator shafts shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. All exposed nuts, bolts and washers shall be 316 stainless steel. Valve packing adjustment shall be accessible without disassembly of the actuator.

2.04 VALVE BOXES

- A. All valves shall have cast-iron two-piece valve boxes. Valve boxes shall be provided

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- with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by UTILITIES. The barrel shall be screw type only, having 5-1/4-inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with locking cast iron covers. Covers shall have "SEWER" cast into the top for all wastewater mains.
- B. Valve box with operating nut extension is required for any size main that is six feet or greater below finished grade. The extension shall be high strength, corrosion resistant steel construction and permanently attached to the operating nut. . The operating nut extension insert shall be one complete assembled unit with a self-adjusting extension stem system that fits inside a standard valve box that will accommodate variable trench depths six-feet and greater as shown in the STANDARD DRAWINGS. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. A valve box centering device designed to eliminate the shifting of the valve box against the operating nut of the valve shall be used. Valve box assembly shall be adjustable to accommodate variable trench depths six-foot and greater as shown in the STANDARD DRAWINGS.
 - C. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The material shall be at minimum galvanized square steel tubing. The stem assembly shall have a built-in device that prevents the stem assembly from disengaging at its fully extended length. The extension stem must be capable of surviving a torque test to 1,000 ft-lb without failure.
 - D. Valve boxes shall have locking lids.
 - E. All valve boxes in non-paved areas shall be installed with a valve collar as shown in the STANDARD DRAWINGS.
 - F. Accessories include valves, collars, tracing wire, and valve markers.

2.05 PRESSURE GAUGES

- A. Pressure gauges shall be installed on each pump station discharge pipe as indicated on the STANDARD DRAWINGS. Each pressure gauge shall be direct mounted, diaphragm (type) gauge, stainless steel case, stainless steel sensing element, liquid filled, with a 4-1/2-inch diameter dial and furnished with a clear glass crystal window, 1/4-inch shut-off (isolation) valve. Gauges shall be weatherproofed. The face dial shall be white finished aluminum with jet-black graduations and figures. The face dial shall indicate the units of pressure measured in psi, gauges shall be provided with pressure at normal operations at the mid range of the gauge as acceptable to the County..

PART 3 - EXECUTION

3.01 MATERIAL IDENTIFICATION AND TESTING

- A. Pipe Identification:

Each length of pipe shall bear the name or trademark of the manufacturer, the location of

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Section 3310: Wastewater Pipes, Valves, and Appurtenances

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the manufacturing plant and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel. Pipe, which is not clearly marked, is subject to rejection. The CONTRACTOR shall remove all rejected pipe from the project site within five NORMAL WORKING DAYS.

B. Material Testing Requirements:

1. If requested by UTILITIES, a sample of pipe to be tested shall be selected at random by UTILITIES or the testing laboratory hired by UTILITIES.
2. When the samples tested conform to applicable standards, all pipe represented by such samples shall be considered acceptable based on the test parameters measured. Copies of test reports shall be available before the pipe is installed on the project.
3. In the event that any of the test samples fail to meet the applicable standards, all pipe represented by such tests shall be subjected to rejection. The CONTRACTOR may furnish two additional test samples from the same shipment or delivery, for each sample that failed and the pipe will be considered acceptable if all of these additional samples meet the requirements of the applicable standards. All such retesting shall be at the CONTRACTOR's expense.
4. Pipe that has been rejected by UTILITIES shall be removed from the site of the work by the CONTRACTOR and replaced with pipe that meets these specifications.

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PART 1 GENERAL

- A. The CONTRACTOR shall request an inspection from the UTILITIES’ Inspector.
- B. UTILITIES will notify the CONTRACTOR of utilities deficiencies or acceptance in accordance with the schedule of notification provided in Table 4110-1 below.

Table 4110-1. UTILITIES’ Schedule of Notification of Inspections

Service	Type of Inspection	Timeframe (NORMAL WORKING DAYS)
Water	Wire Continuity for Pressurized Mains	10
Water	Cross Connection	5
Wastewater	CCTV Data Review	7
Wastewater	Wire Continuity for Pressurized Mains	10
Wastewater	Pump Station Start Up Notification	10
Wastewater	Pump Station Start Up	3
Reclaimed Water	Wire Continuity for Pressurized Mains	10
Reclaimed Water	Cross Connection	5
Construction Inspection	Notice of Commencement of Construction by Contractor	7
Construction Inspection	Notice of Utility Work	2
Construction Inspection	Notice of Connection, Tap, Shutdown, Directional Drill, Jack & Bore, etc	7
Construction Inspection	Notice of CCTV Operations per Mobilization	2
Construction Inspection	Notice of Overtime or Weekend Work	2
Construction Inspection	Review of Record Drawing Submittals	7
Water, Wastewater, Reclaimed water	Walk Through for Subdivisions (Water, Wastewater, Reclaimed Water)	15

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- C. If there are any deficiencies or the system is not ready for inspection, as determined by UTILITIES, the CONTRACTOR shall request a re-inspection which will restart the inspection period, as noted above.
- D. If more than two inspections are required for acceptance, testing or clearance, the CONTRACTOR will be charged for each additional re-inspection per the Orange County OMB Fee Schedule - Reinspection Fee. If the CONTRACTOR works beyond NORMAL BUSINESS HOURS or NORMAL BUSINESS DAYS, the CONTRACTOR shall be responsible for payment per the Orange County OMB Fee Schedule – Inspection Fee Other than Normal Working Hours. Payment shall be delivered to UTILITIES Customer Service located at 9150 Curry Ford Road (first floor) prior to re-inspection or overtime inspection work.
- E. Signed and Sealed RECORD DRAWINGS from ENGINEER and the coordinate asset table signed and sealed by the SURVEYOR shall be submitted, and approved by UTILITIES prior to scheduling the following inspections: air testing or review of the CCTV of gravity sewer, disinfection of water systems, pressure testing of forcemains, pressure testing of reclaimed water mains and pump station startup. Prior to the walk through inspection or issuance of the Certification of Completion, all UTILITIES RECORD DRAWINGS, if submitted individually shall be combined for final submittal and approval by UTILITIES. Under no circumstances shall the aforementioned inspections be scheduled or executed without approved RECORD DRAWINGS.
- F. CONTRACTOR As-Builts shall be located on the project site and maintained concurrently with Construction of the work including SURVEYOR coordinate data. Current coordinate data shall be provided a minimum monthly and shall be available for UTILITIES review.

CHAPTER 4 FIELD TESTING AND INSPECTION PROCEDURES

Section 4210: Testing and Inspection for Acceptance of Water Systems

February 11, 2011

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. These specifications cover the testing and inspection for the acceptance of water systems.
- B. Hydrostatic tests shall be conducted for pressure pipes, joints, fittings and valves for allowable limits of pressure and leakage. Air testing of pressure pipes will not be permitted under any circumstance.
- C. Requests for testing and acceptance of water systems shall follow the procedure in listed in Section 4211, "General Procedures".
- D. The purpose of swabbing a new pipeline is to conserve water while thoroughly cleaning the pipeline of all foreign material, sand, grit, gravel, construction debris and other items not found in a properly cleaned system. Prior to pressure testing and chlorinating of a new pipeline swabbing shall be utilized as specified on the construction plans for each project.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 TESTS

- A. Preliminary flushing may be accomplished through full diameter flush or swabbing.
 1. Preliminary flush shall have a minimum of 2.5 feet per second full diameter in accordance with AWWA C651 Standard, "Disinfecting Water Mains". Flushing shall be allowed for pipes less than or equal to 12-inch.
 2. Swabbing
 - a. In lieu of flushing, new water mains may be hydraulically or pneumatically cleaned with a polypropylene swabbing device to remove dirt, sand and debris from main.
 - b. If swabbing access and egress points are not provided in the design drawings, it will be the responsibility of the CONTRACTOR to provide temporary access and egress points for the cleaning, as required.
 - c. Passage of cleaning poly swabs through the system shall be constantly monitored, controlled and all poly swabs entered into the system shall be individually marked and identified so that the exiting of the poly swabs from the system can be confirmed.
 - d. Cleaning of the system shall be done in conjunction with the initial filling of the system for its hydrostatic test. After initial slow-fill, pipe shall sit full for 24 hours to facilitate cleaning and collection of debris from interior of pipe.
 - e. The CONTRACTOR shall insert flexible polyurethane foam swabs (two pounds per cubic foot density) complete with rear polyurethane drive seal, into the first

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- section of pipe. The swabs shall remain there until the pipeline construction is completed.
- f. The line to be cleaned shall only be connected to the existing distribution system at a single connection point.
 - g. Locate and open all new in-line valves beyond the point of connection on the pipeline to be cleaned during the swabbing operation.
 - h. At the receiver or exit point for the poly swab, the CONTRACTOR is responsible for creating a safe environment for collection of debris, water and the swab. Considerations shall be made for protecting surrounding personnel and property and safe retrieval of the swab.
 - i. Only UTILITIES personnel shall operate the supply valve from the existing distribution system. Cleaning and flushing shall be accomplished by propelling the swab down the pipeline to the exit point with potable water. Flushing shall continue until the water is completely clear and swab is retrieved.
 - j. Re-apply a series of individual swabs in varying diameters and/or densities as required, to attain proper cleanliness of pipeline.
 - k. Swabbing speed shall range between two and five feet per second.
 - l. After the swabbing process, pressure testing and disinfection of the pipe shall be completed in accordance with this MANUAL.
- B. Hydrostatic tests shall consist of pressure test and leakage test. Hydrostatic tests shall be conducted on all newly laid pressure pipes, joints and valves including all service lines to the curb stops. Tests may be made between valves not exceeding 2,000 feet, when this procedure is acceptable to UTILITIES. The CONTRACTOR shall pressure test both sides of the valve. The CONTRACTOR shall furnish all necessary equipment and material, make all taps and furnish all closure pieces in the pipe as required. Equipment to be furnished by the CONTRACTOR shall include graduated containers, pressure gauges, hydraulic forces pumps and suitable hoses and piping. UTILITIES' representative shall monitor a satisfactory test. Multiple sections may be tested simultaneously providing there are dead sections in between each pressure tested section.
- C. The CONTRACTOR may conduct preliminary hydrostatic tests after the trench has been partially backfilled with the joints left exposed for inspection for informational purposes only. The hydrostatic tests for acceptance shall only be conducted after the trenches have been completely backfilled and compacted as specified. Where any section of pipe is provided with concrete thrust collar, pressure test will not be made until at least five days have elapsed after the thrust collar is installed. If high-early cement is used for the concrete thrust collar, the time may be reduced to 24 hours if the concrete has cured and reached adequate strength.
- D. All pipe sections to be pressure tested shall be subjected to a minimum hydrostatic pressure of 150 psi. The duration of each pressure test shall be for a period of two hours. If during the test, the integrity of the tested line is in question, UTILITIES may

CHAPTER 4 FIELD TESTING AND INSPECTION PROCEDURES

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require a six-hour pressure test. The basic provisions of AWWA C600 shall be applicable.

- E. Document and certify the testing and quantity of acceptable leakage with pressure test form in Appendix B, "Pressure Test Form".
- F. Water supply from the existing distribution system shall be provided through a jumper connection consisting of fittings and an RPZ assembly and installed as shown in the STANDARD DRAWINGS.

G. Procedure for Pressure Test:

Pipe, inclusive of all appurtenances to be tested, shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. Provisions shall be made to expel air entrapped in the pipe before applying the specified test pressure. To accomplish this, taps shall be made, and appropriate valves installed to ensure bleeding of all air from the main. If defective pipes, fittings, valves, or hydrants are discovered in consequence of this pressure test, all such items shall be removed and replaced by the CONTRACTOR with sound material and the test shall be repeated until satisfactory results are obtained. Provisions of AWWA C600, and C651 where applicable, shall apply.

H. Procedure for Leakage Test:

1. After completion of the pressure test, a leakage test shall be conducted to determine the quantity of water lost by leakage under the specified test pressure. Applicable provisions of AWWA C600 shall apply.
2. Allowable leakage in gallons per hour for pipeline shall not be greater than that determined by the formula:

$$L = \frac{SD(P)^{0.5}}{148,000}$$

Note:

L - Allowable leakage in gallons per hour.

S - Length of pipe tested, in feet.

D - Nominal diameter of the pipe in inches.

P - Average test pressure during leakage test in pounds per square inch gauge.

3. Leakage is defined as the quantity of water to be supplied in the newly laid pipe or any valved section under test, which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. Should any test of pipe laid disclose leakage greater than that allowed, the CONTRACTOR shall locate and replace or repair the defective joints, pipe or valve until the leakage from subsequent testing is within the specified allowance.

I. Disinfection:

1. Newly installed mains shall be filled, flushed with a minimum velocity of 2.5 feet per second and disinfected in accordance with the ANSI/AWWA C651. During the chlorination period, valves, hydrants and appurtenances in the treated section

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Section 4210: Testing and Inspection for Acceptance of Water Systems

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shall be operated to ensure they are disinfected with the new main. Before being placed into service, new mains or extensions to existing mains shall be chlorinated so that the initial chlorine residual is not less than 25 milligrams per liter and that a chlorine residual of not less than 10 milligrams per liter remains in the water after standing 24 hours in the pipe. The free residual chlorine concentration shall be monitored and documented by the CONTRACTOR for the initial application and after a 24-hour contact period. The testing/monitoring location points, the disinfection process utilized and free chlorine residuals shall be documented on Appendix B, "Water Main Disinfection Certification".

2. The interior of all pipe and fittings, including couplings and fittings, used in making repairs and ties in shall be swabbed or sprayed with a one percent hypochlorite solution before they are installed.
- J. Final Flushing and Testing:
1. Following chlorination, all treated water shall be thoroughly flushed from the new main. If there is any possibility that the chlorinated discharge will cause damage to the environment, then a neutralizing chemical shall be applied to the water to be wasted to thoroughly neutralize the residual chlorine. Flushing shall take place until, upon testing, the free chlorine residual obtained is not in excess of that normally carried in the system.
 2. Water samples shall be collected from the approved sampling points. Each sample result shall show acceptable bacteriological results for two consecutive days. UTILITIES will perform the bacteriological testing. The CONTRACTOR may request testing by a private laboratory. Private laboratories require approval by UTILITIES and certification by the State of Florida.
 3. Proper chain of custody procedures must be followed and samples shall only be collected by certified laboratory personnel in the presence of UTILITIES' personnel.
 4. Copies of testing results and all related correspondence with the FDEP shall be submitted to UTILITIES.
- K. The distribution system piping shall remain isolated and out of service until UTILITIES receives clearance from FDEP.
- L. Repetition of Flushing and Testing:
- Should the initial treatment result in an unsatisfactory bacterial test, the CONTRACTOR shall repeat the original disinfection procedure and flushing as required until satisfactory results are obtained.

PART 4 - ACCEPTANCE

4.01 WIRE CHECK

- A. The locating wire will be inspected and tested for continuous continuity along the entire length of the main and correct material as specified in Appendix D, "List of Approved Products".

CHAPTER 4 FIELD TESTING AND INSPECTION PROCEDURES

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- B. Valve locations will be inspected for the proper installation of the locating wire in accordance with Appendix A, "STANDARD DRAWINGS" and tested for continuity between the main and the valve.

4.02 FIRE HYDRANTS

- A. Fire hydrants will be tested for smooth operation. Inspected for absence of leakage from any ports, joints and or fittings in the hydrant assembly to the main. Inspected to confirm that hydrants are painted the correct colors as stated in Section 3210, "Water Pipes, Valves and Appurtenances", installed as shown in the STANDARD DRAWINGS and located per the RECORD DRAWINGS.

4.03 VALVES

- A. Valves will be operated to verify smooth and correct operation and direction of opening. Inspected to confirm the location per the RECORD DRAWINGS and installed per the STANDARD DRAWINGS.

4.04 VALVE BOXES

- A. Valve boxes will be inspected to ensure they are clear of debris, centered over the operating nut and installed with a collar as shown in the STANDARD DRAWINGS. The depth of the operating nut will be measured to finished grade to confirm that a riser is installed or not required. Valve boxes shall meet the material standards listed in Appendix D, "List of Approved Products".

4.05 SERVICE LINES

- A. Service lines shall be properly identified, free from conflicts with any structure, installed as shown in the STANDARD DRAWINGS and the number location and size is as shown on the RECORD DRAWINGS to serve all intended properties. The materials shall be as listed in Appendix D, "List of Approved Products".

4.06 BLOW OFF VALVE ASSEMBLIES

- A. Blow off valve assemblies shall be free from any conflicts with any structures, installed per the STANDARD DRAWINGS, located as shown in the RECORD DRAWINGS and tested to ensure correct operation. The materials shall be as listed in Appendix D, "List of Approved Products".

4.07 AIR RELEASE VALVE ASSEMBLIES

- A. Air release valve assemblies shall be free from any conflicts with any structures, installed per the STANDARD DRAWINGS, located as shown on the RECORD DRAWINGS tested to ensure correct operation and confirm materials as listed in Appendix D, "List of Approved Products".

CHAPTER 4 FIELD TESTING AND INSPECTION PROCEDURES

Section 4310: Testing & Inspection for Acceptance of Wastewater Collection and Transmission Systems February 11, 2011

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. These specifications cover the testing and inspection for acceptance of wastewater collection and transmission systems.
- B. Requests for testing and acceptance of wastewater collection and transmission systems shall be executed in accordance with Section 4110, "General Procedures".
- C. Gravity Mains:

Shall be inspected with CCTV for alignment, grade variations, separated pipes, leaks, deflection, cracked, broken or otherwise defective pipe to ensure overall pipe integrity. The CCTV inspection contractor that is listed on Appendix D "List of Approved Products" shall perform the CCTV inspection(s) and submit the report(s) to UTILITIES as required.
- D. Pressure Mains:

Hydrostatic tests shall be conducted for pressure pipes, joints and valves for allowable limits of pressure and leakage. Air testing of pressure pipes will not be permitted under any circumstance.

PART 2 - PRODUCTS

2.01 Approved List of CCTV Contractors

- A. The current "List of Approved CCTV Inspection Contractors for Wastewater Gravity Systems" can be found on our website at www.ocfl.net/utilities/. For more information, please contact a Standards Committee representative at 407-254-9900.
- B. CCTV contractors that desire to be added to the "Orange County Utilities List of Approved CCTV Inspection Contractors for Wastewater Gravity Systems" shall submit a request to the Standards Committee by e-mailing their submittal to standards.committee@ocfl.net. The submittal shall contain all of the qualification information requested. Once the submittal is complete, the Standards Committee will evaluate the CCTV contractor. The contractor's work product and an on-site field evaluation may be requested. Procedures for testing or evaluating in the field shall be as agreed upon between the Standards Committee and the contractor. Results will become a part of the product file and will be made available to the contractor upon request.
- C. The Approval Process for CCTV and Inspection Contractors for Wastewater Gravity Systems and the CCTV Inspection Contractor Qualification Form can be found on our website at www.ocfl.net/utilities/.

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2.02 CCTV INSPECTION EQUIPMENT

A. Closed Circuit Television Camera:

The television camera used for the inspection shall be one specifically designed and constructed for sanitary sewer inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100 percent humidity/submerged conditions. The CCTV camera equipment will provide a view of the pipe ahead of the equipment and of features to the side of the equipment through turning and rotation of the lens. The camera shall be capable of tilting at right angles along the axis of the pipe while panning the camera lens through a full circle about the circumference of the pipe. The lights on the camera shall also be capable of panning 90-degrees to the axis of the pipe.

If the equipment proves to be unsatisfactory, it shall be replaced with adequate equipment. The camera unit shall have sufficient quantities of line and video cable to inspect two complete, consecutive sewer reaches with access approximately 750 feet apart.

The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of UTILITIES. The television camera, electronic systems and monitor shall provide an image that meets the following specifications, or approved equal.

1. The gray scale shall show equal changes in brightness ranging from black to white with a minimum of five stages.
2. With the monitor control correctly adjusted, the six colors - Yellow, Cyan, Green, Magenta, Red, and Blue, plus black and white shall be clearly resolved with the primary colors in order of decreasing luminance. The gray scale shall appear in contrasting shades of gray with no color tint.
3. The picture shall show no convergence or divergence over the whole of the picture. The monitor shall be at least 13 inches diagonally across the picture tube.
4. The live picture on the CCTV monitor shall be capable of registering a minimum of 470 lines horizontal resolution and be a clear, stable image with no interference.
5. Lighting intensity shall be remote controlled and shall be adjusted to minimize reflective glare. Lighting and camera quality shall provide a clear, in-focus picture of the entire inside periphery of the sewers and laterals for all conditions except submergence. Under ideal conditions (no fog in the sewer) the camera lighting shall allow a clear picture up to five pipe diameter lengths away for the entire periphery of the sewer. The lighting shall provide uniform light free from shadows or hot spots.
6. Camera focal distance shall be remotely adjustable through a range of 6 inches to infinity.
7. The monitor and software shall also be able to capture and save screen images of

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typical sewer details and all defects. Screen images shall be embedded into the pipe inspection report document submitted with the inspection video. The video camera shall be capable of displaying on screen data.

B. Lateral Video Camera

Lateral cameras may be push type or launched from the sewer main line. Lateral cameras shall be color, shall be self leveling, and equipped with a footage counter to provide on screen display of footage measurement. Monitor resolution shall be as specified above in paragraph 2.01 A Close Circuit Television Camera, or approved equal.

C. Video Capture System:

The video recordings of the sewer inspections shall be made using digital video equipment. A video enhancer may be used in conjunction with, but not in lieu of, the required equipment. The digital recording equipment shall capture sewer inspection on DVD disks or hard drive, with each sewer reach inspection recorded as an individual movie file (.MPEG, .MPG, or .WMV) or approved equal.

1. The video file names will be referenced in the inspection database and in an inspection report generated in PDF format. The pipeline collection and real time video capture and data acquisition systems shall be provided.
2. The system shall use the most current PACP compliant application software and shall be fully object oriented or approved equal. It shall be capable of printing pipeline inspection reports with captured images of defects or other related significant visual information on a standard color printer.
3. The imaging capture system shall store digitized color picture images and be saved in digital format on a DVD, hard drive or approved equal. Also, this system shall have the capability to supply UTILITIES with inspection data reports for each line segment.
4. The contractor shall have the ability to store the compressed video files in industry standard and approved UTILITIES format and be transferable with the PACP compliant inspection database.
5. The contractor's equipment shall have the ability to "Link". "Linking" is defined as storing the video time frame code with each observation or defect with the ability to navigate from/to any previously recorded observation or defect instantaneously.
6. The system shall be able to produce data reports to include, at a minimum, all observation points and pertinent data. All data reports shall match the defect severity codes in accordance with PACP naming conventions
7. The data-sorting program shall be capable of sorting all data stored using generic sort key and user defined sort fields.

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8. Camera footage, date & manhole numbers shall be maintained in real time and shall be displayed on the video monitor as well as the video character generators illuminated footage display at the control console.
9. Depth gage: The camera shall have a depth gage or approved method to measure deflection in the pipe and joint separation approved by the UTILITIES.

2.03 GRAVITY MAIN INSPECTION CCTV DATA

- A. CCTV data shall be recorded and saved in MPEG format or Windows Media video format.
- B. CCTV inspections shall use unique identification numbers established and provided by UTILITIES in pipe segment reference, upstream manhole number and the downstream manhole number fields.
- C. The video files will be named in accordance with UTILITIES file naming convention: Upstream MH ID _ Downstream MH ID _ Inspection Date (year_month_day).wmv. Example: 39540008_39540007_2009_08_05.wmv
- D. Reports shall be submitted in an electronic version (.pdf) generated by the computer software shall be consistent with PACP requirements, observation report with still images; and CCTV inspection results.
 1. PACP export pipe inspection database (.mdb) saved on CD-R's, DVD, or portable hard drives
 2. Inspection digital photographs in JPEG format saved on CD-Rs, DVD or portable hard drives
 3. QA/QC report
- E. The video file names will be referenced in the inspection database and in an inspection report generated in PDF format. The pipeline collection and real time video capture and data acquisition systems shall be provided
- F. The system shall use the most current PACP compliant application software and shall be fully object oriented or approved equal. It shall be capable of printing pipeline inspection reports with captured images of defects or other related significant visual information on a standard color printer.
- G. The imaging capture system shall store digitized color picture images and be saved in digital format on a DVD, hard drive or approved equal. Also, this system shall have the capability to supply the UTILITIES with inspection data reports for each line segment.
- H. The CONTRACTOR shall have the ability to store the compressed video files in industry standard and approved UTILITIES format and be transferable with the PACP compliant inspection database.
- I. The CONTRACTOR'S equipment shall have the ability to "Link". "Linking" is defined as storing the video time frame code with each observation or defect with the

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- ability to navigate from/to any previously recorded observation or defect instantaneously.
- J. The system shall be able to produce data reports to include, at a minimum, all observation points and pertinent data. All data reports shall match the defect severity codes in accordance with PACP naming conventions
 - K. The data-sorting program shall be capable of sorting all data stored using generic sort key and user defined sort fields.
 - L. Camera footage, date and manhole numbers shall be maintained in real time and shall be displayed on the video monitor as well as the video character generators illuminated footage display at the control console.

PART 3 - EXECUTION

3.01 LEAKAGE TESTING OF GRAVITY MAINS

- A. The CONTRACTOR, with UTILITIES' representation present, shall perform the leakage testing. The CONTRACTOR shall be responsible for furnishing all necessary labor and equipment to conduct such testing.
 - 1. Leakage tests shall be by a low-pressure air test. Each test section shall not exceed 400 feet in length and shall be tested between adjacent manholes. Leakage testing shall be conducted in accordance with the procedure for "Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe" as established by the Uni-Bell PVC Pipe Association. The pipe shall pass the current most stringent UNI-B-6 Uni-Bell standards for testing gravity sewers and shall have no evidence of leaks in the pipe or connections.

3.02 GRAVITY MAIN REQUIREMENTS BEFORE CCTV INSPECTION

- A. All manhole flow channels and benching per specifications shall be constructed and coated (if applicable) prior to CCTV inspection.
- B. CCTV inspections shall be received, reviewed and approved by UTILITIES prior to installation of pavement.
- C. The CONTRACTOR shall clean gravity mains to remove debris and stains from the pipe prior to televising. Flushing water or debris will not be allowed to enter pump station wet wells. Water will be pumped from the sewer system during flushing to an acceptable discharge location. A visual inspection shall be made and all obstructions removed.
- D. Gravity Mains/Pipes that are dirty (dirty walls and/or debris in the inverts) shall be re-flushed and cleaned before rescheduling a CCTV inspection. If necessary, swabbing may be required of specific sections of pipe.
- E. The CONTRACTOR shall pass a mandrel through the PVC pipe to confirm ring deflection in excess of five percent (5%). The base inside diameter shall be used to

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determine mandrel size as per ASTM D 3034.

- F. Dewatering system shall not be operated within 48 hours prior to CCTV inspection.
- G. Backfill from the gravity main to the subgrade shall be compacted and stabilized for inspection and cleaning vehicle access prior to CCTV.

3.03 NOTIFICATION

- A. Contractor shall notify the UTILITIES a minimum of 48 hours prior to performing any CCTV gravity main inspection work.

3.04 TELEVISIONING OF GRAVITY MAINS

- A. Wherever possible, gravity mains shall be televised in the downstream direction.
- B. Sufficient water shall be run through each section of main until water runs through each downstream manhole no more than 24 hours prior to televising. Lines that are dry or that enough water has not run through to reach the downstream manhole shall not be televised.
- C. Gravity mains shall be televised from manhole to manhole utilizing a 360-degree pan and tilt color camera driven through at a moderate rate of speed not more than 30 feet per min. The camera shall be of the self-propelled tractor type with a measuring device mounted to the front capable of being read as the tractor moves and capable of accurately measuring depth of standing water up to, and including, three inches.
- D. Begin video recording at the top of the manhole to see the condition of the manhole and any pipe that is connected to the manhole. Record going down into the manhole all the way to the preset footage with continuous recording until the down stream manhole.
- E. Lighting should be set to allow for clear visibility without excessive reflection and should allow realistic colors to be visible.
- F. The iris of the camera should be adjusted to allow for a sharp focused image and the lens should be kept clean and free of obstructions.
- G. The operator should follow the manufacturer's instructions to achieve the proper color correction.
- H. All notes or coded references shall have footages recorded with them
- I. The camera should be centered within the pipe.
- J. The distance between manhole centers shall be accurate within 0.5 percent..
- K. The camera shall be stopped at all laterals adjusted for a clear picture and an orbital scan of the lateral taken pausing at the invert at the service lateral to detect dirt or infiltration.
- L. All laterals shall be televised when reaching the lateral if a launch type camera is utilized.

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- M. The camera shall also be stopped at any suspected or confirmed defects, the focus properly adjusted and a clear digital video taken.
- N. Areas suspected of leaking shall be paused long enough to determine if a leak exists currently or if deposits have occurred.
- O. A digital photo shall be taken of all areas noted on the report including laterals and any confirmed or suspected defects.
- P. Manholes upstream and downstream shall be measured from rim to invert and the depth recorded on the inspection header in feet and inches.
- Q. Manhole material and defects shall be noted.
- R. Manholes that have laterals tied into them shall have sufficient water ran through them and a CCTV inspection to the property line will be conducted.

3.05 CCTV QA/QC INSPECTION PROCEDURES AND CAUSES FOR REJECTION OF CCTV WORK

- A. The CONTRACTOR shall submit their Quality Assurance Plan and Quality Control procedures to UTILITIES. The CONTRACTOR shall ensure data quality and submit the results of the internal quality control checks performed on submitted data.
- B. UTILITIES will perform quality control checks on submitted inspection data. Failure to meet the minimum accuracy noted below will be cause for rejection of submitted data. The following is the QC procedure to be employed by UTILITIES and serves as the minimum requirements for the CONTRACTOR.
 - 1. The CONTRACTOR shall review of a minimum of 5% of the total inspections by each PACP certified operator entering the field CCTV data. The CONTRACTOR shall number the inspection reports in the order they were inspected.
 - 2. The CONTRACTOR shall number the inspection reports in the order they were inspected.
 - 3. Each inspection report that corresponds to the random numbers will be marked for review, the inspection report printed and the video copied to the QA/QC directory.
 - 4. Each selected inspection report will be reviewed in detail against the inspection digital video.
 - 5. Each field that is populated and those that should have been populated will be counted to produce a “number of fields checked” for the required header information and detailed inspection information. The fields with errors, or missing data, regardless of the error will be totaled to determine the “error count”. The accuracy level will then be calculated as follows: $100 - ((\text{error count} / \text{number of fields checked}) * 100) = \text{accuracy percentage}$
 - 6. Utilities will review contractor’s quality control report and review an additional 5% or more inspections to insure contractor’s quality of work has been met.

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7. The accuracy of each PACP certified operator entering the field CCTV data shall meet or exceed **90%**. Submittals where the accuracy level falls below 90% will be returned in their entirety for re-inspection and/or resubmittal.

3.06 GRAVITY MAIN INSPECTION CCTV REPORT

- A. The CONTRACTOR will be required to submit the following deliverables on a weekly basis.
 1. Inspection Reports to include:
 - a. Inspection session header information (see required fields above)
 - b. Defect log report including photo captures from CCTV video
 - c. Schematic drawing of pipe showing defects
 - d. Format: Adobe Acrobat PDF files – 1 report PDF per pipe
File name: <upstream MH ID>_<downstream MH ID>_<Date (year_mo_day format)>.PDF
Example: 30060002_30060001_2010_02_16.pdf
- B. The CONTRACTOR shall submit quality control forms that include a hard copy print out of the inspection reports checked with errors and omissions clearly marked
- C. Inspection video files on DVD or portable hard drive, labeled as follows: DVD/Hard drive Labels - Typed labels shall be attached to the face of each DVD. The typed index labels shall include the following information:
 1. Content (CCTV)
 2. Contractor name
 3. Purpose of Survey
 4. Tributary Pump station number
 5. Reaches included (from Manhole Number ## to Manhole Number ##)
 6. Date of survey
 7. Contract Number / Delivery Order Number (if applicable)
 - a. Electronic Inspection Data stored and exported in a NASSCO Pipeline Assessment and Certification Program (PACP) compliant Microsoft Access database (.MDB) version 4.4 delivered on DVD or portable hard drive.
 - b. Inspection photograph digital files (jpeg) indexed to NASSCO PACP compliant database.

3.07 CAUSES FOR REJECTION OF GRAVITY MAINS

- A. The CONTRACTOR shall be required to replace the pipeline if the acceptance or bond CCTV inspection reveals cracked, broken or defective pipe, and/or in the case of PVC pipe a ring deflection in excess of five percent (5%).

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- B. Joint separation shall be no greater than two inches between the spigot and bell of the pipe.
- C. No evidence of leakage will be acceptable for private gravity mains connecting to UTILITIES' collection system.
- D. The following NASSCO PACP codes or notes shall be cause for rejection of gravity sewer systems
 - 1. PACP coding of "Line" (L) shall be accompanied by a measurement of the line, grade or angular deviation. Variance of established line and grade at any point along the length of the pipe shall not be greater than 1 inch, provided such variation does not result in a level or reverse sloping invert. An approved method shall be used to determine this deviation. A PACP coding of MWLS with a percentage of pipe greater than 12.5% on 8-inch sewer, 15% on 10-inch sewer etc. will be corrected by excavation and repair.
 - 2. PACP coding of "Infiltration" (I) for pipe joints shall be replaced or the pipe joint shall be reseated at the joint. Grouting shall not be considered a method of repair and will not be accepted. Replace the leaking gravity main segment if there is visible infiltration at any point other than the pipe joint.
 - 3. Any PACP coding in the category of "Structural Family".
 - 4. PVC pipe having ID tears will be rejected.
 - 5. PACP condition grading of "OB" (obstruction) in pipe shall be rejected, the obstruction shall be removed and the line cleaned and re-televised.

3.08 ACCEPTANCE

- B. Successful passage of both the leakage test and CCTV inspection is required before acceptance by UTILITIES.
- C. Prior to repair or replacement of failed sewer pipe, the method of repair or replacement shall be submitted to UTILITIES for approval. Pressure grouting of pipe or manholes shall not be considered as an acceptable method of repair.

3.07 TESTING AND INSPECTION OF MANHOLES

- A. Leakage Test:
There shall be no visible leakage through the walls or pipe connections.
- B. Vacuum Test:
All manholes shall be required to meet the requirements of the vacuum test as per the current ASTM C 1244 "Standard Test Method for Concrete Sewer Manholes by the negative Air Pressure (Vacuum) Test" prior to acceptance. Manholes that fail the vacuum test or that develop a leak during the one year warranty period shall be rejected, removed and replaced with new material at no cost to the COUNTY. No field repair shall be approved.

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C. Manhole Inspections:

1. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by UTILITIES. Such inspection may be made at the place of manufacture and/or at the site after delivery, or at both places. The sections shall be subject to rejection at any time due to failure to meet any of the specification requirements; even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be immediately removed from the job. All sections or joints, which have been damaged, will be rejected, removed from the site and replaced with new material. If already installed, rejected section shall be removed and replaced entirely at the CONTRACTOR's expense.
2. At the time of inspection, the sections will be carefully examined for compliance with the specified ASTM 478 "Standard Specification for Precast Reinforced Concrete Manhole Sections", and with the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength" blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured. Installed manholes shall be inspected for proper filling and coating of the lifting holes and proper installation of any liner, coating or shrink-wrap.

3.08 TESTING OF WASTEWATER FORCE MAINS

A. Tracing Wire System:

All wastewater force mains shall be installed with a continuous green insulated copper wire. Locating wire installed as per STANDARD DRAWINGS shall pass a continuity check with an approved tracing system before acceptance by UTILITIES.

B. Inspection of Wastewater Air Release Valves:

After completion of the pressure test the ARV shutoff valve shall be opened and UTILITIES shall test the ARV for proper connection and operation.

C. Inspection of Plug Valves and Valve Boxes:

Valves shall be opened wide, then tightly closed and the various nut and bolts shall be tested for tightness. Any valve that does not operate correctly shall be replaced.. Valve boxes shall be properly marked and checked for installation as per the STANDARD DRAWINGS. Operating nuts, extensions and upper guides shall not interfere with valve operation. Before acceptance by UTILITIES valve boxes shall be adjusted to finished grade with the operating nut properly centered and shall have a "V" notched in the curb or street in the absence of a curb directly opposite the valve box.

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D. Hydrostatic Pressure Testing:

1. Hydrostatic tests shall consist of pressure and leakage tests. Air testing of pressure pipes will not be permitted under any circumstance. Testing shall be performed from in-line valve to in-line valve with a depressurized section behind each valve. The CONTRACTOR shall pressure test both sides of the valve. The CONTRACTOR shall furnish all necessary testing material and equipment to perform this test. UTILITIES will monitor and approve a satisfactory test. Multiple sections may be tested simultaneously providing there are dead sections in between each pressure tested section.
2. All pipe sections to be pressure tested shall be subjected to a hydrostatic pressure of 100 psi. The duration of each pressure test shall be for a period of two hours. If during the test, the integrity of the tested line is in question, UTILITIES may require a 6-hour pressure test. The basic provisions of AWWA C600 shall be applicable.

3. Procedure for Pressure Test:

Each section of pipe, inclusive of all appurtenances to be tested, as determined by UTILITIES, shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made and appropriate valves installed to ensure bleeding of all air from the main. If defective pipes, fittings or valves are discovered during this pressure test, all such items shall be removed and replaced by the CONTRACTOR with sound material and the test shall be repeated until satisfactory results are obtained. Provisions of the current AWWA C600, where applicable, shall apply.

E. Hydrostatic Leakage Testing:

1. Procedure for Leakage Test:

After completion of the pressure test, a leakage test shall be conducted to determine the quantity of water lost by leakage under the specified test pressure. Applicable provisions of AWWA C600 shall apply.

- a. Allowable leakage in gallons per hour for pipeline shall not be greater than that determined by the formula:

$$L = \frac{SD(P)^{0.5}}{148,000}$$

Note:

L = Allowable leakage in gallons per hour.

S = Length of pipe tested, in feet.

D = Nominal diameter of the pipe in inches.

P = Average test pressure, pounds per square inch

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- b. Leakage is defined as the quantity of water to be supplied in the installed pipe or any valve section under test, which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. Should any test of pipe installed disclose leakage greater than that allowed, the CONTRACTOR shall locate and replace or repair the defective joints, pipe or valve until subsequent testing is within the specified leakage allowance.

ATTACHMENT B

Geotechnical Exploration Report Porter Transfer Station
Improvements, Blue Marlin Engineering, August 31, 2017



August 31, 2017

Shane R. Fischer, P.E.
Project Director
SCS Engineers
4041 Park Oaks Blvd., Suite 100
Tampa, FL. 33610

Re: Geotechnical Exploration Report
Porter Transfer Station Improvements
BME Project No. 17-109

Dear Mr. Fisher:

Blue Marlin Engineering (BME) submits this Report in fulfillment of the scope of services described in our proposal number BME P16-052 and dated June 14, 2016. You verbally authorized us to proceed with our work on this project. This Report describes our understanding of the project and presents our evaluations.

EXECUTIVE SUMMARY

For this Report, the conditions at this site were explored using two standard penetration test (SPT) borings and nine cone penetrometer test (CPT) borings. The following generalized subsurface conditions were encountered:

Layer 1: A 6-foot thick layer of Fill Soils*

Layer 2: A 6-foot thick layer of Trash/Debris

Layer 3: A 16-foot thick layer of slightly silty Sand (SP-SM)

Layer 4: A 22-foot thick layer of silty, silty to clayey Sand (SM, SM-SC)

**Fill Soils consisted of fine to slightly silty Sand (SP, SP-SM) with some gravel*

Following the recommendations provided in this Report, it appears that the proposed development is viable at this site. The engineering evaluations performed for this project indicate the following:

www.BlueMarlinEngineering.com

Blue Marlin Engineering, LLC * 102 Drennen Road, Suite B-10 * Orlando, FL 32806
Phone: 407-217-4464 * Fax: (321) 710-2483

- Provided the structures can accommodate the predicted settlement and following the site preparation activities as described in this report, shallow foundations can be used to transfer (future) building loads.
- Shallow foundations should be constructed to bear 36 inches below finished grade.
- Shallow foundations can utilize an allowable bearing pressure of 2.0 ksf.
- Ground floor slabs can be constructed as slab-on-grade following site preparation.

PROJECT INFORMATION

The project will consist of the designing, permitting and construction services for a new scalehouse, truck scale, citizen's drop-off area and household hazardous waste collections building at the Orange County Porter Solid Waste Transfer Station.

The facility is located at 1326 Good Homes Rd, Orlando, FL 32818. Appended drawing A-1 shows a Vicinity Map of the subject site.

We have assumed the maximum loads are assumed to be on the order of 100 kips for columns, 4 kips per lineal foot for walls, and 250 psf for floors.

PURPOSE

The purpose of our services on this project was to explore the shallow subsurface conditions at the site and to use the information obtained to provide geotechnical engineering recommendations for the site preparation and design of the building foundations and pavements.

NRCS SOIL SURVEY REVIEW

The subject site is located within Section 22, Township 22 South, and Range 28 East. The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey for Orange County, Florida was reviewed to obtain near surface soils and groundwater information at the subject site. Where the project site falls, the site is predominantly covered with the following three soil types: Candler fine sand, 0 to 5 percent slopes (4); Candler fine sand, 5 to 12 percent slopes (5); Tavares-Millhopper complex, 0 to 5 percent slopes (47). A soil survey map is shown on appended drawing A-3 and summarized in Table 1 below.



Table 1
NRCS Soil Survey

Soil Unit Map No.	Soil Name	Depth (inch)	Description	USCS Classification Symbol	Depth to Seasonal High Water Table (feet)
4	Candler fine sand, 0 to 5 percent slopes	0-5	Fine sand	SP, SP-SM	>6.0
		5-74	Sand, fine sand	SP, SP-SM	
		74-80	Sand, fine sand	SP-SM	
5	Candler fine sand, 5 to 12 percent slopes	0-4	Fine sand	SP, SP-SM	>6.0
		4-61	Sand, fine sand	SP, SP-SM	
		61-80	Sand, fine sand	SP-SM	
47	Tavares-Millhopper complex, 0 to 5 percent slopes	0-64	Fine sand	SP-SM, SM	3.5 – 6.0
		64-76	Loamy sand, loamy fine sand	SM	
		76-80	Sandy loam, fine sand sandy clayey loam	SM, SM-SC, SC	

The soil units listed above are generally classified as sands with varying amounts of silt. The NRCS predicts seasonal high groundwater levels within the site limits to be from the ground surface to greater than 6 feet below existing site grades. Our field exploration program revealed groundwater conditions similar to those predicted by the NRCS (discussion in the Subsurface Conditions section of this report).

Please note that information contained in the NRCS Soil Survey is very general. It may not, therefore, be reflective of actual soil and groundwater conditions. The information obtained from the soil borings provides a better characterization of actual site subsurface conditions.

FIELD TESTS

The subsurface conditions were explored with a total of 11 soil borings. Borings were completed within the proposed development area. Nine (9) cone penetrometer test (CPT) borings and two (2) standard penetration test (SPT) borings and were performed. The approximate test locations are shown in the appended Drawing No. 2.

The CPT borings were performed at the following locations: Three borings, 50 feet deep, were performed under the proposed scale. Three borings, 50 feet deep, were performed within the citizen’s drop off area. One boring, 30 feet deep, was performed under the proposed household hazardous waste collection area. Two borings, 20 feet deep, were performed under the new proposed paved areas. In addition, we performed two standard penetration test (SPT) borings. The standard penetration test borings were performed to parallel the CPT data at two locations.

Cone Penetration Test – CPT testing was performed in substantial accordance with ASTM D 5778, “Standard Test for Performing Electronic Friction Cone and Piezocone Penetration



Testing of Soils". Simply stated, a penetrometer tip with a conical point is pushed through the soil at a constant rate. The cone resistance q_c , is calculated as the force required to move the cone divided by the horizontally projected area of the cone. A continuous record of the resistance versus depth is then obtained. The unit side shear, f_s , measured on the friction sleeve mostly helps to identify soil type through comparison with the tip bearing.

Standard Penetration Tests – SPT testing was performed in substantial accordance with ASTM Procedure D 1586, "Penetration Test and Split-Barrel Sampling of Soils." This test procedure drives a 1.4-inch I.D. split-tube sampler into the soil profile using a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler the second and third 6-inch increments is the soil N-value, in blows per foot, and is an indication of soil strength. The soil samples recovered from the soil borings were classified and stratified by a geotechnical engineer.

The results of the classification and stratification for each boring are shown in the appended Records of Test Boring. It should be noted that soil conditions may vary between the strata interfaces which are shown. The soil boring data reflects information from a specific test location only.

SUBSURFACE CONDITIONS

Subsurface Profile - The field tests performed for this project disclose subsurface conditions which are similar with the geology described in the NRCS Soil Survey.

In general, the borings disclosed reasonably consistent subsurface conditions across the site. The borings performed at this site revealed a subsurface profile that consisted of a 6 foot (average thickness) thick layer of fill soils over a 6 foot (average thickness) thick layer of trash. The trash material was underlain by a series of fine sands with varying amounts of silt and clay until boring termination depths. More discussion on the encountered soil layers is below.

Layer 1 soils, the fill soils, consisted of fine, slightly silty, and silty sand intermixed with coarse aggregates. This layer was not consistent in color, or the amount of the minor constituents or coarse aggregate through the depth of the soil layer. The relative density of this layer was observed to be medium dense.

Layer 2 soils consisted of miscellaneous trash/debris.

Layer 3 and 4 soils were observed to be uniform and consisted of fine sand with varying amounts of silt and clay (SP, SP-SM, SM, and SM-SC). Standard Penetration Testing (SPT) indicates the relative density of this layer to be medium dense.



Our soil classification is based on the material encountered in widely spaced borings. Soils encountered during the construction process may vary significant across the site and from what is shown in our soil borings. If different subsurface conditions are encountered at the time of construction, BME should be contacted immediately to evaluate the conditions encountered.

Groundwater - The groundwater table depth was monitored during drilling operations. However, once the use of driller's mud was introduced, accurate readings can be difficult to obtain. We were not able to accurately determine the depth of the groundwater table for this study. However, based on the field data gathered at the site, it appears the groundwater table at the time of our field exploration program was on the order of 20 feet below existing site grades.

We estimate that the seasonal high groundwater table at the site to be 3 to 4 feet higher than what we encountered in the soil borings.

The seasonal high groundwater level is affected by a number of factors. Such factors include the drainage characteristics of the soils, the land surface elevations, relief points, and distance to relief points. The existing stormwater pond on site likely lowers groundwater levels on the site.

Groundwater levels will vary as a result of seasonal and storm events and with changes in subsurface conditions between boring locations. It is possible that groundwater levels are higher or lower than the levels being reported. In order to better define the groundwater conditions at this site, longer term monitoring in cased holes or piezometers would be required.

EVALUATION

Discussion - A foundation must meet three requirements for successful design and construction: bearing capacity, settlement, and environmental factors. Shallow foundations are initially considered because of their relative economy. If shallow foundations do not meet allowable design requirements for bearing capacity, settlement and environmental factors, then deep foundations (piles, shafts, etc.) or soil improvement are considered.

The soil bearing capacity is the ability of a soil to support loads without plunging into the soil profile. Bearing capacity failures are analogous to shear failures in structural design and are usually sudden and catastrophic. Shallow foundations are designed so that columns do not plunge into the soil profile. Analytical techniques for soil bearing capacity estimation generally apply to sands, clays and silts. In a cemented deposit or rock formation, bearing capacity is evaluated using techniques such as factor of safety against punching shear failure, factor of safety against beam tension failure, and factor of safety against crushing.



Foundation allowable bearing pressures and bearing elevations must be adjusted so as to provide margins of safety against bearing capacity failure. Another requirement of a shallow foundation is the ability of the structure to tolerate the predicted settlement. The following parameters are necessary in order to estimate settlement: footprint bearing pressure, stress reduction factor, thickness of each compressible underlying stratum, modulus of each stratum, and foundation dimensions.

The allowable amount of settlement that a structure may tolerate is dependent on several factors including: uniformity of settlement, time rate of settlement, structural dimensions and properties of the structural materials. Generally, total or uniform settlement does not damage a structure but may affect drainage and utility connections. These can generally tolerate movements of several inches for building construction. In contrast, differential settlement affects a structure's frame and is limited by the structural flexibility.

The final requirement of a shallow foundation is to resist environmental factors such as soil freezing, soil swelling, hurricane scour, sinkholes, or long term degradation.

Summary - It is our professional opinion that shallow foundations bearing on compacted engineered fill soils can be used to support the planned development for this site.

That being said, developing a site over unknown fill soils and trash pose certain risks that must be accounted for in the design and construction of this site. Careful site preparation becomes paramount to the functional ability of the developed site.

The more conservative approach for foundation performance at this site would be to support the planned structures with a deep foundation (piles) system. Given the subsurface conditions encountered at this site, we would recommend the deep foundation system consist of micro piles. The micro piles would transfer the foundation loads past the fill and trash layer and supporting the weight of the structures on the more competent layer 3 and 4 soils.

If shallow foundations are constructed, utilizing a geogrid to distribute structural loads more efficiently over the underlying soils will be necessary. Geogrids increase a soils' bearing capacity and decrease differential settlement.

If site preparation is properly performed as recommended in this Report, including the placement of a geogrid, shallow foundations can be designed to use an allowable soil bearing pressure of 2.0 ksf. Shallow foundations supported as described herein should result in total settlements of about 2 inches for column loads up to 200 kips and continuous footings loaded up to 8 kips per lineal foot. Differential settlements will be a result of changes in applied load and the variations in subsurface conditions. We estimate that differential settlement will be about one-half the total settlement and occur over a distance of 30 feet.



We anticipate that the planned structures will be able to tolerate the predicated settlement. As such, we provide shallow foundation recommendations below. In the event a deep foundation system will be more desirable, we can provide those recommendations upon your request.

RECOMMENDATIONS

The recommendations provided below are based on the project information described in this Report, field test data, our evaluation as stated in this Report, and our past experience with foundation engineering in Florida. If project information or design concepts change, we should be advised of these changes in writing, and should be provided with an opportunity to review our recommendations as presented in this Report.

Geotechnical Site Preparation

1. Geotechnical site preparation should consist of stripping all surficial vegetation, stumps, debris, organic topsoil, and any other deleterious materials from beneath the proposed development extending a minimum lateral distance of 5 feet outside the limits.
2. After stripping, the site should be grubbed or root-racked such that roots with a diameter greater than ½ inch, stumps, or small roots in a dense state, are completely removed. Based on current ground cover, significant root concentrations are not expected to occur throughout the majority of site. The actual depth(s) of stripping and grubbing must be determined by visual observation and judgment during the earthwork operation by engineering personnel.
3. Prior to the placement of any new fill soils, the exposed subgrade soils should be proofrolled. The purposes of the proofrolling will be to detect unstable soils that yield when subjected to compaction and to densify the near surface sands. Fill compaction/proofrolling recommendations are given below. Fill soils should be placed with loose lift thicknesses of not more than 12 inches. Remove material that yield excessively during proofrolling and replace with fill selected and compacted as described in this Report.
4. Fill soils should consist of inorganic, non-plastic sand having less than 10% material by weight passing the no. 200 sieve. The moisture content of the fill soils should be within 2% of the optimum moisture content based on ASTM D 1557. All fill materials should be free of construction debris and organic materials such as roots and vegetation.
5. Fill compaction and proofrolling efforts should be implemented with a compactor with a minimum static at-drum weight of 10 tons. The areas of the site that will support proposed construction should be proofrolled with several overlapping coverages of a



heavy compactor. We recommend a minimum of 10 overlapping passes in each of two perpendicular directions. Vibratory compaction is not recommended near existing structures.

6. Following the proofrolling of the exposed subgrade soils, a density equivalent of at least 95% of the modified Proctor maximum dry density (ASTM D 1557) should be achieved. Proofrolled areas should be compacted to a depth of at least 12 inches below the surface. Density tests should be performed on the compacted proofrolled soils. One in-place density test should be performed for each 2,500 square feet of proofrolled soils.
7. Once the subgrade compaction efforts are verified by testing, fill may be needed to raise site grades. Representative samples of the fill soils should be collected for classification and compaction testing. The maximum dry density as indicated by ASTM D 1557, optimum moisture content, and percent by weight passing a no. 200 sieve should be determined. These tests are needed for quality control of the compacted soils
8. All structural fill should be placed in loose lift thicknesses of not more than 12 inches. Each lift should be compacted to at least 95% of the modified Proctor maximum dry density (ASTM D 1557). The filling and compaction operations should continue in 12 inch lifts until the desired elevation is achieved. Density tests should be performed on the compacted fill soils. One test should be performed for each 12 inch lift and 2,500 square feet of fill soils.
9. The Geotechnical Engineer should be involved during all earthwork activities to verify that procedures and results are as specified and as anticipated.
10. Prospective bidders on this project should be made aware of the potential for encountering questionable fill soils.

Shallow Foundations

1. Shallow foundation construction needs to occur in the dry. Dewatering may be necessary for this project.
2. Shallow foundations can be used for support of the proposed the building(s). Shallow foundation construction should start upon completion of all geotechnical site preparation and fill placement activities (if any).
3. Following the placement of a geogrid, shallow foundations should be designed using an average soil bearing pressure of 2.0 ksf.
4. Shallow foundations should be constructed as deep as possible. We recommend that shallow foundations be designed with a minimum depth of embedment (below finished



- grade) of 36 inches. Foundation excavation bottoms should be level and free of any loose soils.
5. Over excavate the bottom of the shallow foundation footings by at least 2 feet. Place geogrid (i.e. Tensar UX100 or equivalent) at the bottom of the excavation. The soils should be level and free of any loose and deleterious materials prior to geogrid placement. Place FDOT #57 stone on top of the geogrid until the desired bottom footing elevation is achieved. The FDOT #57 soil will be the foundation subgrade of the shallow foundation element.
 6. Foundation excavations should be cut to final grade and footings constructed as soon as possible to minimize potential damage to bearing soils as result of exposure to the environment.
 7. The placement of the geogrid should extend by at least 4 feet from the edge of a footing. Care should also be maintained so that all the geogrid joints overlap by at least 5 feet.
 8. The Geotechnical Engineer, who is familiar with the foundation design and construction assumptions as well as the intent of the geotechnical recommendations, should observe the excavations for all shallow foundations and be involved with the field geotechnical observations during construction.

Pavement Subgrade Preparation

1. Prepare pavement areas in accordance with the specifications stated above.
2. Stabilizing material will likely be necessary for the construction of asphalt pavement subgrades. Stabilization of subgrade soils beneath concrete pavements (if any) is generally not required.
3. A minimum separation of 12 inches between the bottom of the pavement subgrade or concrete pavement and the anticipated seasonal high groundwater table should be maintained at all times.
4. Compact 12 inch subgrade beneath the base to a minimum of 98% of ASTM D-1557 maximum dry density. A minimum frequency of one in-place density test for each 5,000 square feet of area should be used.
5. We recommend that pavements be designed for a minimum 20-year design life, and have the following minimum pavement sections for light and heavy duty roadways.

Light-Duty Asphalt (Car Parking Areas)

- 1.5 inches Type S-III asphalt
- 6 inches Limerock Base Course (LBR = 100)
- 12 inches of well-draining stabilized subgrade (LBR = 40).
- Stabilization to consist of coarse admixtures such as limerock screenings, recycled concrete or crushed shells.

Heavy-Duty Asphalt Section (Entrance Drives)

- 2 inches Type S-I Asphalt
- 10 inches Limerock Base Course (LBR = 100)
- 12 inches of well-draining stabilized subgrade (LBR = 40).
- Stabilization to consist of coarse admixtures such as limerock screenings, recycled concrete or crushed shells.

Heavy-Duty Concrete Section (Loading Areas)

- 6 inch concrete pavement (with a 28 day compressive strength of 4,000 psi)
- 6 inch crushed concrete base (LBR = 120 or limerock base (LBR = 100)
- Subgrade beneath concrete pavement should be well-draining fine sand/and or fine sand with silt.
- Subgrade should be compacted to a minimum 98% of the soil's modified Proctor to a depth of at least 24 inches.
- Expansion joints should be placed at normal spacing for the recommended thickness of concrete. Joints should be orientated to provide a square pattern.

6. The project Civil Engineer should provide pavement design based on the appropriate design criteria and the soil and groundwater conditions noted in this Report.

Ground Floor Slab

1. Slab-on-grade construction may be used for this project following the recommended geotechnical site preparation. Slab-on-grade construction should occur in the dry.
2. Construction joints should be provided at column and wall interfaces, and throughout the slab, to minimize the potential for cracking at these locations.
3. Compact the subgrade beneath the slab to a minimum of 95% of ASTM D-1557 maximum dry density for a depth of 12 inches. In-place density testing should be performed at an interval of one test per 2,500 square feet of slab as previously recommended in this Report.



Temporary Excavations

1. The contractor should be aware that slope height, slope inclination, and excavations depths (including utility trench excavations) should not exceed those specified in local, state, or federal safety regulations (OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926).
2. If any excavation is extended to a depth of more than 20 feet, OSHA requires that the side slopes of such excavation be designed by a Professional Engineer registered in the State of Florida.

REPORT LIMITATIONS

This consulting Report has been prepared for the exclusive use of the project design team and the owner(s) of this site for the specific application to this project. This Report has been prepared in accordance with generally accepted local geotechnical engineering practices; no other warranty is expressed or implied.



CLOSURE

If you have questions about information contained in this Report, please contact the undersigned.

Sincerely,

BLUE MARLIN ENGINEERING
Certificate of Authorization Number 29218


Osciel F. Plaza, P.E.
President
Florida Registration No. 73262

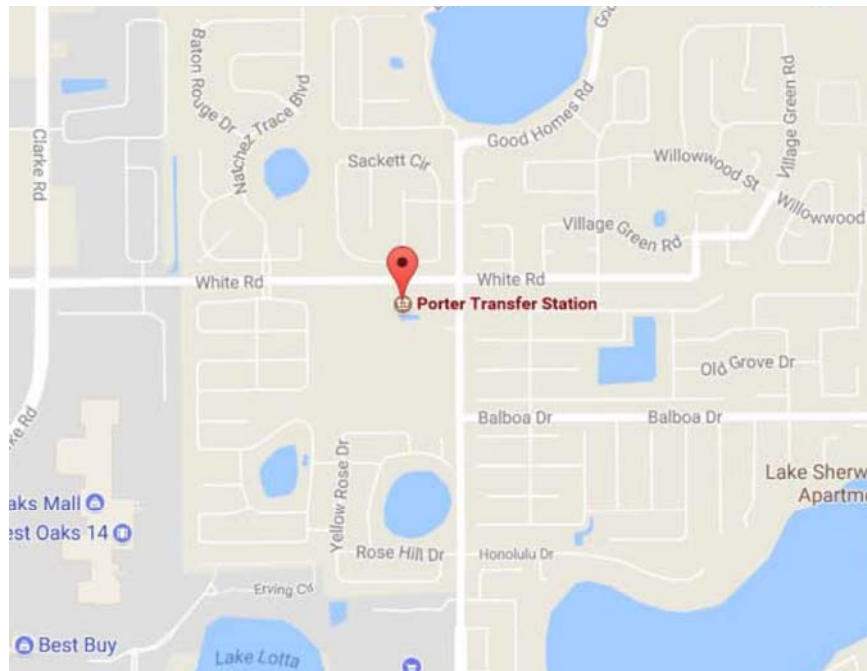
Attachments: Drawing No. 1 - Vicinity Map (A-1)
Drawing No. 2 - USDA Soil Survey (A-2)
Drawing No. 3 - Test Location Plan (A-3)
Notes Related to Profile and Borings (A-4)
Key to Symbols (A-5)
Records of SPT Borings (A-6 to A-7)
Records of CPT Borings (A-8 to A-33)

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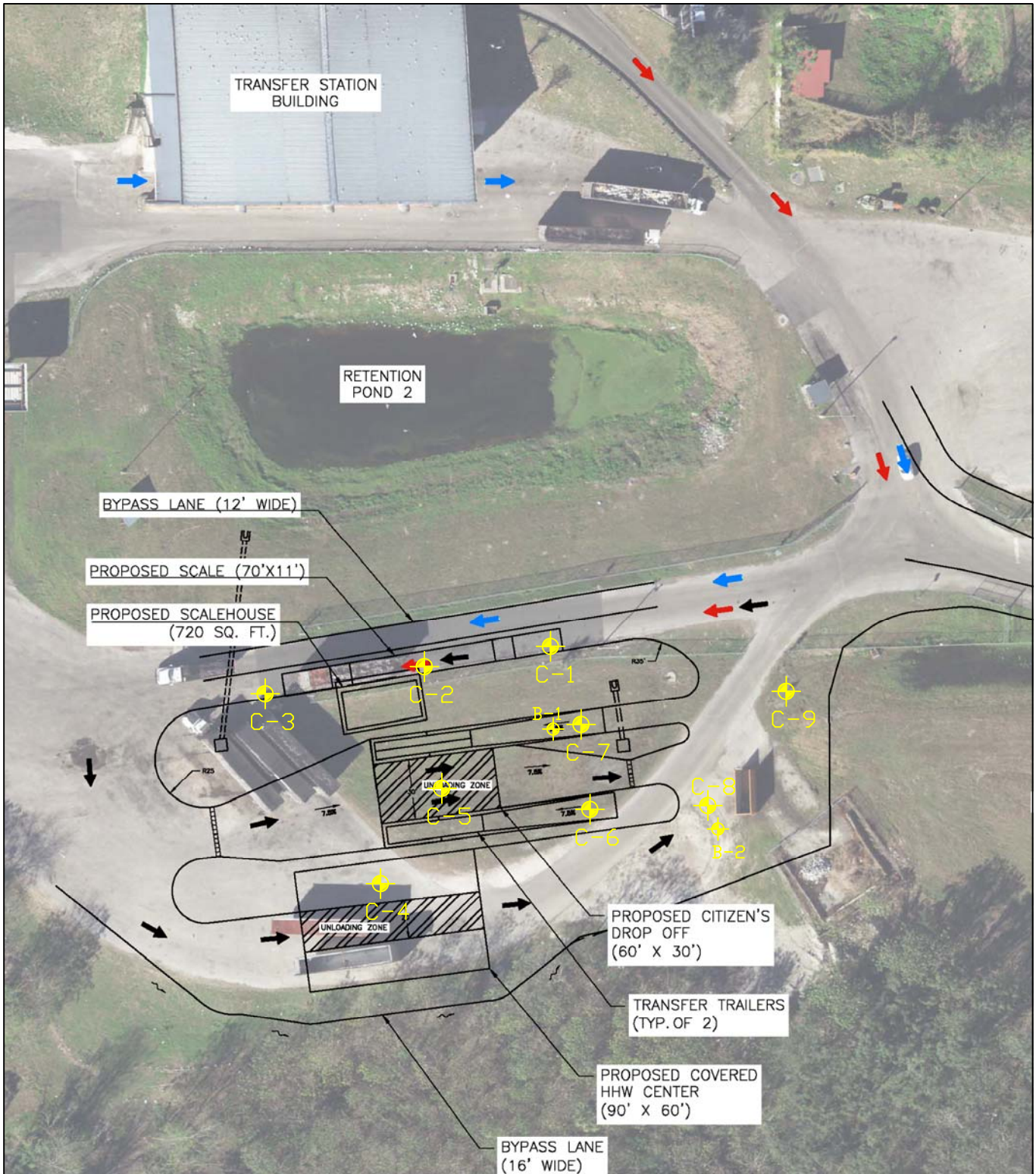
Township: 22 South
 Range: 28 East
 Section: 22



Geotechnical
 Engineering &
 Construction Materials
 Testing

DWG TITLE:		Vicinity Map		DWN BY:	ACT
PROJ NAME:		Porter Transfer Station 1326 Good Homes Rd, Orlando, FL 32818		CKD BY:	CFP
PROJ. NO:	17-109	DATE:	8/20/17	DWG NO:	1

DWN BY:	ACT
CKD BY:	CFP
APD BY	—




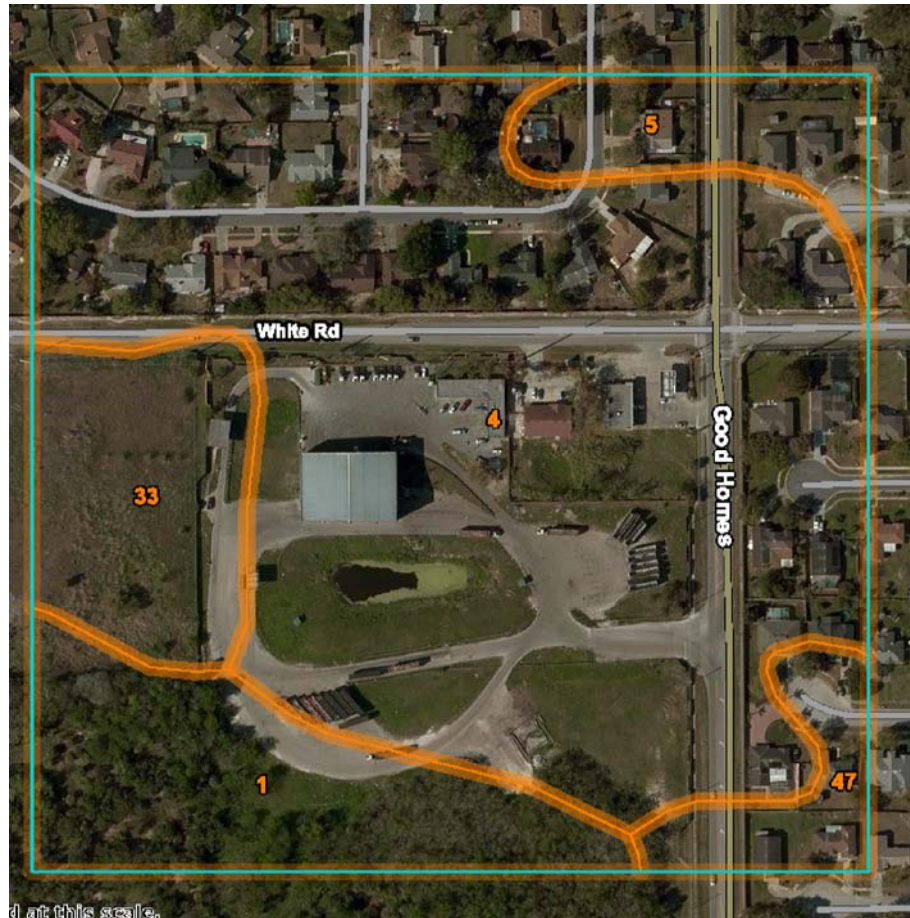
Legend

- ⊕ - SPT Boring
B-1
- ⊕ - CPT Boring
CPT

Notes:

1. Test locations are shown as approximate.
2. Test location symbols are not to scale.
3. Drawing not to scale.

 <p>BLUE MARLIN ENGINEERING Geotechnical Engineering & Construction Materials Testing</p>	DWG TITLE: <i>Test Location Plan</i>			DWN BY: <i>ACJ</i>	
	PROJ NAME: <i>Porter Transfer Station 1326 Good Homes Rd, Orlando, FL 32818</i>			CKD BY: <i>OFJ</i>	
	PROJ. NO: <i>17-109</i>	DATE: <i>8/20/17</i>	DWG NO: <i>2</i>	APD BY _____	



at this scale.

Map Unit Symbol	Map Unit Name
1	Arents, nearly level
4	Candler fine sand, 0 to 5 percent slopes
5	Candler fine sand, 5 to 12 percent slopes
33	Pits
47	Tavares-Millhopper complex, 0 to 5 percent slopes



Geotechnical
Engineering &
Construction Materials
Testing

DWG TITLE:

Soil Survey Map

DWN BY: *ACJ*

PROJ NAME:

Porter Transfer Station
1326 Good Homes Rd, Orlando, FL 32818

CKD BY: *OSP*

PROJ. NO:

17-109

DATE:

8/20/17

DWG NO:

3

APD BY

**NOTES RELATED TO RECORDS OF TEST BORING AND
GENERALIZED SUBSURFACE PROFILE
BLUE MARLIN ENGINEERING**

1. Groundwater level was encountered and recorded (if shown) following the completion of the soil test boring on the date indicated. Fluctuations in groundwater levels are common; consult report text for a discussion.
2. The boring location was identified in the field by offsetting from existing reference marks and using a cloth tape and survey wheel.
3. The borehole was backfilled to site grade following boring completion, and patched with asphalt cold patch mix when pavement was encountered.
4. The Record of Test Boring represents our interpretation of field conditions based on engineering examination of the soil samples.
5. The Record of Test Boring is subject to the limitations, conclusions and recommendations presented in the report text.
6. "Field Test Data" shown on the Record of Test Boring indicated as 11/6 refers to the Standard Penetration Test (SPT) and means 11 hammer blows drove the sampler 6 inches. SPT uses a 140-pound hammer falling 30 inches.
7. The N-value from the SPT is the sum of the hammer blows required to drive the sampler the second and third 6-inch increments.
8. The soil/rock strata interfaces shown on the Record of Test Boring are approximate and may vary from those shown. The soil/rock conditions shown on the Record of Test Boring refer to conditions at the specific location tested; soil/rock conditions may vary between test locations.
9. Relative density for sands/gravels and consistency for silts/clays and limestone are described as follows:

SPT Blows/ Foot	Sands/Gravels Relative Density	SPT Blows/ Foot	Silt/Clay Relative Consistency	SPT Blows/ Foot	Limestone Relative Consistency
0-4	Very loose	0-2	Very Soft	0-20	Very Soft
5-10	Loose	3-4	Soft	21-30	Soft
11-30	Medium Dense	5-8	Firm	31-45	Medium Hard
31-50	Dense	9-15	Stiff	46-60	Moderately Hard
Over 50	Very Dense	16-30	Very Stiff	61-50/2"	Hard
		Over 30	Hard	Over 50/2"	Very Hard

10. Grain size descriptions are as follows:

<u>NAME</u>	<u>SIZE LIMITS</u>
Boulder	12 inches or more
Cobbles	3 to 12 inches
Coarse Gravel	3/4 to 3 inches
Fine Gravel	No. 4 sieve to 3/4 inch
Coarse Sand	No. 10 to No. 4 sieve
Medium Sand	No. 40 to No. 10 sieve
Fine Sand	No. 200 to No. 40 sieve
Fines	Smaller than No. 200 sieve

11. Definitions related to adjectives used in soil/rock descriptions:

<u>PROPORTION</u>	<u>ADJECTIVE</u>	<u>APPROXIMATE ROOT DIAMETER</u>	<u>ADJECTIVE</u>
About 10%	with a trace	Less than 1/32"	Fine roots
About 25%	with some	1/32" to 1/4"	Small roots
About 50%	and	1/4" to 1"	Medium roots
		Greater than 1"	Large roots

KEY TO SYMBOLS

Symbol Description

Strata symbols



Gravel and Sand



Slightly silty Sand (SP-SM)



Trash/Debris/Garbage (TR)



Silty to Clayey Sand (SM-SC)



Silty Sand (SM)



Fine Sand (SP)

Misc. Symbols



Boring continues

Soil Samplers



Standard penetration test.
140 lb. hammer dropped 30"

Notes:

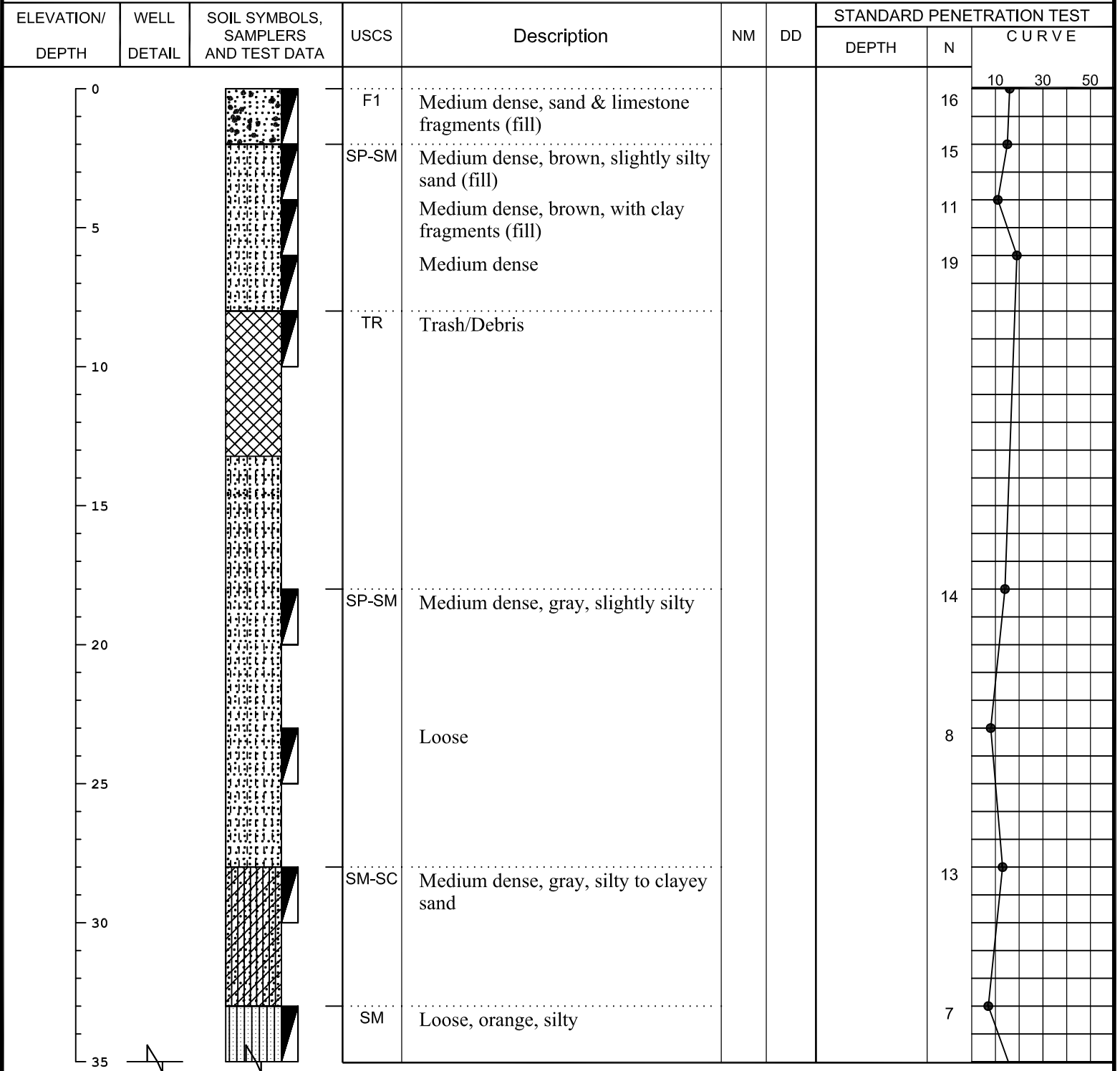
1. Exploratory borings were drilled on 8-21-17 using a rotary drill with wash and mud.
2. The groundwater table was checked following drilling completion.
3. Boring locations were taped from existing features and elevations extrapolated from the final design schematic plan.
4. These logs are subject to the limitations, conclusions, and recommendations in this report.
5. Results of tests conducted on samples recovered are reported on the logs.

DRILL HOLE LOG

BORING NO.: B-1

PROJECT: Porter Transfer Station Improvements
 CLIENT: SCS Engineers
 LOCATION: Refer to Test Location
 DRILLER: RD
 DRILL RIG: BR 2500
 DEPTH TO WATER> INITIAL ∇ :

PROJECT NO.: J17-109
 DATE: 8-21-17
 LOGGED BY: BM



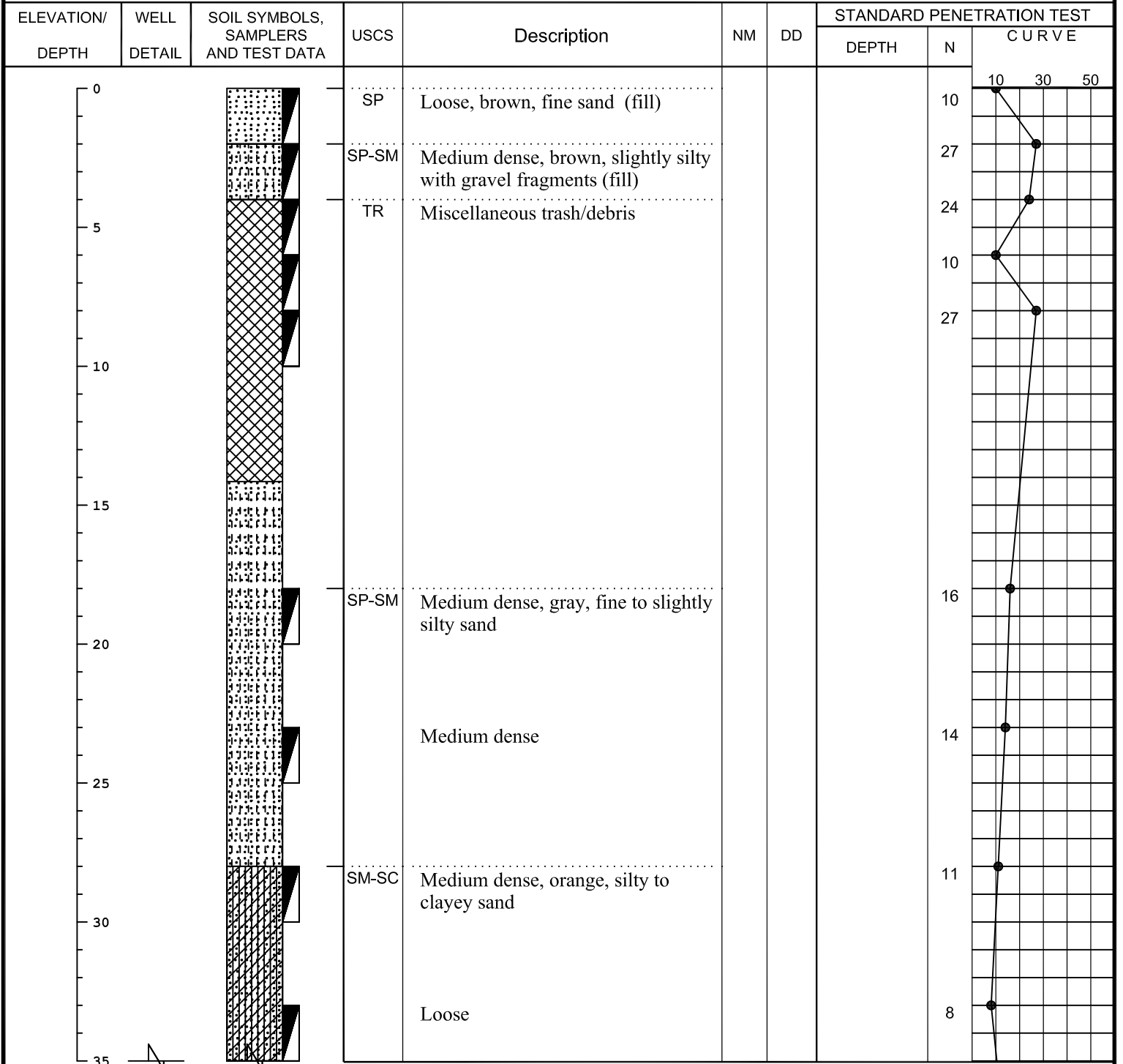
This information pertains only to this boring and should not be interpreted as being indicative of the site.

DRILL HOLE LOG

BORING NO.: B-2

PROJECT: Porter Transfer Station Improvements
 CLIENT: SCS Engineers
 LOCATION: Refer to Test Location
 DRILLER: RD
 DRILL RIG:
 DEPTH TO WATER > INITIAL ∇ :

PROJECT NO.: J17-109
 DATE: 8-21-17
 LOGGED BY: BM



This information pertains only to this boring and should not be interpreted as being indicative of the site.

STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
1	SILTY SAND TO SANDY SILT	53.05	0.639	17	0.057	58%-65%	>43	116.71	--	--	--	--
2	SANDY SILT TO CLAYEY SILT	25.98	0.511	10	0.117	50%-58%	39-41	57.16	--	--	--	--
3	SILTY SAND TO SANDY SILT	23.11	0.215	7	0.174	42%-50%	37-39	50.86	--	--	--	--
4	SILTY SAND TO SANDY SILT	22.62	0.133	7	0.231	42%-50%	35-37	49.78	--	--	--	--
5	SILTY SAND TO SANDY SILT	20.13	0.13	6	0.288	42%-50%	33-35	44.28	--	--	--	--
6	SILTY SAND TO SANDY SILT	25.43	0.119	8	0.345	42%-50%	33-35	55.94	--	--	--	--
7	SILTY SAND TO SANDY SILT	26.12	0.13	8	0.402	35-42%	33-35	57.46	--	--	--	--
8	SILTY SAND TO SANDY SILT	21.61	0.112	7	0.459	35-42%	31-33	47.54	--	--	--	--
9	SILTY SAND TO SANDY SILT	49.87	0.402	16	0.516	50%-58%	35-37	109.72	--	--	--	--
10	SILTY SAND TO SANDY SILT	34.61	0.334	11	0.573	35-42%	33-35	76.15	--	--	--	--
11	SILTY SAND TO SANDY SILT	30.15	0.162	10	0.63	35-42%	31-33	66.33	--	--	--	--
12	CLAYEY SILT TO SILTY CLAY	13.83	0.259	6	0.692	--	--	--	.87	5.3	.03	6
13	SILTY SAND TO SANDY SILT	26.76	0.322	8	0.749	35-42%	29-31	58.88	--	--	--	--
14	SAND	118.32	0.556	23	0.804	58%-65%	37-39	260.31	--	--	--	--
15	SAND	114.32	0.531	22	0.859	50%-58%	37-39	251.51	--	--	--	--
16	SAND TO SILTY SAND	61.45	0.256	15	0.916	42%-50%	33-35	135.2	--	--	--	--
17	SAND TO SILTY SAND	66.8	0.209	16	0.973	42%-50%	33-35	146.96	--	--	--	--
18	SAND TO SILTY SAND	61.57	0.22	15	1.03	42%-50%	33-35	135.46	--	--	--	--
19	SAND TO SILTY SAND	59.27	0.194	14	1.087	35-42%	33-35	130.4	--	--	--	--
20	SAND TO SILTY SAND	56.48	0.2	14	1.144	35-42%	31-33	124.27	--	--	--	--
21	SAND TO SILTY SAND	64.78	0.283	16	1.201	35-42%	31-33	142.52	--	--	--	--
22	SAND TO SILTY SAND	64.13	0.249	16	1.258	35-42%	31-33	141.09	--	--	--	--
23	SAND TO SILTY SAND	63.97	0.277	15	1.315	35-42%	31-33	140.75	--	--	--	--
24	SAND TO SILTY SAND	68.63	0.337	17	1.372	35-42%	31-33	150.99	--	--	--	--
25	SILTY SAND TO SANDY SILT	43.36	0.742	14	1.429	35-42%	29-31	95.39	--	--	--	--
26	SANDY SILT TO CLAYEY SILT	39.37	1.084	15	1.489	35-42%	27-29	86.61	--	--	--	--
27	CLAYEY SILT TO SILTY CLAY	24.57	0.79	12	1.551	--	--	--	1.53	3.1	.01	3
28	CLAYEY SILT TO SILTY CLAY	27.33	0.825	13	1.613	--	--	--	1.71	3.3	.01	6
29	SILTY SAND TO SANDY SILT	46.03	0.634	15	1.67	35-42%	29-31	101.26	--	--	--	--
30	SILTY SAND TO SANDY SILT	49.39	0.586	16	1.727	35-42%	29-31	108.66	--	--	--	--
31	SILTY SAND TO SANDY SILT	50.11	0.44	16	1.784	35-42%	29-31	110.25	--	--	--	--
32	SILTY SAND TO SANDY SILT	44.11	0.415	14	1.841	35-42%	27-29	97.06	--	--	--	--
33	SILTY SAND TO SANDY SILT	37.58	0.384	12	1.898	35-42%	25-27	82.67	--	--	--	--
34	SILTY SAND TO SANDY SILT	43.09	0.509	14	1.955	35-42%	27-29	94.81	--	--	--	--
35	SILTY SAND TO SANDY SILT	49.11	0.683	16	2.012	<35%	27-29	108.04	--	--	--	--
36	SILTY SAND TO SANDY SILT	43.63	0.727	14	2.069	<35%	27-29	95.98	--	--	--	--
37	SANDY SILT TO CLAYEY SILT	44.09	0.967	17	2.129	<35%	25-27	96.99	--	--	--	--
38	CLAYEY SILT TO SILTY CLAY	47.83	1.618	23	2.191	--	--	--	3.04	2.9	0	6
39	SILTY CLAY to CLAY	36.11	1.698	24	2.253	--	--	--	2.25	2.1	.01	3
40	CLAYEY SILT TO SILTY CLAY	36.43	1.188	18	2.315	--	--	--	2.27	3	0	3

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Blue Marlin Engineering
 Porter Transfer Station
 Sounding # CPT-1
 Test Date 7/25/2017 10:47:22 AM

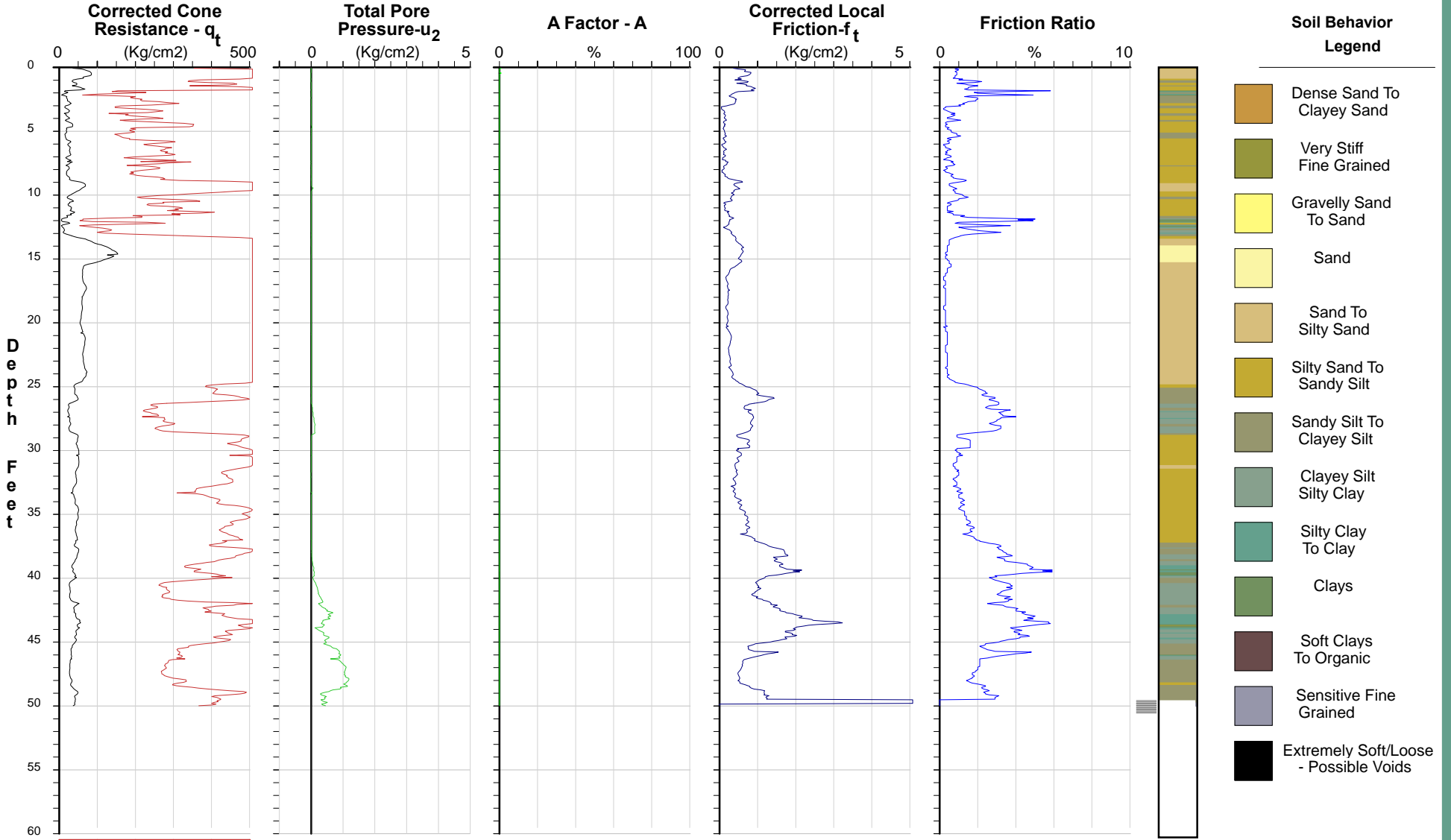
STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
41	CLAYEY SILT TO SILTY CLAY	27.79	0.963	13	2.377	--	--	--	1.69	2.8	.01	3
42	CLAYEY SILT TO SILTY CLAY	39.06	1.36	19	2.439	--	--	--	2.44	2.8	0	6
43	SILTY CLAY to CLAY	46.85	2.288	31	2.501	--	--	--	2.95	2	.01	6
44	CLAYEY SILT TO SILTY CLAY	46.52	2.002	23	2.563	--	--	--	2.93	2.3	0	6
45	SANDY SILT TO CLAYEY SILT	39.21	1.224	15	2.623	<35%	25-27	86.26	--	--	--	--
46	CLAYEY SILT TO SILTY CLAY	31.21	0.973	15	2.685	--	--	--	1.9	3.2	.01	3
47	SANDY SILT TO CLAYEY SILT	27.55	0.556	11	2.745	<35%	<25	60.61	--	--	--	--
48	SANDY SILT TO CLAYEY SILT	30.84	0.569	12	2.805	<35%	<25	67.86	--	--	--	--
49	SANDY SILT TO CLAYEY SILT	43.26	1.146	17	2.865	<35%	25-27	95.17	--	--	--	--
50	CLAYS	40.15	97.66	40	2.927	--	--	--	2.48	.8	.02	3
51	----- END OF SOUNDING -----	36.57										

insitu group

Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-1
Test Date 7/25/2017 10:47:22 AM

PIEZOCONE SOUNDING CPT-1



— Coarse Scale
 — Fine Scale

' = ' Push Interrupted To Add Rod
 Static Data May Be Available

insitu group

Blue Marlin Engineering
 Porter Transfer Station
 Sounding CPT-1
 Test Date 7/25/2017 10:47:22 AM
 A-10

STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
1	SANDY SILT TO CLAYEY SILT	19.33	0.327	7	0.06	42%-50%	39-41	42.53	--	--	--	--
2	SANDY SILT TO CLAYEY SILT	21.1	0.435	8	0.12	42%-50%	37-39	46.42	--	--	--	--
3	SANDY SILT TO CLAYEY SILT	29.63	0.639	11	0.18	50%-58%	37-39	65.18	--	--	--	--
4	CLAYEY SILT TO SILTY CLAY	18.22	0.446	9	0.242	--	--	--	1.19	4	.02	>6
5	CLAYEY SILT TO SILTY CLAY	11.61	0.284	5	0.304	--	--	--	.75	4	.04	6
6	SANDY SILT TO CLAYEY SILT	26.18	0.511	10	0.364	42%-50%	33-35	57.6	--	--	--	--
7	SANDY SILT TO CLAYEY SILT	25.2	0.447	10	0.424	35-42%	33-35	55.44	--	--	--	--
8	SAND TO SILTY SAND	60.24	0.463	15	0.481	50%-58%	35-37	132.52	--	--	--	--
9	SAND TO SILTY SAND	119.54	1.145	29	0.538	58%-65%	39-41	262.98	--	--	--	--
10	SAND TO SILTY SAND	85.96	0.506	21	0.595	50%-58%	37-39	189.11	--	--	--	--
11	SAND TO SILTY SAND	71.4	0.362	17	0.652	50%-58%	35-37	157.09	--	--	--	--
12	SAND TO SILTY SAND	78.84	0.427	19	0.709	50%-58%	35-37	173.45	--	--	--	--
13	SAND	112.86	0.689	22	0.764	50%-58%	37-39	248.3	--	--	--	--
14	SAND	157.57	0.747	31	0.819	58%-65%	37-39	346.65	--	--	--	--
15	SAND	181.31	0.831	36	0.874	65%-85%	39-41	398.89	--	--	--	--
16	SAND	155.9	0.784	31	0.929	58%-65%	37-39	342.99	--	--	--	--
17	SAND TO SILTY SAND	85.27	0.64	21	0.986	50%-58%	35-37	187.59	--	--	--	--
18	SAND TO SILTY SAND	80.18	0.339	20	1.043	50%-58%	33-35	176.41	--	--	--	--
19	SAND TO SILTY SAND	62.07	0.304	15	1.1	42%-50%	33-35	136.56	--	--	--	--
20	SAND TO SILTY SAND	57.06	0.199	14	1.157	35-42%	31-33	125.54	--	--	--	--
21	SAND TO SILTY SAND	57.78	0.219	14	1.214	35-42%	31-33	127.13	--	--	--	--
22	SAND TO SILTY SAND	61.61	0.256	15	1.271	35-42%	31-33	135.55	--	--	--	--
23	SAND TO SILTY SAND	63.46	0.278	15	1.328	35-42%	31-33	139.61	--	--	--	--
24	SAND TO SILTY SAND	63.67	0.23	15	1.385	35-42%	31-33	140.08	--	--	--	--
25	SAND TO SILTY SAND	50.68	0.245	12	1.442	35-42%	29-31	111.51	--	--	--	--
26	SANDY SILT TO CLAYEY SILT	22.66	0.527	9	1.502	35-42%	25-27	49.86	--	--	--	--
27	CLAYEY SILT TO SILTY CLAY	17.26	0.474	8	1.564	--	--	--	1.04	3.6	.02	3
28	CLAYEY SILT TO SILTY CLAY	16.55	0.532	8	1.626	--	--	--	.99	3.1	.03	3
29	SILTY CLAY to CLAY	16.72	0.645	11	1.688	--	--	--	1	2.5	.01	3
30	SANDY SILT TO CLAYEY SILT	26.5	0.691	10	1.748	35-42%	25-27	58.31	--	--	--	--
31	SANDY SILT TO CLAYEY SILT	25.62	0.342	10	1.808	35-42%	<25	56.36	--	--	--	--
32	SILTY SAND TO SANDY SILT	32.51	0.372	10	1.865	35-42%	25-27	71.53	--	--	--	--
33	SILTY SAND TO SANDY SILT	34.18	0.397	11	1.922	35-42%	25-27	75.21	--	--	--	--
34	SILTY SAND TO SANDY SILT	34.73	0.346	11	1.979	35-42%	25-27	76.41	--	--	--	--
35	SILTY SAND TO SANDY SILT	37.32	0.395	12	2.036	<35%	25-27	82.1	--	--	--	--
36	SILTY SAND TO SANDY SILT	35.03	0.544	11	2.093	<35%	25-27	77.08	--	--	--	--
37	SILTY SAND TO SANDY SILT	41.03	0.612	13	2.15	<35%	25-27	90.26	--	--	--	--
38	SILTY SAND TO SANDY SILT	60.14	1.192	20	2.207	<35%	29-31	132.31	--	--	--	--
39	SANDY SILT TO CLAYEY SILT	59.94	1.67	23	2.267	<35%	27-29	131.88	--	--	--	--
40	CLAYEY SILT TO SILTY CLAY	46.39	1.62	23	2.329	--	--	--	2.93	2.8	0	6

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Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-2
Test Date 7/25/2017 11:47:52 AM

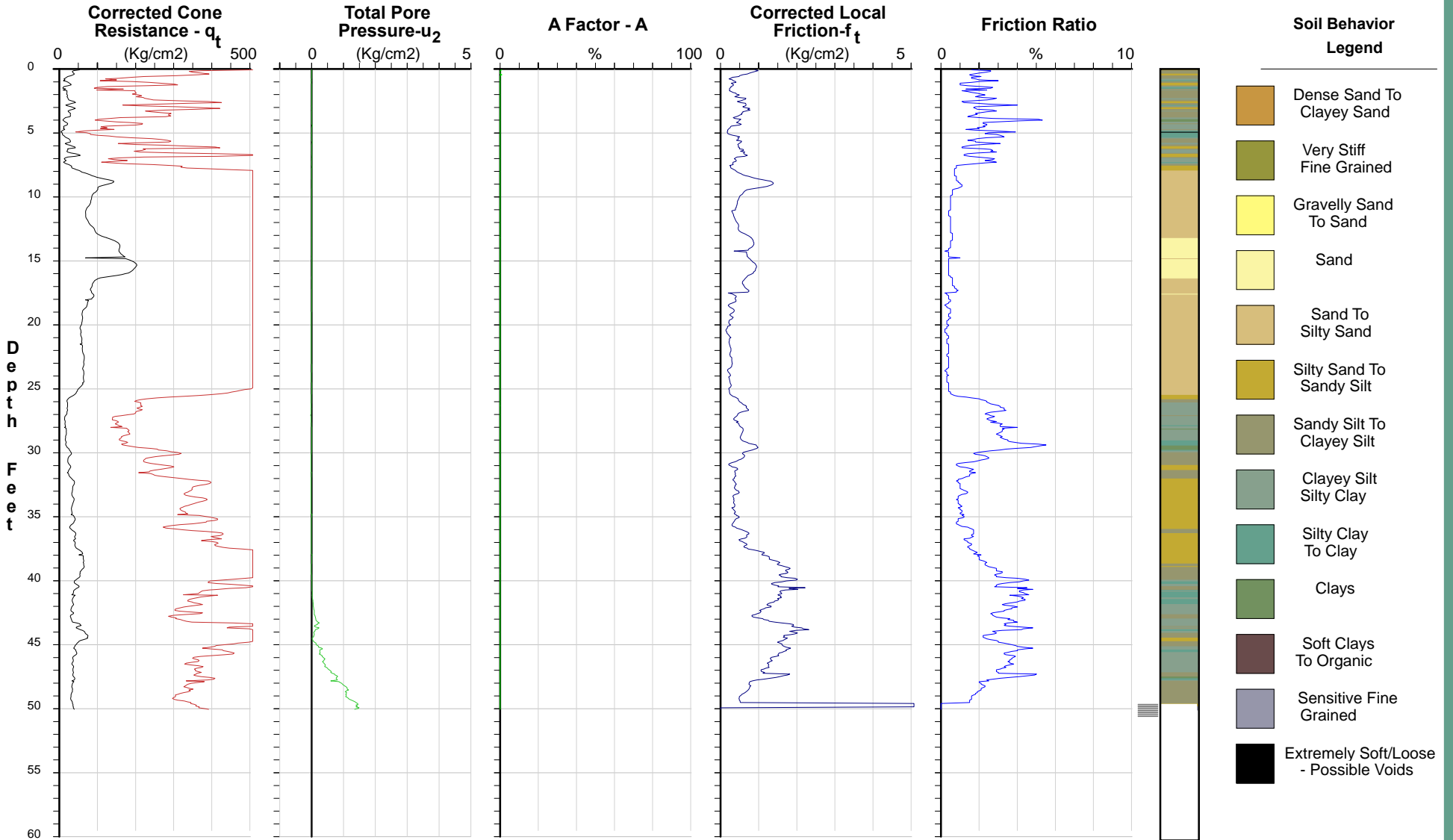
STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
41	SILTY CLAY to CLAY	37.71	1.612	25	2.391	--	--	--	2.35	2.3	.01	3
42	CLAYEY SILT TO SILTY CLAY	33.74	1.2	16	2.453	--	--	--	2.08	2.8	0	3
43	CLAYEY SILT TO SILTY CLAY	37.4	1.269	18	2.515	--	--	--	2.32	2.9	0	3
44	SANDY SILT TO CLAYEY SILT	63.62	1.91	25	2.575	<35%	27-29	139.97	--	--	--	--
45	CLAYEY SILT TO SILTY CLAY	45.58	1.652	22	2.637	--	--	--	2.86	2.7	0	6
46	CLAYEY SILT TO SILTY CLAY	38.47	1.394	19	2.699	--	--	--	2.38	2.7	0	3
47	CLAYEY SILT TO SILTY CLAY	36.06	1.303	18	2.761	--	--	--	2.21	2.7	0	3
48	SANDY SILT TO CLAYEY SILT	35.47	0.84	14	2.821	<35%	<25	78.04	--	--	--	--
49	SANDY SILT TO CLAYEY SILT	31.5	0.548	12	2.881	<35%	<25	69.31	--	--	--	--
50	CLAYS	36.38	97.66	36	2.943	--	--	--	2.22	.8	.02	3
51	----- END OF SOUNDING -----	39.07										

insitu group

Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-2
Test Date 7/25/2017 11:47:52 AM

PIEZOCONE SOUNDING CPT-2



— Coarse Scale
— Fine Scale

' = ' Push Interrupted To Add Rod
Static Data May Be Available

insitu group

Blue Marlin Engineering
Porter Transfer Station
Sounding CPT-2
Test Date 7/25/2017 11:47:52 AM
A-13

STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
1	SAND	194.82	0.958	38	0.055	>85%	>43	428.6	--	--	--	--
2	SAND	183.31	1.033	36	0.11	>85%	>43	403.28	--	--	--	--
3	SILTY SAND TO SANDY SILT	60.95	0.766	20	0.167	58%-65%	41-43	134.1	--	--	--	--
4	SANDY SILT TO CLAYEY SILT	33.5	0.842	13	0.227	50%-58%	37-39	73.7	--	--	--	--
5	SANDY SILT TO CLAYEY SILT	19.93	0.389	7	0.287	42%-50%	33-35	43.85	--	--	--	--
6	SILTY SAND TO SANDY SILT	50.89	0.582	16	0.344	50%-58%	37-39	111.97	--	--	--	--
7	SAND TO SILTY SAND	97.42	0.595	24	0.401	58%-65%	39-41	214.33	--	--	--	--
8	SAND TO SILTY SAND	66.16	0.365	16	0.458	50%-58%	37-39	145.56	--	--	--	--
9	SILTY SAND TO SANDY SILT	46.72	0.378	15	0.515	42%-50%	35-37	102.79	--	--	--	--
10	SANDY SILT TO CLAYEY SILT	21.25	0.405	8	0.575	35-42%	31-33	46.75	--	--	--	--
11	SAND TO SILTY SAND	75.75	0.505	18	0.632	50%-58%	35-37	166.65	--	--	--	--
12	SAND	157.57	1.112	31	0.687	65%-85%	39-41	346.66	--	--	--	--
13	SAND TO SILTY SAND	96.14	1.107	24	0.744	50%-58%	37-39	211.51	--	--	--	--
14	SAND	118.11	0.741	23	0.799	58%-65%	37-39	259.84	--	--	--	--
15	SAND	144.45	0.988	28	0.854	58%-65%	37-39	317.8	--	--	--	--
16	SAND	166.96	1.161	33	0.909	58%-65%	37-39	367.31	--	--	--	--
17	SAND	162.11	0.807	32	0.964	58%-65%	37-39	356.64	--	--	--	--
18	SAND	121.87	0.47	24	1.019	50%-58%	35-37	268.13	--	--	--	--
19	SAND TO SILTY SAND	72.83	0.554	18	1.076	42%-50%	33-35	160.22	--	--	--	--
20	SAND TO SILTY SAND	60.22	0.266	15	1.133	35-42%	31-33	132.48	--	--	--	--
21	SAND TO SILTY SAND	60.08	0.127	15	1.19	35-42%	31-33	132.18	--	--	--	--
22	SAND TO SILTY SAND	56.71	0.166	14	1.247	35-42%	31-33	124.76	--	--	--	--
23	SAND TO SILTY SAND	53.38	0.154	13	1.304	35-42%	31-33	117.44	--	--	--	--
24	SAND TO SILTY SAND	56.17	0.151	14	1.361	35-42%	31-33	123.58	--	--	--	--
25	SAND TO SILTY SAND	56.46	0.174	14	1.418	35-42%	31-33	124.23	--	--	--	--
26	SAND TO SILTY SAND	60.91	0.236	15	1.475	35-42%	31-33	134	--	--	--	--
27	SAND TO SILTY SAND	65.36	0.269	16	1.532	35-42%	31-33	143.8	--	--	--	--
28	SAND TO SILTY SAND	57.71	0.226	14	1.589	35-42%	31-33	126.97	--	--	--	--
29	CLAYEY SILT TO SILTY CLAY	27.39	0.76	13	1.651	--	--	--	1.71	3.6	.01	6
30	CLAYEY SILT TO SILTY CLAY	25.7	0.908	12	1.713	--	--	--	1.59	2.8	.01	3
31	CLAYEY SILT TO SILTY CLAY	19.87	0.489	9	1.775	--	--	--	1.2	4	.02	3
32	CLAYEY SILT TO SILTY CLAY	19.19	0.477	9	1.837	--	--	--	1.15	4	.02	3
33	SILTY CLAY to CLAY	32.71	1.579	21	1.899	--	--	--	2.05	2	.01	6
34	SILTY SAND TO SANDY SILT	68.33	1.327	22	1.956	35-42%	29-31	150.32	--	--	--	--
35	SILTY SAND TO SANDY SILT	49.45	0.934	16	2.013	<35%	27-29	108.8	--	--	--	--
36	SILTY SAND TO SANDY SILT	50.22	0.572	16	2.07	<35%	27-29	110.5	--	--	--	--
37	SAND TO SILTY SAND	61.33	0.582	15	2.127	<35%	29-31	134.93	--	--	--	--
38	SILTY SAND TO SANDY SILT	58.05	0.594	19	2.184	<35%	27-29	127.71	--	--	--	--
39	SAND TO SILTY SAND	75.77	0.832	18	2.241	<35%	29-31	166.71	--	--	--	--
40	SILTY SAND TO SANDY SILT	74.89	0.95	24	2.298	<35%	29-31	164.77	--	--	--	--

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Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-3A
Test Date 7/25/2017 1:57:52 PM

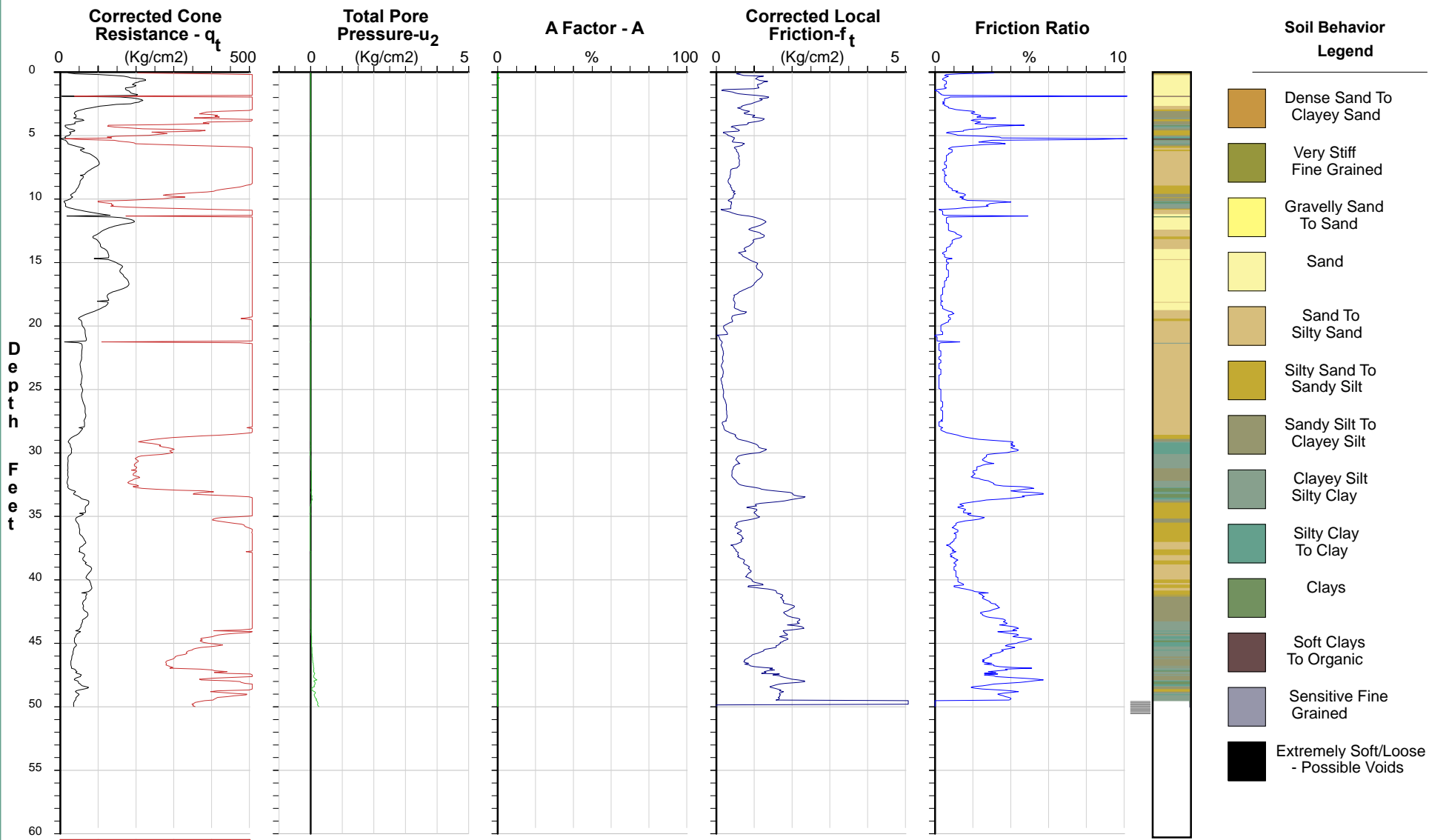
STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
41	SILTY SAND TO SANDY SILT	72.35	1.554	24	2.355	<35%	29-31	159.18	--	--	--	--
42	SANDY SILT TO CLAYEY SILT	61.24	1.89	24	2.415	<35%	27-29	134.74	--	--	--	--
43	SANDY SILT TO CLAYEY SILT	64.09	2.037	25	2.475	<35%	27-29	141.02	--	--	--	--
44	CLAYEY SILT TO SILTY CLAY	47.64	1.955	23	2.537	--	--	--	3	2.4	0	6
45	SILTY CLAY to CLAY	38.22	1.659	25	2.599	--	--	--	2.37	2.3	.01	3
46	CLAYEY SILT TO SILTY CLAY	31.05	0.934	15	2.661	--	--	--	1.89	3.3	.01	3
47	CLAYEY SILT TO SILTY CLAY	36.77	1.217	18	2.723	--	--	--	2.26	3	0	3
48	CLAYEY SILT TO SILTY CLAY	50.47	1.837	25	2.785	--	--	--	3.17	2.7	0	6
49	CLAYEY SILT TO SILTY CLAY	45.14	1.664	22	2.847	--	--	--	2.81	2.7	0	3
50	CLAYS	35.38	97.66	35	2.909	--	--	--	2.16	.8	.02	3
51	----- END OF SOUNDING -----	35.52										

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Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-3A
Test Date 7/25/2017 1:57:52 PM

PIEZOCONE SOUNDING CPT-3A



— Coarse Scale
 — Fine Scale

' = ' Push Interrupted To Add Rod
 Static Data May Be Available

insitu group

Blue Marlin Engineering
 Porter Transfer Station
 Sounding CPT-3A
 Test Date 7/25/2017 1:57:52 PM

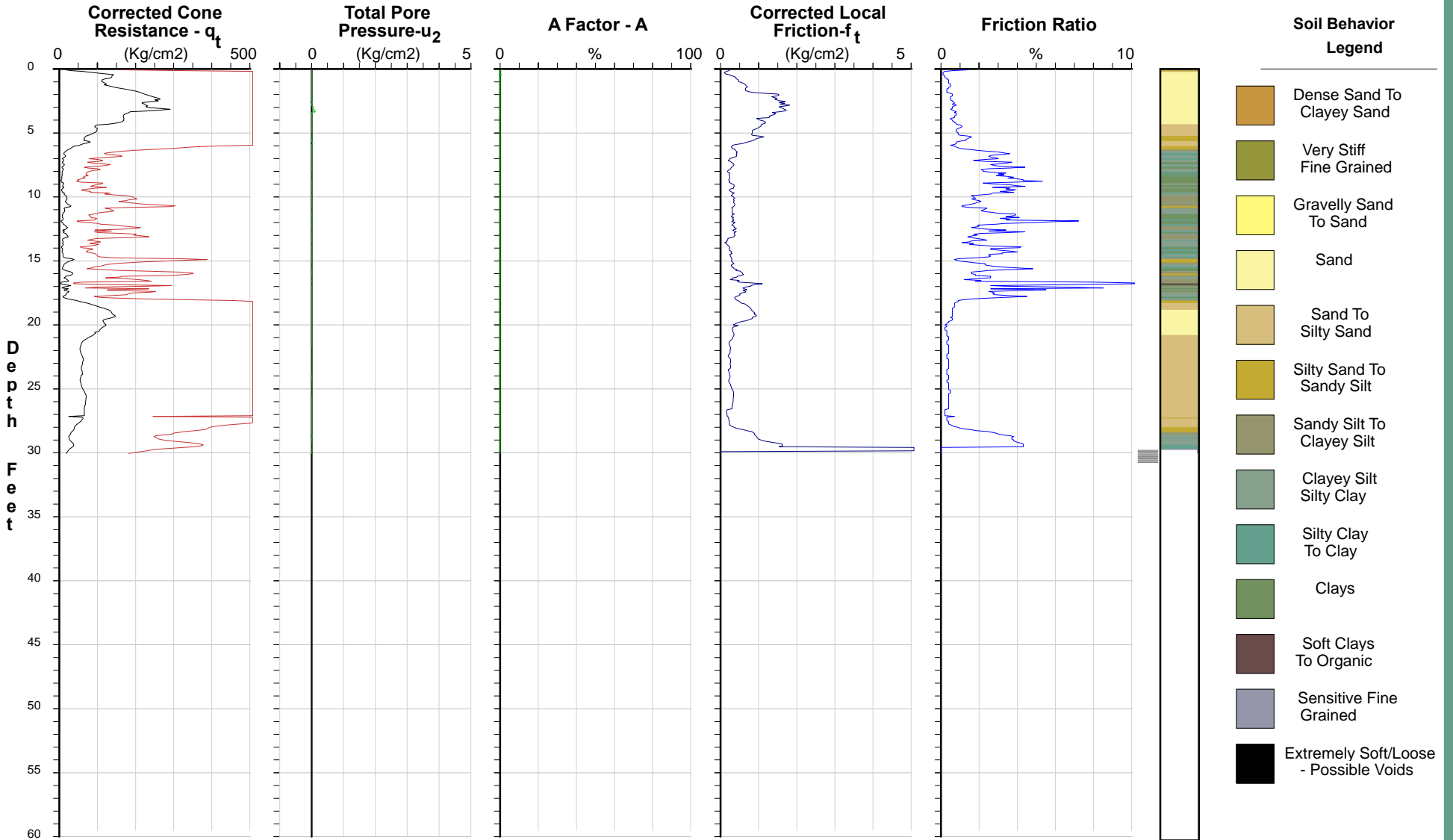
STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
1	SAND	127.63	0.522	25	0.055	>85%	>43	280.8	--	--	--	--
2	SAND	230.69	1.229	46	0.11	>85%	>43	507.53	--	--	--	--
3	SAND	225.83	1.599	45	0.165	>85%	>43	496.84	--	--	--	--
4	SAND	151.57	1.138	30	0.22	>85%	>43	333.45	--	--	--	--
5	SAND TO SILTY SAND	85.22	0.908	21	0.277	58%-65%	39-41	187.48	--	--	--	--
6	SILTY SAND TO SANDY SILT	45.19	0.471	15	0.334	50%-58%	37-39	99.43	--	--	--	--
7	CLAYEY SILT TO SILTY CLAY	11.5	0.324	5	0.396	--	--	--	.74	3.5	.04	6
8	SILTY CLAY to CLAY	7.89	0.236	5	0.458	--	--	--	.49	3.3	.03	6
9	CLAYS	7.84	0.279	7	0.52	--	--	--	.48	2.8	.03	3
10	CLAYEY SILT TO SILTY CLAY	15.96	0.329	7	0.582	--	--	--	1.02	4.8	.03	6
11	CLAYEY SILT TO SILTY CLAY	15.39	0.317	7	0.644	--	--	--	.98	4.8	.03	6
12	CLAYEY SILT TO SILTY CLAY	11.83	0.337	5	0.706	--	--	--	.74	3.5	.04	6
13	CLAYEY SILT TO SILTY CLAY	13.9	0.301	6	0.768	--	--	--	.87	4.6	.03	6
14	SILTY CLAY to CLAY	8.14	0.221	5	0.83	--	--	--	.48	3.6	.03	3
15	SANDY SILT TO CLAYEY SILT	18.82	0.293	7	0.89	35-42%	27-29	41.4	--	--	--	--
16	SANDY SILT TO CLAYEY SILT	21.64	0.447	8	0.95	35-42%	27-29	47.6	--	--	--	--
17	CLAYS	15.59	0.694	15	1.012	--	--	--	.97	2.2	.01	3
18	SILTY SAND TO SANDY SILT	42.38	0.495	14	1.069	35-42%	31-33	93.25	--	--	--	--
19	SAND	132.79	0.847	26	1.124	50%-58%	35-37	292.14	--	--	--	--
20	SAND	114.13	0.423	22	1.179	50%-58%	35-37	251.09	--	--	--	--
21	SAND TO SILTY SAND	75.61	0.297	18	1.236	42%-50%	33-35	166.36	--	--	--	--
22	SAND TO SILTY SAND	56.28	0.238	14	1.293	35-42%	31-33	123.82	--	--	--	--
23	SAND TO SILTY SAND	60.12	0.252	15	1.35	35-42%	31-33	132.27	--	--	--	--
24	SAND TO SILTY SAND	57.24	0.227	14	1.407	35-42%	31-33	125.92	--	--	--	--
25	SAND TO SILTY SAND	62.22	0.3	15	1.464	35-42%	31-33	136.9	--	--	--	--
26	SAND TO SILTY SAND	68.26	0.32	17	1.521	35-42%	31-33	150.19	--	--	--	--
27	SAND TO SILTY SAND	60.53	0.18	15	1.578	35-42%	31-33	133.17	--	--	--	--
28	SILTY SAND TO SANDY SILT	40.09	0.471	13	1.635	35-42%	27-29	88.2	--	--	--	--
29	CLAYEY SILT TO SILTY CLAY	30.18	1.199	15	1.697	--	--	--	1.89	2.5	.01	6
30	CLAYS	24.18	97.66	24	1.759	--	--	--	1.49	.8	.04	3
31	----- END OF SOUNDING -----	18.18										

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Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-4
Test Date 7/24/2017 11:19:41 AM

PIEZOCONE SOUNDING CPT-4



Depth
Feet

0 — Coarse Scale
— Fine Scale

' = ' Push Interrupted To Add Rod
Static Data May Be Available

insitu group

Blue Marlin Engineering
Porter Transfer Station
Sounding CPT-4
Test Date 7/24/2017 11:19:41 AM
A-18

STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
1	SAND	120.65	0.452	24	0.055	>85%	>43	265.43	--	--	--	--
2	SILTY SAND TO SANDY SILT	49.59	0.624	16	0.112	50%-58%	41-43	109.11	--	--	--	--
3	SILTY SAND TO SANDY SILT	51.08	0.644	17	0.169	50%-58%	39-41	112.38	--	--	--	--
4	CLAYEY SILT TO SILTY CLAY	18.93	0.44	9	0.231	--	--	--	1.24	4.3	.02	>6
5	SILTY SAND TO SANDY SILT	38.11	0.471	12	0.288	50%-58%	37-39	83.84	--	--	--	--
6	SANDY SILT TO CLAYEY SILT	19.26	0.4	7	0.348	35-42%	33-35	42.38	--	--	--	--
7	CLAYEY SILT TO SILTY CLAY	13.58	0.25	6	0.41	--	--	--	.87	5.4	.03	6
8	SANDY SILT TO CLAYEY SILT	20.13	0.368	8	0.47	35-42%	31-33	44.3	--	--	--	--
9	SANDY SILT TO CLAYEY SILT	26.08	0.472	10	0.53	35-42%	31-33	57.38	--	--	--	--
10	SANDY SILT TO CLAYEY SILT	25.25	0.36	10	0.59	35-42%	31-33	55.56	--	--	--	--
11	SANDY SILT TO CLAYEY SILT	24.36	0.595	9	0.65	35-42%	31-33	53.59	--	--	--	--
12	CLAYEY SILT TO SILTY CLAY	24.37	0.677	12	0.712	--	--	--	1.57	3.5	.01	6
13	CLAYEY SILT TO SILTY CLAY	16.84	0.359	8	0.774	--	--	--	1.07	4.6	.02	6
14	SANDY SILT TO CLAYEY SILT	16.5	0.313	6	0.834	35-42%	25-27	36.3	--	--	--	--
15	SANDY SILT TO CLAYEY SILT	17.45	0.218	6	0.894	35-42%	25-27	38.4	--	--	--	--
16	SILTY CLAY to CLAY	10.16	0.33	6	0.956	--	--	--	.61	3	.02	3
17	SILTY SAND TO SANDY SILT	30.82	0.329	10	1.013	35-42%	29-31	67.81	--	--	--	--
18	SILTY SAND TO SANDY SILT	44.9	0.698	14	1.07	35-42%	31-33	98.78	--	--	--	--
19	SAND TO SILTY SAND	68.48	0.32	17	1.127	42%-50%	33-35	150.66	--	--	--	--
20	SAND TO SILTY SAND	60.58	0.254	15	1.184	35-42%	31-33	133.27	--	--	--	--
21	SAND TO SILTY SAND	57.08	0.284	14	1.241	35-42%	31-33	125.58	--	--	--	--
22	SAND TO SILTY SAND	60.07	0.294	15	1.298	35-42%	31-33	132.16	--	--	--	--
23	SAND TO SILTY SAND	58.81	0.29	14	1.355	35-42%	31-33	129.39	--	--	--	--
24	SAND TO SILTY SAND	61.24	0.31	15	1.412	35-42%	31-33	134.72	--	--	--	--
25	SAND TO SILTY SAND	64.25	0.322	16	1.469	35-42%	31-33	141.36	--	--	--	--
26	SAND TO SILTY SAND	63.18	0.302	15	1.526	35-42%	31-33	139	--	--	--	--
27	SILTY SAND TO SANDY SILT	45.1	0.34	15	1.583	35-42%	29-31	99.23	--	--	--	--
28	SILTY CLAY to CLAY	21.45	0.803	14	1.645	--	--	--	1.32	2.6	.02	3
29	SILTY CLAY to CLAY	17.05	0.643	11	1.707	--	--	--	1.02	2.6	.01	3
30	SILTY CLAY to CLAY	17.59	0.618	11	1.769	--	--	--	1.05	2.8	.01	3
31	SILTY CLAY to CLAY	14.77	0.591	9	1.831	--	--	--	.86	2.4	.01	1-1.5
32	CLAYEY SILT TO SILTY CLAY	18.18	0.518	9	1.893	--	--	--	1.08	3.5	.02	3
33	CLAYEY SILT TO SILTY CLAY	23.79	0.635	11	1.955	--	--	--	1.45	3.7	.01	3
34	SILTY SAND TO SANDY SILT	36.74	0.53	12	2.012	<35%	25-27	80.82	--	--	--	--
35	SILTY SAND TO SANDY SILT	45.38	0.419	15	2.069	<35%	27-29	99.84	--	--	--	--
36	SILTY SAND TO SANDY SILT	51.4	0.468	17	2.126	<35%	27-29	113.08	--	--	--	--
37	SILTY SAND TO SANDY SILT	45.25	0.365	15	2.183	<35%	25-27	99.56	--	--	--	--
38	SILTY SAND TO SANDY SILT	37.96	0.434	12	2.24	<35%	25-27	83.51	--	--	--	--
39	SILTY SAND TO SANDY SILT	54.24	0.866	18	2.297	<35%	27-29	119.33	--	--	--	--
40	SILTY SAND TO SANDY SILT	67.33	1.527	22	2.354	<35%	29-31	148.14	--	--	--	--

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Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-5A
Test Date 7/24/2017 12:09:21 PM

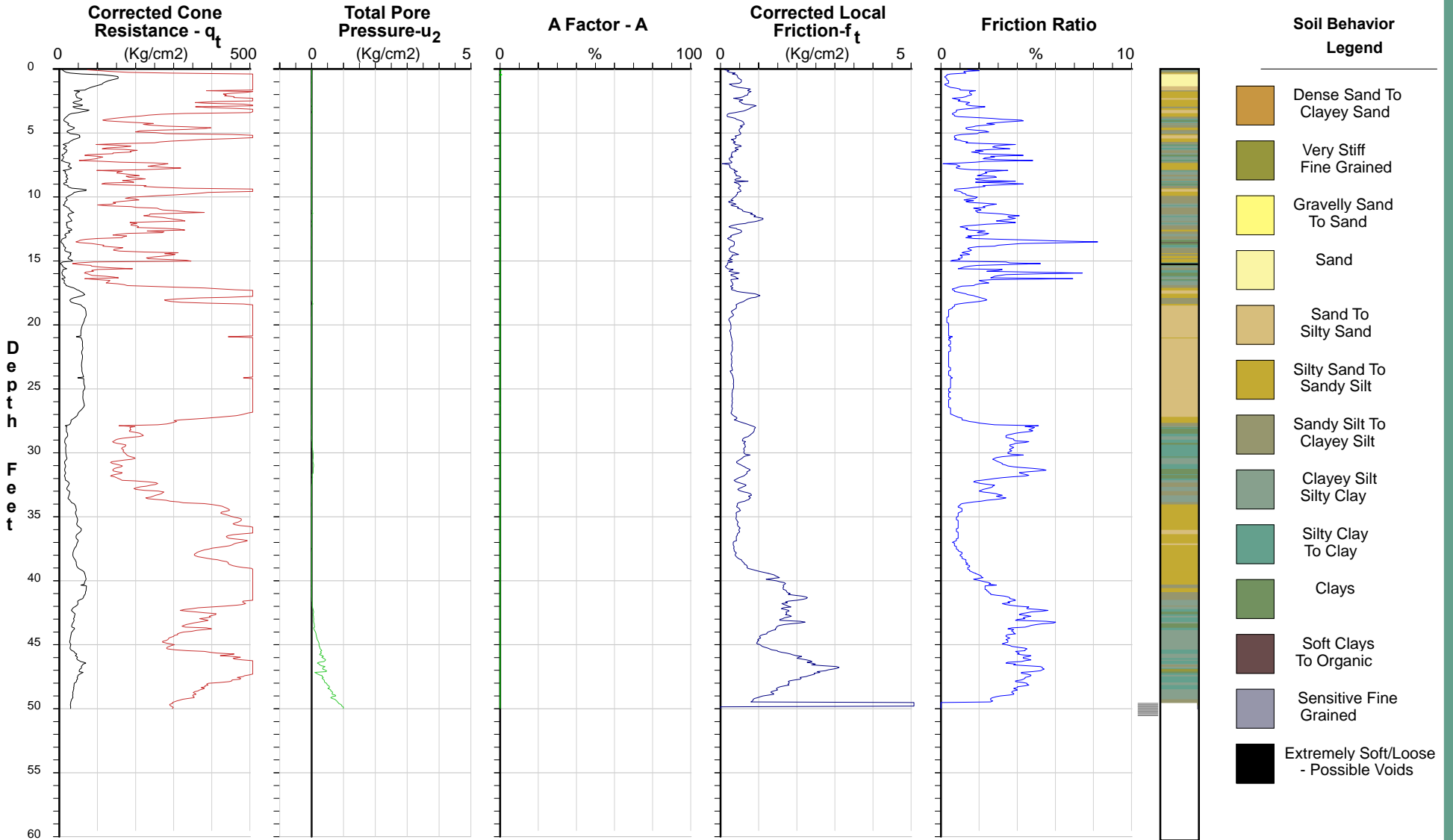
STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
41	SANDY SILT TO CLAYEY SILT	66.11	1.907	26	2.414	<35%	29-31	145.44	--	--	--	--
42	CLAYEY SILT TO SILTY CLAY	40.86	1.714	20	2.476	--	--	--	2.55	2.3	0	6
43	SILTY CLAY to CLAY	37.19	1.779	24	2.538	--	--	--	2.31	2	.01	3
44	CLAYEY SILT TO SILTY CLAY	33.09	1.239	16	2.6	--	--	--	2.03	2.6	.01	3
45	CLAYEY SILT TO SILTY CLAY	28.86	1.104	14	2.662	--	--	--	1.74	2.6	.01	3
46	CLAYEY SILT TO SILTY CLAY	48.94	2.064	24	2.724	--	--	--	3.08	2.3	0	6
47	SILTY CLAY to CLAY	54.82	2.646	36	2.786	--	--	--	3.46	2	.01	6
48	SILTY CLAY to CLAY	41.18	1.75	27	2.848	--	--	--	2.55	2.3	.01	3
49	CLAYEY SILT TO SILTY CLAY	34.03	1.1	17	2.91	--	--	--	2.07	3	0	3
50	CLAYS	29.37	97.66	29	2.972	--	--	--	1.76	.8	.03	3
51	----- END OF SOUNDING -----	29.55										

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Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-5A
Test Date 7/24/2017 12:09:21 PM

PIEZOCONE SOUNDING CPT-5A



Depth Feet

0 — Coarse Scale
 — Fine Scale

' = ' Push Interrupted To Add Rod
 Static Data May Be Available

insitu group

Blue Marlin Engineering
 Porter Transfer Station
 Sounding CPT-5A
 Test Date 7/24/2017 12:09:21 PM

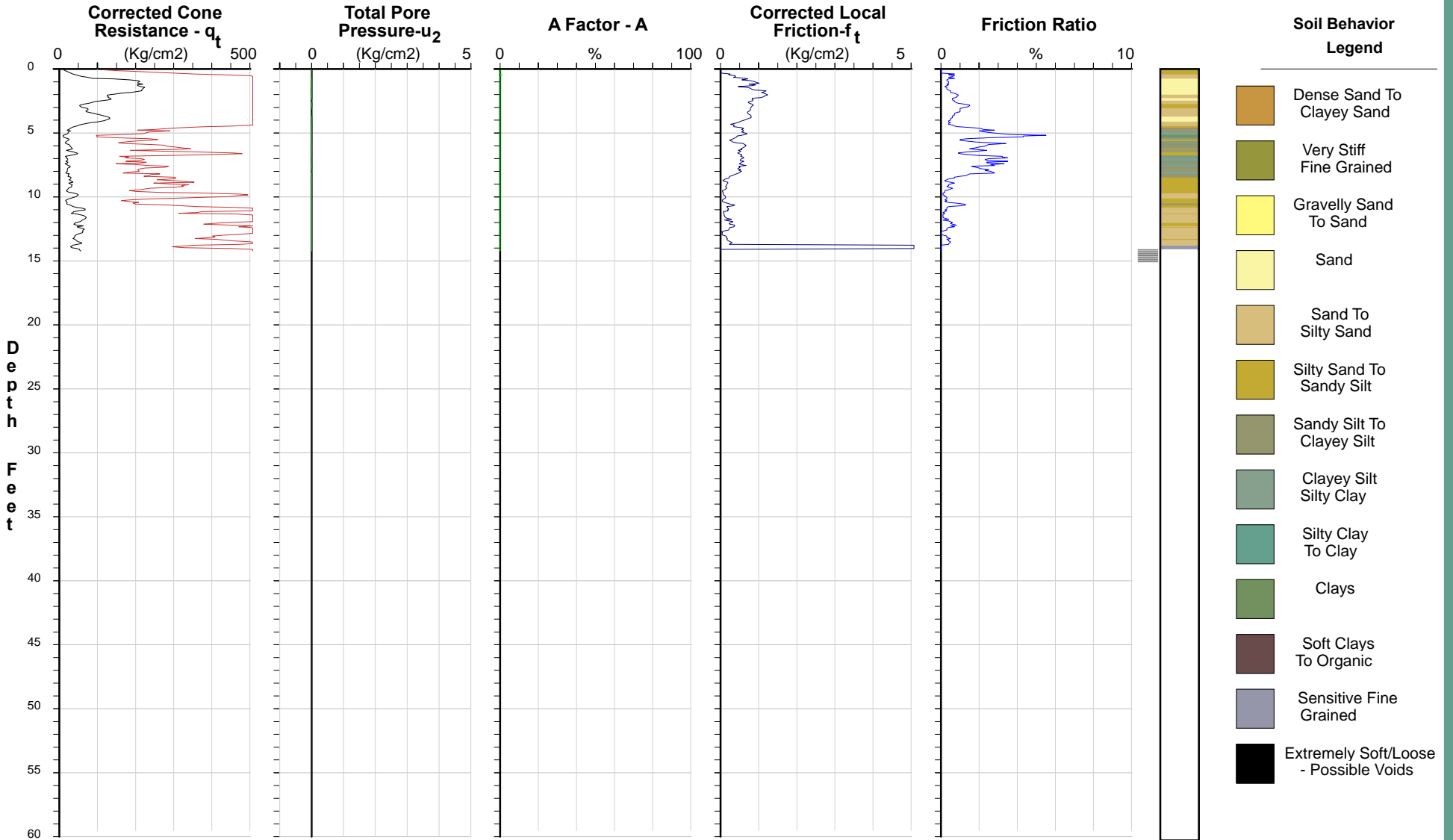
STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
1	SAND	169.35	0.688	33	0.055	>85%	>43	372.58	--	--	--	--
2	SAND	152.93	1.038	30	0.11	>85%	>43	336.45	--	--	--	--
3	SAND TO SILTY SAND	70.39	0.771	17	0.167	58%-65%	41-43	154.86	--	--	--	--
4	SAND TO SILTY SAND	99.4	0.573	24	0.224	58%-65%	41-43	218.68	--	--	--	--
5	CLAYEY SILT TO SILTY CLAY	20.5	0.537	10	0.286	--	--	--	1.34	3.8	.01	>6
6	SANDY SILT TO CLAYEY SILT	25.46	0.505	10	0.346	42%-50%	33-35	56.03	--	--	--	--
7	SANDY SILT TO CLAYEY SILT	23.48	0.543	9	0.406	35-42%	33-35	51.65	--	--	--	--
8	SANDY SILT TO CLAYEY SILT	23.07	0.427	9	0.466	35-42%	31-33	50.76	--	--	--	--
9	SILTY SAND TO SANDY SILT	28.61	0.134	9	0.523	35-42%	33-35	62.94	--	--	--	--
10	SILTY SAND TO SANDY SILT	30.41	0.088	10	0.58	35-42%	31-33	66.9	--	--	--	--
11	SAND TO SILTY SAND	47.27	0.167	11	0.637	42%-50%	33-35	103.99	--	--	--	--
12	SAND TO SILTY SAND	54.52	0.252	13	0.694	42%-50%	33-35	119.95	--	--	--	--
13	SAND TO SILTY SAND	48.34	0.118	12	0.751	42%-50%	33-35	106.36	--	--	--	--
14	CLAYS	45.51	61.136	45	0.813	--	--	--	2.98	.8	.02	6
15	----- END OF SOUNDING -----	56.27										

insitu group

Blue Marlin Engineering
 Porter Transfer Station
 Sounding # CPT-6
 Test Date 7/24/2017 1:02:12 PM

PIEZOCONE SOUNDING CPT-6



Depth Feet

0 — Coarse Scale
 — Fine Scale

' = ' Push Interrupted To Add Rod
 Static Data May Be Available

insitu group

Blue Marlin Engineering
 Porter Transfer Station
 Sounding CPT-6
 Test Date 7/24/2017 1:02:12 PM
 A-23

STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
1	SAND TO SILTY SAND	74.65	0.57	18	0.057	58%-65%	>43	164.24	--	--	--	--
2	SAND TO SILTY SAND	118.84	1.081	29	0.114	>85%	>43	261.45	--	--	--	--
3	SILTY SAND TO SANDY SILT	61.55	0.799	20	0.171	58%-65%	41-43	135.41	--	--	--	--
4	SILTY SAND TO SANDY SILT	37.62	0.612	12	0.228	50%-58%	37-39	82.76	--	--	--	--
5	SANDY SILT TO CLAYEY SILT	22.91	0.406	9	0.288	42%-50%	33-35	50.41	--	--	--	--
6	SANDY SILT TO CLAYEY SILT	17.44	0.364	6	0.348	35-42%	31-33	38.37	--	--	--	--
7	CLAYEY SILT TO SILTY CLAY	16.02	0.464	8	0.41	--	--	--	1.04	3.4	.03	6
8	SANDY SILT TO CLAYEY SILT	16.34	0.327	6	0.47	35-42%	29-31	35.95	--	--	--	--
9	CLAYEY SILT TO SILTY CLAY	16.74	0.393	8	0.532	--	--	--	1.08	4.2	.02	6
10	SILTY CLAY to CLAY	11.07	0.349	7	0.594	--	--	--	.69	3.1	.02	6
11	SILTY SAND TO SANDY SILT	67.11	0.901	22	0.651	50%-58%	35-37	147.65	--	--	--	--
12	SILTY SAND TO SANDY SILT	43.83	0.7	14	0.708	35-42%	33-35	96.42	--	--	--	--
13	SANDY SILT TO CLAYEY SILT	38.1	0.709	15	0.768	35-42%	31-33	83.82	--	--	--	--
14	SANDY SILT TO CLAYEY SILT	30.04	0.532	12	0.828	35-42%	31-33	66.08	--	--	--	--
15	SILTY SAND TO SANDY SILT	57.28	0.748	19	0.885	42%-50%	33-35	126.02	--	--	--	--
16	SAND TO SILTY SAND	82.37	0.532	20	0.942	50%-58%	35-37	181.21	--	--	--	--
17	SAND TO SILTY SAND	67.83	0.382	16	0.999	42%-50%	33-35	149.24	--	--	--	--
18	SAND TO SILTY SAND	53.85	0.367	13	1.056	35-42%	31-33	118.48	--	--	--	--
19	SAND TO SILTY SAND	66.07	0.333	16	1.113	42%-50%	33-35	145.36	--	--	--	--
20	SAND TO SILTY SAND	67.19	0.265	16	1.17	42%-50%	33-35	147.83	--	--	--	--
21	SAND TO SILTY SAND	60.27	0.256	15	1.227	35-42%	31-33	132.6	--	--	--	--
22	SAND TO SILTY SAND	57.89	0.265	14	1.284	35-42%	31-33	127.36	--	--	--	--
23	SAND TO SILTY SAND	59.27	0.265	14	1.341	35-42%	31-33	130.4	--	--	--	--
24	SAND TO SILTY SAND	63.8	0.28	15	1.398	35-42%	31-33	140.36	--	--	--	--
25	SAND TO SILTY SAND	60.88	0.31	15	1.455	35-42%	31-33	133.94	--	--	--	--
26	SAND TO SILTY SAND	61.77	0.343	15	1.512	35-42%	31-33	135.91	--	--	--	--
27	SILTY SAND TO SANDY SILT	44.55	0.35	14	1.569	35-42%	29-31	98.02	--	--	--	--
28	CLAYS	21.12	0.993	21	1.631	--	--	--	1.29	2.1	.04	3
29	SILTY CLAY to CLAY	19.2	0.753	12	1.693	--	--	--	1.16	2.5	.01	3
30	SILTY CLAY to CLAY	18.14	0.654	12	1.755	--	--	--	1.09	2.7	.01	3
31	SILTY CLAY to CLAY	16.69	0.608	11	1.817	--	--	--	.99	2.7	.01	3
32	SANDY SILT TO CLAYEY SILT	25.77	0.524	10	1.877	35-42%	<25	56.7	--	--	--	--
33	SILTY SAND TO SANDY SILT	28.94	0.288	9	1.934	35-42%	25-27	63.68	--	--	--	--
34	SANDY SILT TO CLAYEY SILT	21.7	0.308	8	1.994	35-42%	<25	47.74	--	--	--	--
35	SILTY SAND TO SANDY SILT	22.2	0.234	7	2.051	<35%	<25	48.86	--	--	--	--
36	SILTY SAND TO SANDY SILT	32.57	0.27	10	2.108	<35%	25-27	71.65	--	--	--	--
37	SILTY SAND TO SANDY SILT	31.47	0.254	10	2.165	<35%	25-27	69.23	--	--	--	--
38	SILTY SAND TO SANDY SILT	37.7	0.424	12	2.222	<35%	25-27	82.95	--	--	--	--
39	SILTY SAND TO SANDY SILT	58.29	1.057	19	2.279	<35%	27-29	128.25	--	--	--	--
40	CLAYEY SILT TO SILTY CLAY	52.8	1.949	26	2.341	--	--	--	3.36	2.7	0	6

insitu group

Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-6A
Test Date 7/24/2017 1:24:33 PM

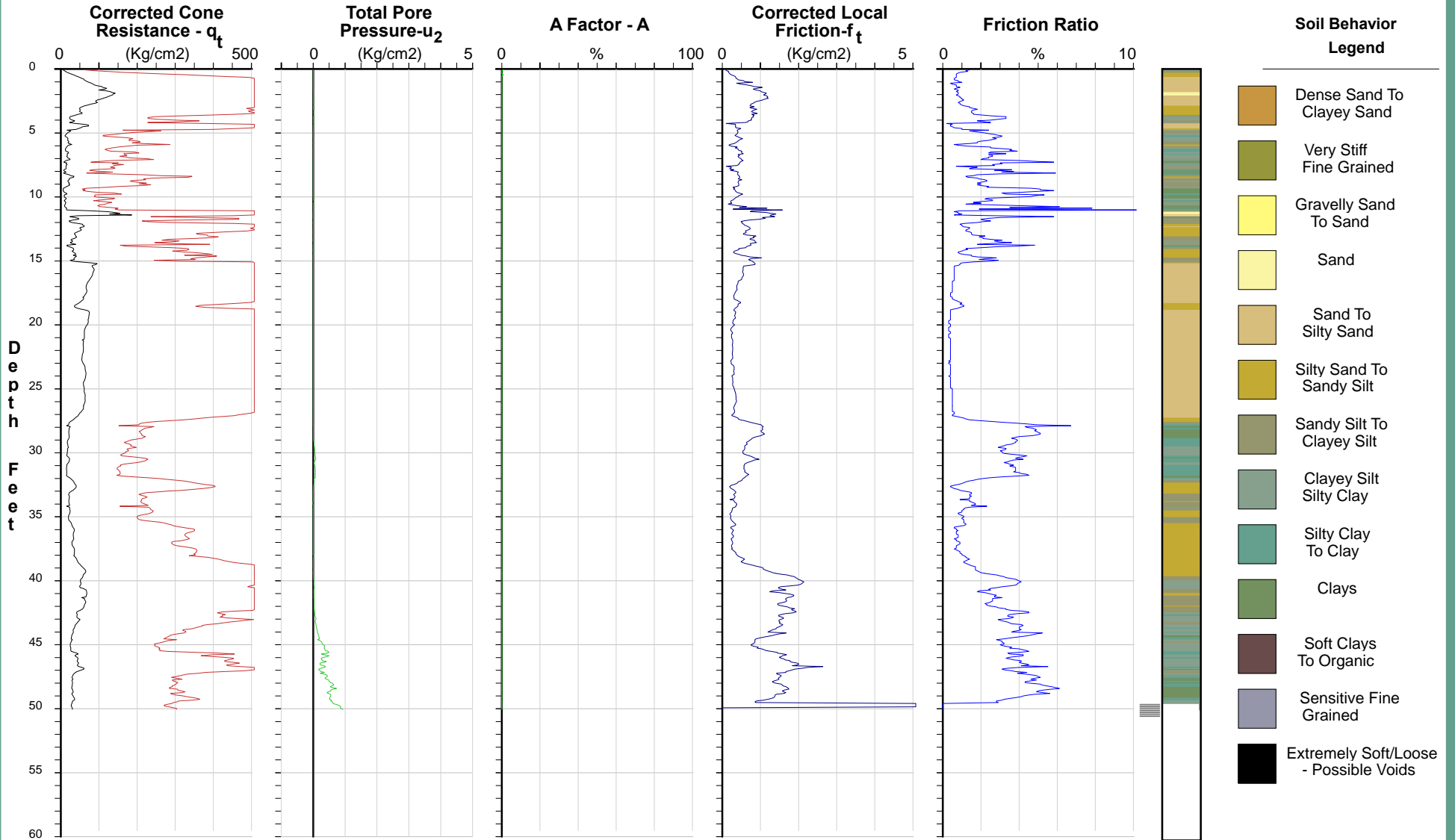
STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
41	SANDY SILT TO CLAYEY SILT	64.35	1.627	25	2.401	<35%	27-29	141.57	--	--	--	--
42	SANDY SILT TO CLAYEY SILT	56.71	1.701	22	2.461	<35%	27-29	124.76	--	--	--	--
43	CLAYEY SILT TO SILTY CLAY	43.31	1.525	21	2.523	--	--	--	2.71	2.8	0	6
44	SILTY CLAY to CLAY	31.3	1.315	20	2.585	--	--	--	1.91	2.3	.01	3
45	CLAYEY SILT TO SILTY CLAY	26.08	0.892	13	2.647	--	--	--	1.56	2.9	.01	3
46	CLAYEY SILT TO SILTY CLAY	42.19	1.633	21	2.709	--	--	--	2.63	2.5	0	3
47	CLAYEY SILT TO SILTY CLAY	43.79	1.799	21	2.771	--	--	--	2.73	2.4	0	3
48	CLAYS	29.75	1.523	29	2.833	--	--	--	1.79	1.9	.03	3
49	SILTY CLAY to CLAY	32.2	1.328	21	2.895	--	--	--	1.95	2.4	.01	3
50	CLAYS	28.64	97.66	28	2.957	--	--	--	1.71	.8	.03	3
51	----- END OF SOUNDING -----	30.2										

insitu group

Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-6A
Test Date 7/24/2017 1:24:33 PM

PIEZOCONE SOUNDING CPT-6A



— Coarse Scale
 — Fine Scale

' = ' Push Interrupted To Add Rod
 Static Data May Be Available

insitu group

Blue Marlin Engineering
 Porter Transfer Station
 Sounding CPT-6A
 Test Date 7/24/2017 1:24:33 PM
 A-26

STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
1	SAND TO SILTY SAND	79.81	0.765	19	0.057	58%-65%	>43	175.58	--	--	--	--
2	SANDY SILT TO CLAYEY SILT	20.74	0.417	8	0.117	42%-50%	37-39	45.63	--	--	--	--
3	SANDY SILT TO CLAYEY SILT	29.64	0.464	11	0.177	50%-58%	37-39	65.21	--	--	--	--
4	SILTY SAND TO SANDY SILT	37.11	0.461	12	0.234	50%-58%	37-39	81.66	--	--	--	--
5	SILTY SAND TO SANDY SILT	26.74	0.287	8	0.291	42%-50%	35-37	58.83	--	--	--	--
6	SILTY SAND TO SANDY SILT	40.54	0.198	13	0.348	50%-58%	35-37	89.19	--	--	--	--
7	SILTY SAND TO SANDY SILT	40.16	0.185	13	0.405	50%-58%	35-37	88.35	--	--	--	--
8	SILTY SAND TO SANDY SILT	35.23	0.208	11	0.462	42%-50%	33-35	77.52	--	--	--	--
9	SILTY SAND TO SANDY SILT	29.43	0.291	9	0.519	35-42%	33-35	64.76	--	--	--	--
10	SILTY SAND TO SANDY SILT	31.5	0.414	10	0.576	35-42%	33-35	69.3	--	--	--	--
11	SAND	133.73	1.003	26	0.631	58%-65%	39-41	294.21	--	--	--	--
12	SANDY SILT TO CLAYEY SILT	40.31	1.021	16	0.691	35-42%	33-35	88.69	--	--	--	--
13	SAND TO SILTY SAND	65.14	0.43	16	0.748	50%-58%	35-37	143.31	--	--	--	--
14	SAND TO SILTY SAND	80.84	0.386	20	0.805	50%-58%	35-37	177.86	--	--	--	--
15	SAND TO SILTY SAND	82.04	0.398	20	0.862	50%-58%	35-37	180.49	--	--	--	--
16	SAND TO SILTY SAND	92.84	0.44	23	0.919	50%-58%	35-37	204.24	--	--	--	--
17	SAND	125.26	0.567	25	0.974	50%-58%	37-39	275.58	--	--	--	--
18	SAND	156.1	0.657	31	1.029	58%-65%	37-39	343.43	--	--	--	--
19	SAND	102.78	0.428	20	1.084	50%-58%	35-37	226.11	--	--	--	--
20	SAND TO SILTY SAND	64.26	0.217	16	1.141	42%-50%	33-35	141.39	--	--	--	--
21	SAND TO SILTY SAND	59.53	0.187	14	1.198	35-42%	31-33	130.97	--	--	--	--
22	SAND TO SILTY SAND	55.28	0.197	13	1.255	35-42%	31-33	121.62	--	--	--	--
23	SAND TO SILTY SAND	52.93	0.172	13	1.312	35-42%	31-33	116.46	--	--	--	--
24	SAND TO SILTY SAND	56.05	0.207	14	1.369	35-42%	31-33	123.31	--	--	--	--
25	SAND TO SILTY SAND	62.44	0.266	15	1.426	35-42%	31-33	137.37	--	--	--	--
26	SAND TO SILTY SAND	60.79	0.25	15	1.483	35-42%	31-33	133.74	--	--	--	--
27	SAND TO SILTY SAND	63.62	0.287	15	1.54	35-42%	31-33	139.98	--	--	--	--
28	SILTY SAND TO SANDY SILT	46.31	0.383	15	1.597	35-42%	29-31	101.89	--	--	--	--
29	SANDY SILT TO CLAYEY SILT	36.51	0.826	14	1.657	35-42%	27-29	80.33	--	--	--	--
30	CLAYEY SILT TO SILTY CLAY	18.73	0.587	9	1.719	--	--	--	1.13	3.1	.02	3
31	CLAYEY SILT TO SILTY CLAY	19.42	0.603	9	1.781	--	--	--	1.17	3.2	.02	3
32	SANDY SILT TO CLAYEY SILT	36.26	0.706	14	1.841	35-42%	25-27	79.79	--	--	--	--
33	SAND TO SILTY SAND	83.14	1.06	20	1.898	35-42%	31-33	182.9	--	--	--	--
34	SILTY SAND TO SANDY SILT	57.51	0.882	19	1.955	35-42%	29-31	126.54	--	--	--	--
35	SILTY SAND TO SANDY SILT	60.08	0.872	20	2.012	<35%	29-31	132.19	--	--	--	--
36	SILTY SAND TO SANDY SILT	55.18	0.546	18	2.069	<35%	27-29	121.4	--	--	--	--
37	SILTY SAND TO SANDY SILT	56.57	0.767	18	2.126	<35%	27-29	124.45	--	--	--	--
38	SAND TO SILTY SAND	92.27	1.091	23	2.183	<35%	31-33	203.01	--	--	--	--
39	SILTY SAND TO SANDY SILT	92.84	1.353	30	2.24	<35%	31-33	204.25	--	--	--	--
40	SANDY SILT TO CLAYEY SILT	77.17	1.949	30	2.3	<35%	29-31	169.77	--	--	--	--

insitu group

Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-7
Test Date 7/24/2017 2:05:21 PM

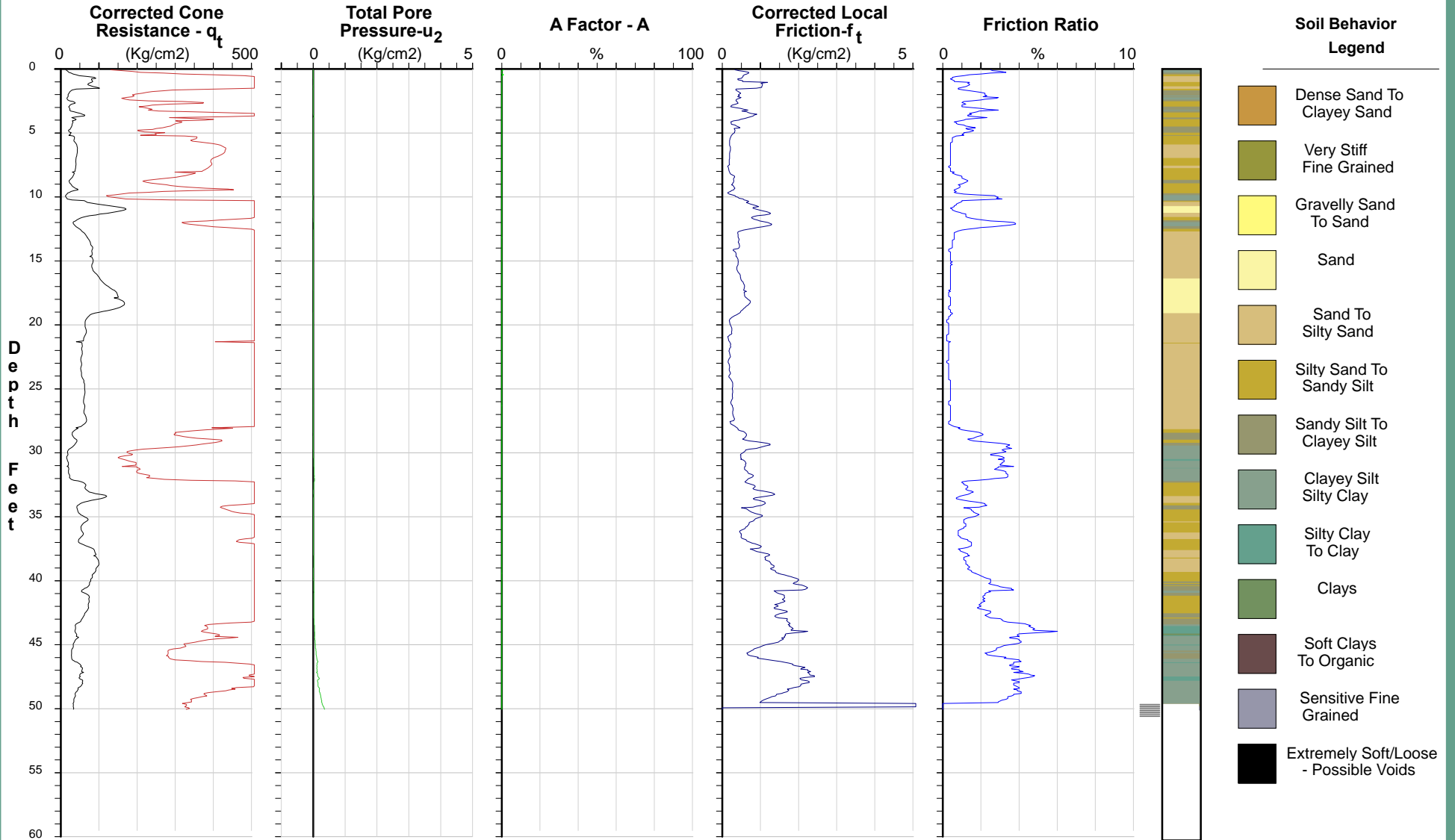
STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
41	SANDY SILT TO CLAYEY SILT	65.59	1.665	26	2.36	<35%	29-31	144.3	--	--	--	--
42	SILTY SAND TO SANDY SILT	70.72	1.515	23	2.417	<35%	29-31	155.59	--	--	--	--
43	SANDY SILT TO CLAYEY SILT	51.66	1.613	20	2.477	<35%	25-27	113.66	--	--	--	--
44	SILTY CLAY to CLAY	39.82	1.787	26	2.539	--	--	--	2.48	2.2	.01	3
45	CLAYEY SILT TO SILTY CLAY	32.82	1.152	16	2.601	--	--	--	2.01	2.8	.01	3
46	CLAYEY SILT TO SILTY CLAY	31.59	1.042	15	2.663	--	--	--	1.92	3	.01	3
47	CLAYEY SILT TO SILTY CLAY	53.37	2.183	26	2.725	--	--	--	3.37	2.4	0	6
48	CLAYEY SILT TO SILTY CLAY	52.31	2.043	26	2.787	--	--	--	3.3	2.5	0	6
49	CLAYEY SILT TO SILTY CLAY	36.92	1.337	18	2.849	--	--	--	2.27	2.7	0	3
50	CLAYS	32.79	97.66	32	2.911	--	--	--	1.99	.8	.03	3
51	----- END OF SOUNDING -----	32.76										

insitu group

Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-7
Test Date 7/24/2017 2:05:21 PM

PIEZOCONE SOUNDING CPT-7



Depth
Feet

0 — Coarse Scale
— Fine Scale

' = ' Push Interrupted To Add Rod
Static Data May Be Available

insitu group

Blue Marlin Engineering
Porter Transfer Station
Sounding CPT-7
Test Date 7/24/2017 2:05:21 PM
A-29

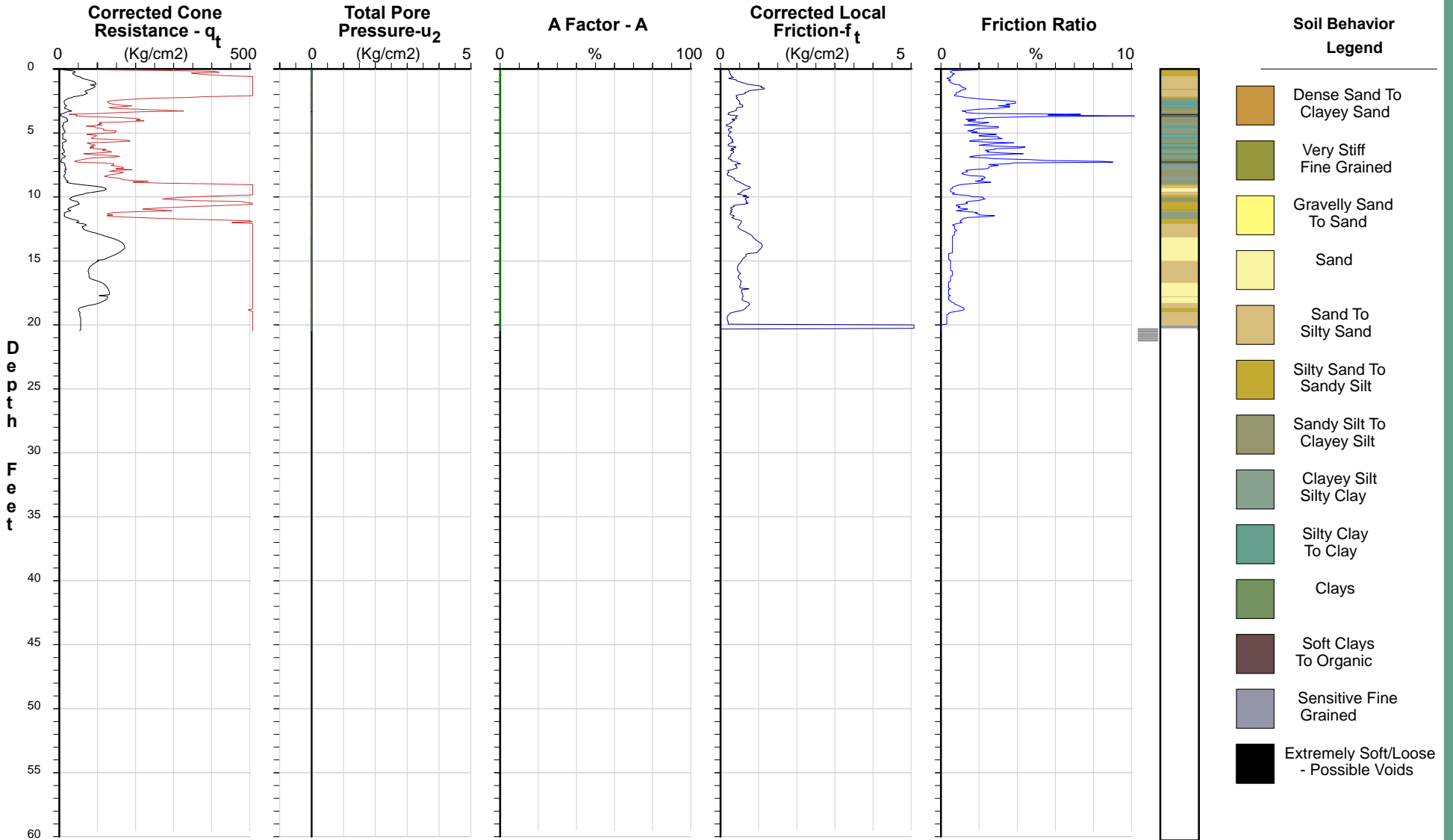
STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
1	SAND TO SILTY SAND	78.41	0.603	19	0.057	58%-65%	>43	172.5	--	--	--	--
2	SILTY SAND TO SANDY SILT	48.95	0.552	16	0.114	50%-58%	41-43	107.7	--	--	--	--
3	CLAYEY SILT TO SILTY CLAY	17.5	0.428	8	0.176	--	--	--	1.15	4	.02	>6
4	CLAYEY SILT TO SILTY CLAY	13.13	0.302	6	0.238	--	--	--	.86	4.3	.03	6
5	CLAYEY SILT TO SILTY CLAY	10.7	0.235	5	0.3	--	--	--	.69	4.5	.04	6
6	CLAYEY SILT TO SILTY CLAY	11.24	0.292	5	0.362	--	--	--	.72	3.8	.04	6
7	SILTY CLAY to CLAY	9.56	0.311	6	0.424	--	--	--	.6	3	.02	6
8	SANDY SILT TO CLAYEY SILT	14.88	0.274	5	0.484	35-42%	29-31	32.75	--	--	--	--
9	SAND TO SILTY SAND	62.44	0.578	15	0.541	50%-58%	35-37	137.36	--	--	--	--
10	SILTY SAND TO SANDY SILT	50.54	0.62	16	0.598	42%-50%	35-37	111.18	--	--	--	--
11	SANDY SILT TO CLAYEY SILT	24.34	0.3	9	0.658	35-42%	31-33	53.56	--	--	--	--
12	SILTY SAND TO SANDY SILT	50.88	0.465	16	0.715	42%-50%	33-35	111.94	--	--	--	--
13	SAND TO SILTY SAND	114.63	0.785	28	0.772	50%-58%	37-39	252.18	--	--	--	--
14	SAND	163.86	0.99	32	0.827	65%-85%	37-39	360.5	--	--	--	--
15	SAND TO SILTY SAND	103.62	0.537	25	0.884	50%-58%	35-37	227.98	--	--	--	--
16	SAND TO SILTY SAND	78.13	0.472	19	0.941	50%-58%	35-37	171.9	--	--	--	--
17	SAND	121.29	0.544	24	0.996	50%-58%	35-37	266.84	--	--	--	--
18	SAND	112.91	0.636	22	1.051	50%-58%	35-37	248.4	--	--	--	--
19	SAND TO SILTY SAND	53.17	0.373	13	1.108	35-42%	31-33	116.99	--	--	--	--
20	VERY STIFF FINE GRAINED	55.73	44.496	55	1.17	--	--	--	3.63	.8	.01	6
21	----- END OF SOUNDING -----	53.43										

insitu group

Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-8
Test Date 7/25/2017 10:03:10 AM

PIEZOCONE SOUNDING CPT-8



Depth Feet

0 — Coarse Scale
 — Fine Scale

' = ' Push Interrupted To Add Rod
 Static Data May Be Available

insitu group

Blue Marlin Engineering
 Porter Transfer Station
 Sounding CPT-8
 Test Date 7/25/2017 10:03:10 AM
 A-31

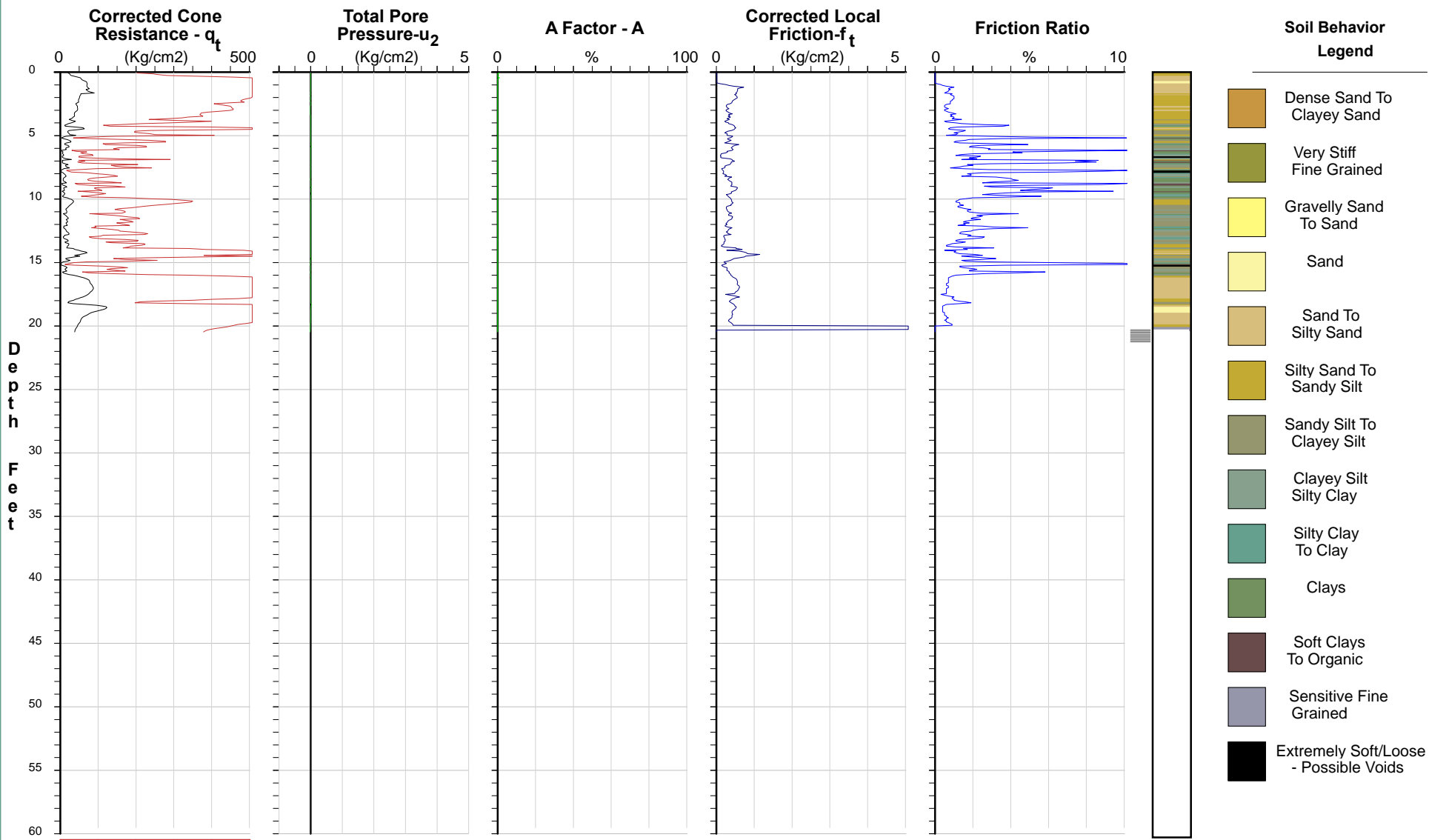
STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt (Kg/cm2)	Corrected Local Friction Lf (Kg/cm2)	CPT N (#)	Vertical Effective Stress (Kg/cm2)	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus (Kg/cm2)	Undrained Shear Strength (Kg/cm2)	Sens.	Comp.	OCR
1	SAND TO SILTY SAND	68.2	0.299	17	0.057	58%-65%	>43	150.06	--	--	--	--
2	SILTY SAND TO SANDY SILT	51.97	0.476	17	0.114	50%-58%	41-43	114.35	--	--	--	--
3	SILTY SAND TO SANDY SILT	41.5	0.303	13	0.171	50%-58%	39-41	91.31	--	--	--	--
4	SILTY SAND TO SANDY SILT	31.49	0.367	10	0.228	50%-58%	37-39	69.29	--	--	--	--
5	SANDY SILT TO CLAYEY SILT	19.57	0.322	7	0.288	42%-50%	33-35	43.06	--	--	--	--
6	CLAYEY SILT TO SILTY CLAY	12.3	0.352	6	0.35	--	--	--	.79	3.4	.04	6
7	CLAYEY SILT TO SILTY CLAY	11.45	0.302	5	0.412	--	--	--	.73	3.7	.04	6
8	SILTY CLAY to CLAY	8.26	0.233	5	0.474	--	--	--	.51	3.5	.03	6
9	CLAYS	9.89	0.445	9	0.536	--	--	--	.62	2.2	.02	6
10	SANDY SILT TO CLAYEY SILT	22.18	0.368	8	0.596	35-42%	31-33	48.79	--	--	--	--
11	CLAYEY SILT TO SILTY CLAY	15.83	0.327	7	0.658	--	--	--	1.01	4.8	.03	6
12	CLAYEY SILT TO SILTY CLAY	14.58	0.303	7	0.72	--	--	--	.92	4.8	.03	6
13	SANDY SILT TO CLAYEY SILT	15.51	0.242	6	0.78	35-42%	25-27	34.14	--	--	--	--
14	SILTY SAND TO SANDY SILT	40.81	0.564	13	0.837	35-42%	31-33	89.78	--	--	--	--
15	CLAYEY SILT TO SILTY CLAY	12.45	0.292	6	0.899	--	--	--	.77	4.2	.04	3
16	SILTY SAND TO SANDY SILT	40.45	0.415	13	0.956	35-42%	31-33	89.01	--	--	--	--
17	SAND TO SILTY SAND	82.41	0.557	20	1.013	50%-58%	35-37	181.31	--	--	--	--
18	SAND TO SILTY SAND	57.37	0.446	14	1.07	35-42%	31-33	126.23	--	--	--	--
19	SAND TO SILTY SAND	79.76	0.417	19	1.127	42%-50%	33-35	175.48	--	--	--	--
20	CLAYS	44.58	44.602	44	1.189	--	--	--	2.89	.8	.02	6
21	----- END OF SOUNDING -----	37.75										

insitu group

Blue Marlin Engineering
Porter Transfer Station
Sounding # CPT-9
Test Date 7/25/2017 9:40:48 AM

PIEZOCONE SOUNDING CPT-9



Depth Feet

0 — Coarse Scale
 — Fine Scale

' = ' Push Interrupted To Add Rod
 Static Data May Be Available

insitu group

Blue Marlin Engineering
 Porter Transfer Station
 Sounding CPT-9
 Test Date 7/25/2017 9:40:48 AM

ATTACHMENT C

Orange County Information Technology Standards, January
18, 2018

Orange County, Florida,
Information Technology Standards



01/18/2018

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1.0 Introduction to Orange County IT Standards

This guide provides a framework for documenting policies, business processes, and internal controls used to effectively support the information technology (IT) resources of the government of Orange County, Florida, Board of County Commissioners (County). It explains the role of the County's Information Systems and Services (ISS) personnel in approving, ordering, delivering, and maintaining IT services and products (hardware, software, networks, security, and other IT components) for employees throughout the County. It identifies County-approved products and procedures for acquiring IT systems and services. This guide also establishes County IT standards for use by third-party vendors providing externally hosted systems to various County departments.

The goal of ISS is to build an efficient, effective, and cost-efficient operation with an excellent return on investment by delivering new technologies and a state-of-the-art network server infrastructure. ISS is dedicated to providing prompt problem resolution through the customer service of its Help Desk. ISS seeks to maintain a diverse computing environment designed to meet the requirements of all County departments, while minimizing the risk of data loss or downtime. All computer hardware and software must be approved by ISS prior to purchase.

The ISS Department is comprised of 160+ employees, who are committed to its customer relationship-building attitude. ISS provides a business approach to serving all County agencies, which together form a partnership with ISS personnel to enhance productivity and service to the community.

The following standards apply to any device approved for connection to the County IT network or in use by County employees:

- ISS personnel are responsible for ordering all new computers, software, servers, telephones, and mobile devices for use by County employees. Hardware and software orders arrive at the ISS Warehouse at 3517 Parkway Center Court, Orlando, FL 32808.
- Submit orders by opening a ticket to request the new equipment or software using the [Service Center, New Problem/Request](#) email address. Each department authorizes specific individuals, who are responsible for placing new equipment and software orders through ISS. The emails will include pertinent information about the requested item(s). If sufficient details are not included in the initial email request, ISS staff will reach out to gather necessary information for the order. A list of authorized new products for purchase begins on the following page.
- ISS Warehouse personnel are responsible for applying County asset inventory tags to computer components, as necessary, prior to installation of the equipment.
- ISS Support personnel will install all operating systems and software. At the time of installation, ISS Support personnel must receive a copy of all installation software, along with written installation instructions, and licensing documentation. ISS will not install software without proof of licensing.
- All installed computers must, at a minimum, have the following:
 - ISS-installed anti-virus software
 - Computer configuration policy control for group management of devices by Active Directory
 - Remote access only as designated by ISS (ISS prohibits the use of Virtual Network Computing [VNC] and Remote Desktop computing.)
 - ISS-approved remote monitoring and management tools
 - Only ISS personnel shall have administrative rights.
 - Hardware must be a standard supported model
- ISS Enterprise Security is responsible for ISS video service; however, deployment of video equipment on the local government network must be discussed with staff members of the Network Operations Center (NOC) prior to purchase to determine compatibility, bandwidth, network equipment requirements, and installation feasibility.
- Generally, ISS does not support multicast on the County networks, except in specific special cases.

2.0 Authorized Products for New Purchases

This section includes detailed information about products authorized for use with the County's IT Systems.

2.1 Authorized Hardware

Dell Desktop Computer

Dell OptiPlex 7050 Small Form Factor (SFF) (does **not** include monitor or external speakers)

- Intel Core Processor Options:
 - i5 or i7 Processor – SFF with Digital Versatile Disk/Rewritable (DVD+/-RW)
 - i5 Processor – Micro Form Factor without DVD+/-RW (for conference rooms only)
- Windows 10 Professional 64-bit
- 128 GB Solid State Drive (SSD) Hard Drive
- 8 GB Random Access Memory (RAM)
- Universal Serial Bus (USB) Keyboard and Mouse
- Optional built-in aircard
- Display Port to Digital Visual Interface (DVI) Adapter 6' Cable
- 3-Year basic parts warranty

Dell Precision CAD Workstation

Dell Precision T3420 SFF (does **not** include monitor or external speakers)

- Intel Core i7-6700
- Windows 10 Professional 64-bit
- 512 GB SSD Hard Drive
- 16 GB RAM
- NVIDIA Quadro K1200 4 GB, 4x Mini DisplayPort mDP) Low Profile Video Graphics Card
- USB Keyboard and Mouse
- Display Port to DVI Adapter 6' Cable
- 3-Year basic parts warranty

Dell Latitude Laptop

Dell Latitude 7480 Laptop (does **not** include Docking Station or Carrying Case)

- Intel Core i5-7300U
- Windows 10 Professional 64-bit
- 14" High Definition (HD) (1,366 x 768) Non-Touch Anti-Glare Liquid Crystal Display (LCD) with Microphone/without Camera
- 128 GB SSD Hard Drive
- 8 GB RAM
- **NO** DVD-ROM Drive
- Absolute DDS Protection
- 3-Year basic parts warranty

Dell Windows Tablet

Dell Latitude 12 5285 Laptop

- Intel Core i5-7200U
- Windows 10 Professional 64-bit
- 12.3" 3:2 Touch (1920x1280) Screen
- 128 GB SSD Hard Drive

- 8 GB RAM
- AT&T LTE AirCard
- **NO** DVD-ROM Drive
- Absolute DDS Protection
- 3 Year ProSupport
- Travel Keyboard
- Stylus
- Dock Station and Targus Rugged Case (Optional Accessories)

2.2 Authorized Software for Desktops and Laptops

- Microsoft Windows 10 Pro
- Internet Explorer 11 and Google Chrome (**Note:** Chrome extensions are prohibited.)
- Microsoft Office 2016 Pro, Office 2013 Pro, and Office 2010 Pro
- All Microsoft Office applications on the same PC must have matching software versions (i.e., Project, Visio, Word, Power Point, Access, etc.).
- ISS Desktop Support must pre-approve any application requiring the use of Active X controls. At a minimum, the application must meet the following criteria:
 - It must be an .MSI file with silent installation/distribution from the command line.
 - It must install and operate without end-user administrator permissions.
- Java 1.8.25 – Only supported version of Java
- Silverlight – latest version
- The preference is hosted solutions not requiring installation of local software or configuration files.
- Bomgar or WebEx for remote access

2.3 Authorized Network Connectivity

- AT&T Wireless AirCards
- ShewSoft VPN Client
- Hosted applications must be accessible from devices with automatically assigned network settings. (Dynamic Host Configuration Protocol (DHCP) should supply all settings. Fixed addresses are not allowed.)

For all devices joined to our domain (this also applies to “**vendor supported**” devices and applications):

- ISS must install the Operating System and software on the device.
- ISS must receive a copy of all software and installation instructions.
- Hardware must be a standard supported model (see also hardware section, for example Optiplex 9020, 7040, 7050).
- Kace management client and Kaspersky software must be installed.
- PGP is required on all laptops.
- The device must receive Windows updates and computer configuration changes via Active Directory policies.
- Only ISS personnel shall have administrative rights.
- VNC and Remote Desktop are not permitted.

2.4 Authorized Client Based Databases

- Oracle (network based database)
- SQL Server (network based database)

2.5 Authorized Mobile Devices

ISS personnel are responsible for placing orders for all new phones and mobile devices. Individual departments may purchase chargers, holsters, rugged cases, and other accessories, along with other office supplies.

Conventional Phones

Legacy phone with data & texting disabled

- Kyocera DuraXE
- Sonim XP5
- LG B470 Flip
- LG B471 Flip (No Camera)

Android Phones

County Android phones must run Android Version 4.1 or above.

- Samsung Galaxy S7
- Samsung Galaxy S7 Active (AT&T only)
- Samsung Galaxy S8
- Samsung Galaxy Tablet S2
- Samsung Galaxy Tablet S3

2.6 Authorized Peripherals and Accessories

Black and White LaserJet Printers

- HP LaserJet Pro 400 Printer M402n (500 to 2,000 pages per month) < 4 users
- HP LaserJet M506dn (5-10 people, 1,500 to 5,000 pages per month + secure printing)
- HP LaserJet M608dn (10-25 people, 5,000 to 16,000 pages/month + secure printing)

Color LaserJet Printers

- HP Color LaserJet Pro M452 (500-1,500 pages per month, small paper tray)
- HP Color Laserjet Enterprise M652dn (2,500 to 17,000 pages/month + secure printing)

HP Multi-Function Devices (MFD) (Print/Scan/Copy)

- HP MFP M426fdn (750 to 4,000 pages per month, B/W)
- HP color MFP M277dw (1 or 2 people, occasional scanning)
- HP color MFP M477fdn (750 to 4,000 pages per month)
- HP color MFP M577dn (2,000 to 7,500 pages per month)

Scanners (all come with Adobe Acrobat and Automatic Document Feeders [ADF])

- Fujitsu ScanSnap iX500 (25 pages per minute [ppm], 50 sheet ADF, Connected via USB)
- Fujitsu N7100 (25 ppm, 50 sheet ADF, Networked)
- Fujitsu 5530C2 (50 ppm, 100 sheet ADF, Connected via USB)

Note: Printers must use Original Equipment Manufacturer (OEM) toner cartridges only.

Note: ISS must review and approve Desktop, Copier, and combo unit purchases used for printing from the PC. Contact ServiceCenter@ocfl.net for more information and assistance.

3.0 Unsupported Products

3.1 Unsupported Hardware

- Pentium dual-core and older desktop systems, Optiplex 745, 755, 960, 990
- Latitude D-series Laptops, Latitude E6500, E6510, E6520, E6530, E65xx
- Non-Dell PCs
- Wireless keyboards and mice (except conference rooms)
- Desktops and Laptops over 5 years old
- See also *Section 3.4, Peripherals and Accessories*.

3.2 Unsupported Software

- MS Office platforms prior to Office 2010 (including Visio & Project)
- Non MS Windows-based operating systems
- Safari Web Browser
- MS Office plug-ins or VBScripts
- Windows Applications from the Windows App Store
- Freeware
- Windows XP, Windows 8, and Windows 8.1
- Freelance
- SHL Vision & Vision Express, WIN9x/WINNT/UNIX
- Reflection version 11 or lower

3.3 Unsupported Client Databases

- No client-based databases are supported (e.g., Microsoft Access, Filemaker Pro)

3.4 Unsupported Peripherals and Accessories

- Inkjet printers
- Printers over 7 years old
- Scanning to multiple folders per device
- Address books in scanners/copiers (users manage their own)
- Personal (non-County) mass storage devices (hard drives, thumb drives, etc.)

4.0 Prohibited Products

4.1 Prohibited Hardware

- Non MS Windows-based PCs, laptops, and tablets
- Recycled, Remanufactured, and non-OEM toner Cartridges
- Refurbished PCs
- Personal (non-County) computing equipment
- Any network (voice or data) device not operated, administered, or expressly approved by ISS
- Any internet access device not operated, administered, or expressly approved by ISS
- Donated and vendor-provided PCs that do not meet County standards

4.2 Prohibited Software

Note: This list is not all inclusive of prohibited software. If you have questions concerning a specific application, please open a ticket or contact the Desktop Support Supervisor.

- Microsoft Internet Explorer version 10 and below
- Server software is not permitted on workstations (SQL server, print servers, web server, file sharing)
- Cloud-based collaborative software (data must be stored within our datacenter).
- Personal Software (purchased for non-commercial use)
- Firefox, Opera, Vivaldi Web Browsers
- Chrome extensions
- Any Alpha, Beta, Shareware, Trialware software not operated, administered or expressly approved by ISS and Purchasing.
- Anti-virus products not operated or administered by ISS
- Personal firewall products
- Network scanning tools
- Remote access software other than that ISS explicitly authorizes
- Desktop sharing, remote control, or remote communications software such as Remote Desktop
- Web page editing tools (without prior approval)
- Software coding tools (without prior approval)
- User installed screen savers
- Games
- Third Party Desktops
- Disk Compression
- Non-Static BITMAP Backgrounds or screen savers
- iTunes or other content sharing applications
- P2P software
- MS Access Run-time Libraries

4.3 Prohibited Network Protocols

- NETBUI
- AppleTalk
- Any network (voice or data) software or service not operated, administered or expressly approved by ISS.
- Any Internet access service not operated, administered, or expressly approved by ISS.

4.4 Prohibited Peripherals and Accessories

- Portable music devices
- Webcams
- Printer sharing through a PC
- Wireless printing

5.0 Standards for In-House Servers and Server Operating Systems

The following server standards apply to all servers on the Orange County network maintained by County ISS personnel:

- Only ISS personnel shall have administrative rights to server-class devices.
- All servers shall operate in a VMWare-based virtual environment. The ISS Infrastructure Manager must approve in writing any exceptions to this rule prior to project implementation.
- Any device that cannot run in a VMWare-based virtual environment (“stand-alone”) must have hardware and software approved by ISS Infrastructure Manager prior to its connection to the County network.
- All servers will comply with ISS standard resource configurations. The ISS Infrastructure Manager must pre-approve any deviation from this standard and may incur additional costs.
- No server shall be configured as a ‘file share’. File storage shall be NAS based.
- In addition to the requirements listed above, all stand-alone devices must, at a minimum, meet the following requirements:
 - Be installed at the County Data Center (RCC)
 - Be rack-mountable
 - Only run server-class operating systems
 - Be configured for out-of-band management and have remote monitoring software installed
 - Meet ISS minimum hardware requirements including, but not limited to:
 - Dual power supplies
 - Dual NIC’s
 - Dual processors
 - Dual HBA’s
 - Dual hard drives, redundant array of independent disks (RAID) configurable for boot drive
 - Use storage area network (SAN) for attached storage devices

The following lists the default standards used for specific server operating systems:

5.1 Microsoft Windows-Based Server Requirements

In no case shall an operating system be installed that is not under current manufacturer support (typically this is N-2 for Microsoft operating systems).

- The Boot partition “C Drive” shall be 40 GB (Thin Provisioned).
- The Data partition shall be 40GB to 100 GB (Thin Provisioned).
- 8 GB RAM
- The C: drive will contain only the operating systems. Databases must reside on separate servers from that of application or Web servers.
- Application, service, or vendor accounts will not be members of the domain administrator’s group.
- Application, service, or vendor accounts will not be in the local administrator’s group for any server.
- Applications must run as a service. ISS prohibits applications that require a user account to remain logged in.

5.2 Linux-Based Server Requirements

- RHEL 7 or greater, kernel 3.0 or greater, 64 bit architecture
- 40 GB Boot partition
- 4 GB memory
- Applications will **not**:
 - Have a web interface that allows users to access the system as a privileged account.
 - Run root processes.
 - Be installed in any file system that is part of root.
 - Write log files to any file system that is part of root.
 - Update root system's files during installation.
- Applications will be installed using a unique user ID and unique group ID.
- Purge application and system logs, as needed.
- Disable Telnet and the "r" commands on all UNIX servers.
- .rhost file is not available.

5.3 Oracle-Based Server Requirements

- County-supported Oracle versions are Oracle Enterprise Edition 10g or higher.
- County-supported environment for Oracle databases is Oracle Linux on an Oracle Exadata shared environment.
- Database setup shall be compliant with Oracle's Optimal Flexible Architecture (OFA) file naming conventions
- Applications must be installed under separate schema not requiring Database Administrator (DBA) privileges or DBA type privileges. Applications will not require or use the Linux Oracle account.
- Applications will provide a security module to manage user IDs and permissions.
- Application vendors shall provide all database creation scripts and any other required scripts to build, maintain, and support the database environment.
- Application vendors shall provide all documentation related to all database creation scripts and any other required scripts to build, maintain, and support the database environment.
- ISS personnel shall install databases using vendor provided scripts, initialization parameters, and any special performance related parameters.
- Oracle's Administrator (SYSADM) account must not be required for software to operate.
NOTE: If SYSADM privileges are required for installation, a County Database Administrator shall perform the installation vendor supplied scripts under the application vendor's direction.

5.4 Microsoft SQL-Based Server Requirements

- Microsoft SQL Server versions are Server SQL 2012 Enterprise or higher.
- Database installations must be on a separate server from the application executables and support files. Database installations cannot be installed to the C: drive of the Windows Server. Applications will allow the ISS Database Administrator to specify the drives and directories where the database files will reside.
- MSDE, SQL Server Express, or MS Access based software are prohibited. Applications must support SQL Servers Integrated Security model.
- Applications must contain a security module to manage user ID's and permissions, with no blank or hard-coded passwords allowed.
- Server Administrator privileges are not permitted.

NOTE: If Server Administrator privileges are required for installation, an ISS Database Administrator shall perform the installation.

- ISS prohibits use of applications that create, update, or delete of any files on the database server outside the constructs of the database engine.
- ISS prohibits use of applications that create new databases or persistent database objects as part of its operation.
- Applications shall support application database backups/restores using the County's Enterprise Backup Tool. Currently, the County standard is CommVault's Galaxy iData-Agent for SQL Server.
- Applications must provide an audit mechanism to record the date, time, and user id that last modified a given row in an application table.
- Applications must utilize database referential integrity.

6.0 Network Systems Requirements

6.1 Protocol Node Names and Addresses

- The ONLY protocol allowed on the County Data Network is the Internet Protocol referred to as Internet Protocol (IP) or Transmission Control Protocol/Internet Protocol (TCP/IP) Version 4.
- There can be only one unique address for each node on the network. Node naming and addressing conventions will conform to the guidelines established here.
- The NOC assigns all addresses for all devices connecting to the County Network. All IP addresses must conform to R.F.C. 1918:

10.0.0.0 - 10.255.255.255/8

172.16.0.0 - 172.31.255.255/12

192.168.0.0 - 192.168.255.255/16

- The NOC maintains an addressing plan and uses the plan to assign addresses. The Internet Addressing Authority, a private entity, assigned a block of addresses for the County. The NOC will maintain and assign these addresses, as needed.
- Use of Registered Internet addresses on the County network is not allowed.
- All network numbers for "special function" TCP/IP networks will be assigned by the NOC.
- No INTERNET connections are allowed from any node, modem, or communications device on the network without NOC and Enterprise Security approval.
- A network-wide, shared-use Internet connection is available to all entities.
- TCP/IP DOMAIN NAME SERVERS (DNS) are an alternative to local administration and maintenance of a "hosts" file. Any Divisions, Elected Officials, or agencies wishing to use the DNS may send a list of IP addresses to be included in the DNS to the ISS Service Center, (407-836-2929 or 6-2929), which will be routed to the NOC staff.
- Entities who have dedicated network staff and wish to be assigned their own IP address space will request the assignment from the NOC through the ISS Service Center, (407-836-2929 or 6-2929). These entities will provision their own DNS and be responsible for administration of their own IP address spaces (as assigned by the NOC for the agency to administer).
- Only routed networks with at least 254 IP nodes are eligible for this option. DHCP is provided by the NOC.
- No shared device (printer, server) may use a DHCP address. Static IP addresses are available in limited amounts on request.

6.2 Bridges, Routers, and Gateways

- Routers are required at points in the network where traffic control and/or broadcast domain segmentation needs exist.
- Routers are required on all Wide Area Network connections.
- Protocol conversion is not supported on this network, as one common protocol (TCP/IP) is standard for all nodes.

6.3 Network Security

- All default accounts on all processors connected to the network will either be disabled or have the default password changed. No accounts are allowed without passwords.
- The default “privileged password” on all network electronics will be changed.
- All dial-up access must be provided through secure access servers. No direct access via dial-up lines is allowed on any type of device, processor, terminal, server, or PC connected to the network.
- The NOC provides and maintains a secure access server for Dial-up use. Contact the ISS Service Center (407-836-2929 or 6-2929) for remote access authorization by the Enterprise Security Team.
- The requesting department will provide the hardware & software for the employee’s home use, unless the employee provides their own.
- Vendor field service will have remote access through NOC provided access servers. VPN access is available for use.
- No entity on the network shall make any connection to the Internet, dial-up service, wireless provider, or wireless access-point without written permission from the ISS Enterprise Security Team and Network Operations.
- An Internet gateway is provided for all entities on the network to use.
- Any entity that directly connects their network to the Internet may not remain connected to the County network, due to security risks. If the Internet connected entity supplies, at their own expense, an acceptable Firewall between their networks and the County networks, the County network connection can resume via the Firewall provided.

Wireless Local Area Network (LAN) (Ethernet) Security

- All 802.11x wireless LANs must use a DOT1X supplicant for network admission control.
- All 802.11x clients must use VPN triple Data Encryption Standard (DES) or Advanced Encryption Standard (AES) encryption. Client authentication via RADIUS server is required. The RADIUS server is provided and administered by ISS Enterprise Security.
- All access points attached to the County network must be Lightweight Access Point (LWAP). (No stand-alone access points are permitted)

Wireless Wide Area Network (WAN) Security

- The County maintains a contract with a wireless provider. A gateway is available for connecting to the contracted wireless provider. The County prohibits access to the network using any other wireless provider.

6.4 Network Components

Transmission Media

- Fiber-optic, Category 5, 5e, and 6, and Category 3 Unshielded Twisted Pair (UTP), Shielded Twisted Pair (STP), and radio (802.11x) are all permitted for IP data communications in the network.

Transmission Methods

- Optical, metallic cable, leased data circuits (analog, digital), private (analog, digital), and wireless (802.11x) are all permitted for IP data communications in the network.

Supported LAN Types

- ETHERNET, 802.3, 10 BASE T, 100 BASE TX, 100 BASE FX, 1000 BASE xx (Gigabit), 802.11x (wireless Ethernet), 10 GIGABIT.
- Etherchannel: The only Etherchannel protocol supported by the County is 802.3ad Link Aggregation Control Protocol (LACP).

6.5 Network Circuits

- The NOC will design all WAN networks and, if required, procure leased data communications circuits from the Carrier.
- The NOC will act as the central point of contact between all entities using WAN circuits.
- The NOC will be notified by the affected entity and/or the ISS Service Center of service affecting WAN outages.
- The ISS Service Center (407-836-2929 or 6-2929) and the NOC will be responsible for coordinating successful repair of WAN circuits.
- The NOC will be responsible for ordering the disconnection and termination of leased data circuits upon notification by the customer.
- Critical LANs and/or WANs may be designed with duplicate, automatic, redundant circuits and electronics to provide automatic recovery of data communications.
- Circuits leased by any entity (other than the County) will be managed by that entity's technical staff.
- A Remote Site is available for recovery of certain critical applications and County networks in the event of a formally declared disaster. This site is located in Tallahassee at the Northwest Regional Data Center. (NWRDC). The NWRDC is permanently connected to the County networks, and is available and operational 24 x 7 x 365.

6.6 Network Installation

- In situations where installation of network equipment by one entity may affect customers from other entities, the installation will be jointly coordinated by representatives of the NOC and the other entities.
- The NOC will design and install all LAN and WAN networks, except in special circumstance.

6.7 Network Trouble Reporting

- Customers exclusively confined to applications delivered by networks supplied by the NOC will call or e-mail the ISS Service Center (407-836-2929 or 6-2929) to report trouble, request service, and get technical advice. The ISS Service Center will screen all calls, resolve any problems it is able to resolve with ISS Service Center staff, and refer unresolved network problems to the NOC.
- Customers exclusively confined to applications on networks supplied by other entities will call that entity's network staff to report trouble, request service, and get technical advice.
- Customers on a mix of processors and networks supplied by the NOC and other entity's processors and networks will call the ISS Service Center (407-836-2929 or 6-2929) to report trouble, request service, and get technical advice.
- The NOC employs a variety of network management and troubleshooting tools and systems. These network management systems are used by the NOC staff to test, troubleshoot, and diagnose all devices attached to the network.
- All LAN equipment attached to the network must support Simple Network Management Protocol (SNMP) and/or SNMP-2. Remote Monitoring (RMON) is also allowed, but not instead of SNMP. RMON is in addition to SNMP. Older equipment not supporting these standards will be phased out. The NOC is the only organization permitted to run SNMP on network equipment.
- Network problems that can be repaired by the NOC will be scheduled in a repair queue. Repair priority is based on the severity of the problem and quantity of customers affected.

- All devices attached to the network must have at least a minimum SNMP profile entered, consisting of the entity's name, address, and technical support staff phone number(s). This will assist NOC staff in locating the network on which the equipment is located, when troubleshooting.

6.8 Network Performance Management

- The NOC is responsible for monitoring all LAN and WAN performance. This includes all SNMP and RMON.
- Only NOC staff members are allowed to run SNMP/RMON on network devices.
- The NOC will redesign networks, which sustain traffic loads that adversely affect customer interactive response times and/or reliability.
- The NOC will assist other entities with managing the performance of their networks as requested.

6.9 Network Documentation

- Each entity on the network will provide the NOC with a current diagram of network topology, equipment location, and configuration (including building address and floor location).
- The NOC will provide a diagram of the network as well as tables and listings of all physical and logical components to any approved requesting entity.
- Each entity on the network will provide on-going, updated information to the NOC reflecting components, circuits, and logical changes.
- The NOC will add this information to its diagram and database, and will provide the revised network documents to all requesting entities.

7.0 IP Telephony Standards

- The definition of IP telephony is telephones and a Private Branch Exchange (PBX) with an integral Ethernet Network Information Card (NIC) using the Internet Protocol to communicate.
- All telecom related applications must be certified under the Avaya DevConnect program and compatible with the County's current level of Avaya Communications Manager for the appropriate site.
- The Telecom Unit must approve all peripheral applications, or software, prior to purchase.
- IP phones must derive their electrical power from the CAT-5e Ethernet cable. (POE type-1, 802.af standard)
- Ethernet switches in the closets will be used to provide in-line DC power through the CAT-5e patch panels.
- All Ethernet electronics used in this configuration will have a UPS attached.
- If the IP phone has a provision to connect the desktop PC into the same Ethernet as the phone, then the IP phone must use Ethernet switch technology. Use of a hub/repeater is not allowed.
- IP phones must operate in a separate subnet from the attached PC.
- IP phone packets will be given the highest priority of all IP communications traffic on the LAN. Other non-telephony applications will have their "IP Precedence" bit modified at the Ethernet switch to conform to this standard.
- IP phone access to the network through the internet provider will use the ISS provided VPN services.
- Direct access to internal devices is prohibited.

8.0 Externally-Hosted System Standards

This information is for all vendors, networks, systems, and applications that will transmit, process, store, or handle electronic data provided by County.

8.1 Data Input and Processing

- Any use of Social Security Number information shall adhere to and abide by Florida Statutes, specifically F.S. 119.071, which provides detailed guidelines on usage of Social Security Numbers.
- The hosted application shall not have access to Social Security information.
- The hosted application shall not have access to data containing bank information.
- The hosted application shall not have nor be granted direct or indirect access to the County's Active Directory user names.
- The hosted application shall not have access to the County's internal or DMZ networks.

8.2 Data Storage and Handling

- The provider shall encrypt any data accessible from the hosted application meeting the following criteria at rest and in transit:
 - Names
 - Addresses
 - Phone numbers
 - Email addresses
 - Birth dates
 - Federal/state/local documents numbers
 - Account numbers
 - Race or religious information
 - User names
 - Passwords
 - Employee identification numbers
 - All Health Insurance Portability and Accountability Act (HIPAA) information
 - All Purchase Card Industry Data Security Standards (PCI DSS) information
- Any data, accessible from the hosted application or directly accessible from it, should be encrypted.

8.3 Transmission of Data

An encrypted tunnel must be used to transmit any data referenced above.

8.4 Disposal of Data

When no longer needed, or when data must be removed from the system, it shall be sanitized and disposed of using one of the methods listed below:

- **Sanitization** – Overwriting data previously stored on a disk or drive with a random pattern of meaningless information
- **Destruction** – Physically damaging a medium, so that it is not usable by any device that may normally be used to read information on the media, such as a computer, tape reader, audio or video player
- **Purging Data** – Using a strong magnetic device, such as a degausser, to render data unrecoverable

8.5 External Audits

- The vendor must ensure that the web hosting environment and application is secure using IT security best practices.
- The external service, system, and application must pass a yearly penetration test performed by ISS personnel.

9.0 Data Center Standards

In addition to standards outlined in 5.0, *Standards for In-House Servers and Server Operating Systems*, the following requirements apply to hardware installed in an Orange County Data Center, such as, network switches, appliances, servers, storage arrays, etc. These requirements apply to orders placed by Orange County personnel, vendor special orders, and orders placed by RCC tenants:

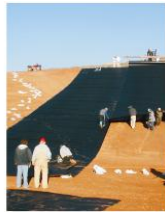
- Standard rack configuration is 42U
- PDU orders need network monitoring (smart PDU) for rack
- Mounting hardware for racks should be included in order
- Dual power supplies for all equipment
- Dual NIC cards for any hardware needing to connect to network

10.0 Acronyms

ADF	Automatic Document Feeder
County	Government of Orange County, Florida, Board of County Commissioners
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Server
DVI	Digital Visual Interface
DVD+/-RW	Digital Versatile Disk-Rewritable
GB	gigabyte
ISS	Orange County Information Systems and Services
IP	Internet Protocol
IT	Information Technology
NOC	Network Operations Center
OEM	Original Equipment Manufacturer
ppm	Pages per minute
RAM	Random Access Memory
RMON	Remote Monitoring
SAN	Storage area network
SNMP	Simple Network Management Protocol
SSD	Solid State Drive
SFF	Small Form Factor
TCP/IP	Transmission Control Protocol/Internet Protocol
USB	Universal Serial Bus
WAN	Wide Area Network
VNC	Virtual Network Computing
VPN	Virtual Private Network

ATTACHMENT D

Excavation and Disposal Plan March 2018



EXCAVATION AND DISPOSAL PLAN FOR THE PORTER TRANSFER STATION SITE IMPROVEMENTS

Porter Transfer Station
1326 Good Homes Rd
Orlando, Orange County, Florida

Prepared for:



Orange County Utilities
5901 Young Pine Rd
Orlando, Florida 32829

Presented by:

SCS ENGINEERS
5850 S. Semoran Blvd,
Orlando, FL 32822
(407) 204-3231

Certificate of Authorization No.

File No. 09216054.01
March 2018

Offices Nationwide
www.scsengineers.com

**EXCAVATION AND DISPOSAL PLAN
FOR THE PORTER TRANSFER STATION
SITE IMPROVEMENTS
1326 GOOD HOMES ROAD
ORLANDO, FLORIDA 32818**

Prepared for:



Orange County Utilities
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Appendix A – FDEP’s “Guidance for Disturbance and Use of Old Closed Landfills of Waste Disposal Areas in Florida”, Version 2.2, dated August 2015

I. APPLICABLE NOTES

- A. The Contractor shall comply with all applicable federal, state, and local codes applicable to the work, including, but not limited to building and construction codes, environmental codes, and health and safety codes.
- B. The proposed construction activities are within a former landfill and therefore the potential for exposure to contaminated water, soil and air exists. Documents relevant to the contamination at the site can be obtained via the Florida Department of Environmental Protection's (FDEP) on-line document management system (OCULUS) and the Geotechnical Report prepared by Blue Marlin located in Appendix A of the Contract Documents.
- C. Construction shall be accomplished in a safe manner and in strict compliance with all the requirements of the Federal Occupational Safety and Health Act Of 1970, and all state and local safety and health regulations.
- D. Waste relocation procedures shall be in accordance with Florida Department Of Environmental Protection (FDEP) requirements located in the Florida Administrative Code (FAC) Chapter 62-701; Guidance for Disturbance and Use of Closed Landfills or Waste Disposal Areas in Florida (FDEP, August 2015).

II. PRE-CONSTRUCTION RESPONSIBILITIES

- A. With the Contractor's Bid package submittal the Contractor shall provide to the Engineer and Owner a site specific Health and Safety Plan (HASP) for employees and subcontractors. The Owner and/or Engineer may comment on the HASP as a courtesy. However, it is the Contractor's sole responsibility to develop and implement a HASP to comply with all applicable health and safety regulations. A copy of the HASP shall be maintained at all times at the jobsite and be available for inspection by the Owner and/or Engineer.

III. WASTE HANDLING PROCEDURES

- A. Best Management Practices (BMPs) shall be implemented during waste excavation activities at the site. These BMPs are listed below.
 - 1. The FDEP shall be notified in writing at least three working days prior to the commencement of any waste excavation activity.
 - 2. Prior to waste excavation in the areas that already received six inches of cover or greater, the cover material may be relocated to an onsite designated staging area, and used once the waste excavation is completed and area is graded. The soil must meet the requirements of the Contract Documents and be approved for re-use by the Engineer in an appropriate manner.

3. During waste excavation activities, excavated solid waste shall be disposed of at a Class I landfill for non-hazardous waste in compliance with local, state, and federal requirements.
4. Temporary storage of bulky/unacceptable solid waste that will be disposed off-site shall not exceed thirty days.
5. Waste suspected of being hazardous shall be segregated and subsequently inspected and tested to determine if it is a characteristic hazardous waste. Orange County shall be notified immediately. The FDEP shall be notified within 24 hours if the waste is found to be hazardous and the waste will be managed and disposed of in accordance with applicable regulations. Refer to the Porter Transfer Station Contingency Plan prepared by SCS Engineers dated July 2017 for further information regarding hazardous waste that may be encountered.
6. During waste compaction and grading operations, cover will be placed on the exposed waste at the end of each working day. Initial cover may consist of clean fill, Recycled Screened Material (RSM), or acceptable Alternative Daily Cover (ADC), such as foam-based cover or tarps. The cover shall be sufficient to minimize adverse environmental, safety, or health effects, such as those resulting from birds, blowing litter, odors, disease vectors, or fires. A temporary cover, such as a tarp, may be used in areas where additional solid waste will be cut or filled within 18 hours of the conclusion of work, which may be removed prior to deposition of additional waste.
7. After proposed final waste grade is achieved in an area, the area will be graded and covered with six-inches of interim soil cover or other approved material or ADC until development activities are complete. In the event that an ADC material is utilized, consideration will be given to the ADC's performance based on weather conditions (wind and rain), manufacturer recommendations, and life expectancy. Accordingly, proper supervision for the correct application of the ADC and maintenance/replacement will be performed, as necessary. Final waste grade slopes will not be steeper than a 4 (horizontal):1 (vertical) ratio.
8. Stormwater runoff that is generated by the activity will be controlled on site by temporary cover, as listed above, and re-direction of stormwater sheet flow to the appropriate permanent or temporary drainage areas.
9. Erosion control methods (silt fence, etc.) Shall be implemented in accordance with the site's Stormwater Pollution Prevention Plan (SWPPP) and the NPDES generic permit for Stormwater discharge from large and small construction activities (CGP).
10. The requirements that apply to the former Good Homes Landfill, including an adequate cover or other site development features, shall be restored in accordance with the FDEP-approved reports plan.

IV. CONTROL OF ODORS AND VECTORS

- A. Odors will be monitored at the active area boundaries and a more detailed odor control plan will be developed if deemed necessary.
- B. Vectors, animals, or insects that transmit pathogens will be kept within acceptable limits. The primary safeguards against vector problems are maintaining the working area as small as possible, providing initial cover on exposed areas, and eliminating water-ponding. Well-compacted wastes and cover material effectively prevent vectors emerging from or burrowing into wastes.
- C. Odor will be monitored at the sand/waste excavation area in the unlined landfill cells and the screening and processing areas in the active lined cells. Daily cover will be applied to the excavation area if an extended excessive odor problem is observed. If an odor problem arises at the active lined areas due to the use of the sand/waste mix in the operations, clean sand will be used to cover the mined sand/waste mix.

V. EARTHWORK

- A. The cut areas will be cut to grade using an excavator and off road trucks in accordance with Contract Documents.
- B. The Contractor shall not fill excavated areas with refuse.
- C. Compaction of the exposed waste surface shall be performed using a heavy compactor model as required by the geotechnical report recommendations and Contract Documents. The compactor will make at least six crisscross passes under full energy.

VI. WHITE GOODS AND TIRE MANAGEMENT PLAN

- A. White goods and tires that are recovered during waste mining will be separated and transported to the appropriate storage areas. These items will be managed in accordance with the current transfer station permit and operation plan.

VII. STORMWATER RUN-ON CONTROL PLAN

- A. Similar to the daily disposal cells build during current active operations, Stormwater will be diverted from entering the working face (excavation face) by construction of diversion berms of grading of the surface in such a way that the Stormwater run-on flows away from the working face. Additionally, the Stormwater that comes into contact with Excavated waste will not leave the mining area. Excavation will begin at the lowest elevation of the cell and will generally proceed upslope.

VII. RUNOFF MANAGEMENT

- A. Stormwater which contacts the active landfill excavation, screening and processing areas will not be allowed to run outside of the mining area. Water that contacts the exposed mixed sand/waste will be contained within and not drain beyond the solid waste boundaries. Waste mining will not continue in areas where there is ponded water until it has drained.
- B The Contractor shall have a trash pump on-site during excavation and may pump liquids to the on-site lift station. De-watering is not anticipated. The Contractor shall notify the Engineer and Owner immediately if they need to dewater.

VII. DUST AND LITTER CONTROL PLAN

- A. Dust and litter will be controlled in accordance with existing facility dust and litter control plans. If excessive dust is observed, water will be sprayed over the problem areas with the tanker truck by the Contractor. Litter generated from the project will immediately be collected by the Contractor for disposal. Additional litter-control devices such as portable fences will be used to control litter blowing away from waste excavation and screening operations on an as-needed basis to supplement current litter control practices.

VIII. EXCAVATION AREA COVER

- A. The excavated waste is anticipated to be composed of mostly sandy soil, along with well-decomposed organic municipal solid waste and construction debris. Application of 6" of clean cover will be applied if the exposed sand/waste mix slope of the excavation is not anticipated to be further excavated within 30 days. However, if the excavated surface causes litter and odor problem(s), the excavated final cover will be used to cover the excavated areas at the end of each working day.

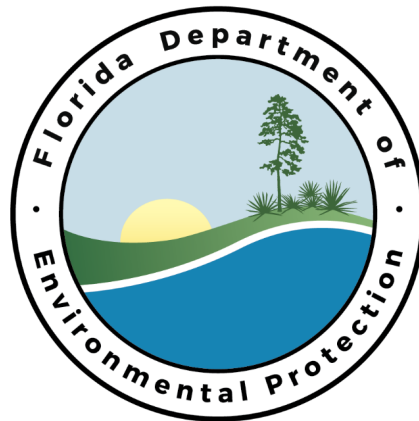
APPENDIX A

FDEP's "Guidance for Disturbance and Use of Old Closed Landfills of Waste Disposal Areas in Florida", Version 2.2, dated August 2015

GUIDANCE FOR DISTURBANCE AND USE OF OLD CLOSED LANDFILLS OR WASTE DISPOSAL AREAS IN FLORIDA

**Version 2.2
FINAL**

August 19, 2015



Prepared by:

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Solid Waste Section
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Tallahassee, Florida 32399-2400

DISCLAIMER

The information contained in this document is intended for guidance only. It is not a rule and does not create any standards or criteria which must be followed by the regulated community. Furthermore, compliance with this document does not relieve the owner or operator from the responsibility for complying with the Department's rules nor from any liability for environmental damages caused by the disturbance of or activities near old landfills or waste disposal areas.

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LIST OF ACRONYMS

EDP	Excavation and Disposal Plan
EPA	U. S. Environmental Protection Agency
F.A.C.	Florida Administrative Code
F.S.	Florida Statutes
GWMP	Ground Water Monitoring Plan
HRA	Health Risk Assessment
MOP	Monitoring Only Plan
NELAP	National Environmental Laboratory Accreditation Program
PCAP	Preliminary Contamination Assessment Plan
PCAR	Preliminary Contamination Assessment Report
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RSM	Recovered Screened Material
RTL	Reuse Target Level
SPLP	Synthetic Precipitation Leaching Procedure
SSW	Screened Solid Waste
WPF	Waste Processing Facility
WTE	Waste-to-Energy

1.0 BACKGROUND AND PURPOSE

In the past, the Florida Department of Environmental Protection (Department) has received notifications that old landfills or old disposal areas were unexpectedly discovered during various construction projects. The Department has also been contacted by property owners who were seeking to develop property which was known to contain areas where waste had been disposed. As such, the Department was asked to provide guidance regarding proper management of waste for similar situations. Questions are typically raised about the relocation of wastes, where they can be properly disposed, permitting requirements, back-filling of excavated areas, use of screened material from the waste and ground water monitoring requirements.

There have also been situations where development projects, such as residential housing units, schools, recreational areas or retail businesses, have been constructed on top of or adjacent to old disposal areas. Some of these projects have resulted in considerable health and safety concerns for individuals living or working near these disposal areas and for the integrity of the environmental protection measures that may be in place at the disposal sites.

The potential risks from old disposal sites may vary considerably and are usually not well understood. This can be due to a variety of factors such as a lack of records on the types of waste disposed at a site or a lack of data on the generation and fate of gases and leachate from these wastes. For example, some wastes contain more biodegradable material than others and as a result may generate more methane gas under anaerobic conditions causing odors and green house gases. Or, due to the age of the wastes, they may have stabilized to the point that gas generation is no longer of concern. If gases are still being generated, they may or may not be migrating off-site depending on the specific geological and physical features of the site. Also, since these old disposal sites were unlined, impact to ground water from leachate generation may be a problem, but this can not be determined without a ground water investigation.

Due to the difficulties encountered in dealing with these old sites, the Department has been asked to develop recommendations for managing the problems arising from construction near or over them. Consequently, this document is intended to provide guidance to the regulated community on the Department's requirements and recommendations for disturbing or using old, closed landfills or disposal areas. While owners of these old sites are encouraged to use this guidance, this document is not a rule and does not create any standards or criteria which must be followed by the regulated community.

The original document for this guidance was issued on May 3, 2001. Since that time, changes have occurred which require the Department to update this document. For example, on April 17, 2005, Chapter 62-780, Florida Administrative Code (F.A.C.) became effective. This new chapter establishes the procedures for the assessment and cleanup of contaminated sites when it has been established that a person is legally responsible for conducting site rehabilitation or when a person voluntarily rehabilitates a

contaminated site. As a result, the previous process used by the Department, (i.e., the process known as Corrective Actions for Contaminated Site Cases) is an obsolete tool and individuals choosing to conduct contamination assessment and possibly cleanup are now encouraged to use the process identified in Chapter 62-780, F.A.C. In addition, concentrations for some of the Reuse Target Levels (RTLs) listed in the original document have been changed. Consequently, this guidance document needed to be revised to implement these updates. This revision was completed on June 3, 2009 in version 2.0. The basic processes contemplated in the original document remained the same. This version of the document dated February 3, 2011, version 2.1, merely updated some statute and rule references that had changed since version 2.0 was issued.

2.0 APPLICABILITY

In general, this document only applies to old disposal sites that are inactive, i.e. no longer receiving wastes, and can normally be placed into one of three categories:

- (1) old permitted landfills that had a final cover¹ installed before July 1, 1985 without a closure permit;
- (2) old disposal sites, such as dumps, open dumps and promiscuous dumps, that were operated and closed without permits and which may have had few or no records available of their operations; and
- (3) construction and demolition (C&D) debris disposal areas which were operated and closed prior to August 2, 1989.

The application of this document to any other sites will be determined on a case-by-case basis by the Department.

For the purposes of this document, a "landfill" means a Class I, II or III landfill as it is currently defined in the Department's Solid Waste Management Facilities rule, Chapter 62-701, F.A.C. Also, C&D debris² in this document means the same as it is currently defined in Section 403.703(6), Florida Statutes (F.S.) which reads:

- (6) "Construction and demolition debris" means discarded materials generally considered to be not water-soluble and nonhazardous in nature, including, but not limited to, steel, glass, brick, concrete, asphalt roofing material, pipe, gypsum wallboard, and lumber, from the construction or destruction of a structure as part of a construction or demolition project or from the renovation of a structure, and includes rocks, soils, tree remains, trees, and other vegetative matter that normally results from land clearing or land development operations for a construction project, including such debris from construction of structures at a site remote from the construction or demolition project site. Mixing of construction and demolition debris with other types of

¹ In July 1, 1985, final cover was generally defined as a 24-inch thick soil layer placed over the wastes in the landfill.

² An additional explanation of how C&D debris wastes are defined is contained in Section 4.3.2 of this document.

solid waste will cause the resulting mixture to be classified as other than construction and demolition debris. The term also includes:

- (a) Clean cardboard, paper, plastic, wood, and metal scraps from a construction project;
- (b) Yard trash and unpainted, nontreated wood scraps and wood pallets from sources other than construction or demolition projects;
- (c) Scrap from manufacturing facilities which is the type of material generally used in construction projects and which would meet the definition of construction and demolition debris if it were generated as part of a construction or demolition project. This includes debris from the construction of manufactured homes and scrap shingles, wallboard, siding concrete, and similar materials from industrial or commercial facilities; and
- (d) De minimis amounts of other nonhazardous wastes that are generated at construction or destruction projects, provided such amounts are consistent with best management practices of the industry.

Dumps, open dumps, and promiscuous dumps were defined in earlier rules by the Department. In 1974, dumps were defined in Rule 17-7.02(7), F.A.C. as:

"Dump" is a land disposal site at which solid waste is disposed of in a manner which does not protect the environment and is exposed to the elements, vectors and scavengers.

In 1979, open dumps and promiscuous dumps were defined in Rules 17-7.02(33) and (36), F.A.C., respectively, as:

"Open Dump" means a site for the disposal of solid waste which does not comply with the criteria of Chapter 17-7, F.A.C.; and

"Promiscuous Dump" means an unauthorized site where indiscriminate deposits of solid waste are made.

3.0 GOAL

If plans are made to disturb an old landfill, the owner is required to notify the Department before beginning this activity. The basic regulatory requirements for the old, closed landfills are contained in Rule 62-701.610(1), F.A.C. and read as follows:

Use of closed landfill areas. Closed landfill areas, if disturbed, are a potential hazard to public health, ground water and the environment. The Department retains regulatory control over any activities which may affect the integrity of the environmental protection measures such as the landfill cover, drainage, liners, monitoring system, or leachate and stormwater controls.

Consultation with the Department is required prior to conducting activities at the closed landfill areas.

The goal of this document is not to impose new regulatory burdens on owners of old landfills or disposal sites but to clarify what the Department's expectations are if an old site is disturbed or used. The owners of these sites are strongly encouraged to consult with the Department prior to disturbing any of these areas or conducting any construction near or over them and to develop a plan of action that achieves the goals of the owner but is also protective of human health and the environment. To facilitate communication with the Department in these matters, a list of contacts and addresses for the Tallahassee and District offices is provided in APPENDIX A.

The remaining portions of this document describe the activities that should be conducted or considered when attempting development near or over these old sites. The Department encourages the owners of these sites to follow these recommendations.

4.0 WASTE DISTURBANCE

4.1 Waste Relocation On-site

There have been occasions when construction projects have included the on-site relocation of existing wastes (i.e., within the footprint of the original landfill disposal area) which were either known to exist at the site before construction or discovered during construction. The owner may also desire to sort uncontaminated concrete from the waste before reburial³.

In 2001, the Department revised its solid waste rule to address the relocation of these on-site wastes at closed landfills. Specifically, Rule 62-701.610(2), F.A.C., reads:

Relocation of waste. The owner of a closed landfill may request permission from the Department to move waste from one point to another within the footprint of the same solid waste disposal unit. If the landfill has a valid closure permit, the permittee shall seek a modification to reflect the relocation of waste. The Department shall approve such a request upon a demonstration that:

- (a) The activity will not cause or contribute to any leachate leakage from the landfill, and will not adversely affect the closure design of the landfill;
- (b) Any leachate, stormwater runoff, or gas which is generated by the activity is controlled on site;
- (c) Any hazardous waste which is generated by the activity will be managed in accordance with Chapter 62-730, F.A.C.;

³ Sorting materials other than uncontaminated concrete will require written approval by the Department before the sorting begins in accordance with the requirements of Section 4.4 of this document.

(d) Immediately after the activity is completed, the landfill will be covered, vegetated, and graded so as to comply with the closure requirements that apply to that landfill, which shall include a final cover of at least two feet of soil; and

(e) The appropriate District Office of the Department is notified at least seven days before the activity takes place in order to have the opportunity to inspect the site.

If the landfill has a valid closure permit, then a modification of that closure permit will be required to relocate on-site wastes. The owner of the landfill will have to demonstrate that the requirements of Rule 62-701.610(2), F.A.C. will be satisfied during the relocation activities. Uncontaminated concrete which is excavated from the disposal site and removed from the wastes may be used as a raw material or as fill material without a permit⁴, i.e. used as clean debris. But it must meet the definition of clean debris contained in Rule 62-701.200(15), F.A.C. before it can be used as fill or raw material.

If the landfill was closed before closure permits were required, then waste relocation activities may still be allowed and the Department will not require a closure permit or long-term care requirements provided the following occur.

- (a) A Relocation Plan must be submitted for review and approval to the Department's District office in the District where the disposal site is located (see contacts and addresses in APPENDIX A). At a minimum, it should include the following:
- a site map showing which waste will be removed and where it will be reburied;
 - an estimate of the total volume of wastes to be relocated and the time needed to complete the project;
 - a description of how the wastes will be excavated and relocated; and
 - a description of how odors will be minimized and how surface water and leachate resulting from the relocation activities will be controlled.
- (b) The waste must only be relocated within the original landfill or disposal site footprint⁵, and must be covered with two feet of soil, compacted and revegetated.
- (c) No off-site waste can be transported to the site and disposed of in the relocation areas.
- (d) Should any hazardous wastes be encountered, they will be managed as a hazardous waste according to Chapter 62-730, F.A.C.

⁴ For the Department's requirements on this use, see Rules 62-701.220(2)(f) and 62-701.730(15), F.A.C.

⁵ Relocation of wastes outside the original footprint is considered new disposal and may require a permit.

- (e) The only wastes to be relocated are those which are necessary to implement the construction project.
- (f) If sorting of uncontaminated concrete from the waste is planned, a description of how the sorting will be accomplished shall be provided. Uncontaminated concrete may be used as a raw material or as fill without a permit provided it meets the requirements stated above for facilities having valid closure permits.
- (g) If it is determined that the waste at the site is causing ground water contamination, then some water quality monitoring, and possibly corrective actions, will be required as described in Section 4.6.

4.2 Waste Left In-place

Waste left in-place and not disturbed, is generally subject only to the closure requirements that applied at the time the site was operated. If there are questions about these requirements, the summaries in APPENDICES B and C may provide some guidance.

Normally, no further action is required by the Department in the areas containing undisturbed waste. However, if the waste is not stabilized⁶ and the final cover is inadequate, the Department may require the soil cover be repaired (for example, at least two feet of soil cover and no areas of ponding). Also, if it is determined that the waste is causing ground water contamination, then some water quality monitoring, and possibly corrective action, will be required according to Section 4.6.

4.3 Waste Removal and Off-site Disposal

Removing the waste may be the best option to achieve unrestricted use of former disposal areas. This option may not be practical if a large area of land was used for disposal or if much of the waste was disposed of in the ground water and cannot be easily removed. In those cases, a partial removal may be appropriate. The Department must be notified prior to beginning these activities. However, a permit will not generally be required for these activities provided the work is conducted under a Department approved Excavation and Disposal Plan (see Section 4.3.1).

Uncontaminated concrete which is excavated from the disposal site and removed from the wastes may be used as a raw material or as fill material without a permit⁷, i.e. used as clean debris. But it must meet the definition of clean debris contained in Rule 62-701.200(15), F.A.C. before it can be used as fill or raw material.

⁶ Rule 62-701.200(120), F.A.C. defines stabilized to mean the "biological and chemical decomposition of the wastes has ceased or diminished to a level so that such decomposition no longer poses a pollution, health, or safety hazard."

⁷ For the Department's requirements on this use, see Rules 62-701.220(2)(f) and 62-701.730(15), F.A.C.

4.3.1 Excavation and Disposal Plan

Before beginning waste removal, an Excavation and Disposal Plan (EDP) must be submitted for review and approval to the Department's District office in the District where the disposal site is located. An EDP should include at least the following items.

- (a) Extent of Waste - The extent of the disposal area where the waste will be removed must be fully delineated as follows:
- The extent of the in-place waste disposal area must be fully delineated in both the vertical and horizontal directions. Normally this delineation can be conducted using soil borings or test pits. Other geophysical methods may also be used.
 - A site plan showing the location of the disposal area and locations of the test pits or soil borings must be provided.
 - A description of the materials found in the test pits or borings and the depths where these materials were encountered must also be provided.
 - If ground water was encountered in the pits or borings, the depth to water should be described.
- (b) Gas Concerns - To ensure there are no potential adverse effects from waste gas, a combustible gas⁸ survey of ambient air conditions must be conducted at the site before the wastes are removed and again within ninety days after removal. Combustible gases in confined spaces must not exceed twenty-five percent of the lower explosive limit of methane. Ambient air monitoring must also be conducted periodically during excavation to ensure conditions for combustible gases are not being created. In addition, before wastes are removed, soil monitoring probes must be installed where the wastes are located and sampled for combustible gases. Sampling must be conducted in the headspace of the monitoring probe without purging the gas before collecting the sample.
- (c) Waste Removal – The EDP should describe the waste removal activities planned including a description of:
- the procedures for staging wastes prior to removal and an estimate of the length of time wastes will be staged;
 - an estimate of the total volume of wastes to be removed and the time needed to complete the project;
 - the methods(s) that will be used to characterize the various types of waste encountered according to the recommendations of Section 4.3.2;
 - the procedures for handling any hazardous waste or hazardous materials should they be encountered;
 - the procedures for handling any land clearing debris should it be generated and designated for off-site disposal or recycling;

⁸ Combustible gas meters shall be calibrated to methane.

- the intended permitted disposal facility(s) for wastes removed;
- how odors and dust will be minimized and the procedures for controlling leachate from disturbed or staged waste areas prior to removal of the wastes from the site;
- if sorting of uncontaminated concrete from the waste is planned, a description of how the sorting will be accomplished shall be provided; and
- the procedures that will be used to ensure the water quality monitoring, and possibly corrective action, requirements of Section 4.6 will be followed.

4.3.2 Waste Characterizations

Before excavated waste can be disposed of off-site, it will need to be characterized to determine which method of disposal is appropriate. The waste can usually be placed into one of four categories:

- (1) a hazardous waste;
- (2) a waste suitable for disposal in a permitted Class I landfill;
- (3) a waste suitable for disposal in a permitted Class III landfill; and
- (4) C&D debris waste (if it meets the definition of C&D debris waste as described below).

In addition, some sites may involve a significant amount of land clearing operations prior to excavation of the waste. The vegetative waste generated from these land clearing operations may be suitable for disposal in a permitted Class III landfill, C&D debris facility, or a land clearing debris disposal facility.

If the excavated waste is a hazardous waste, it will need to be managed in accordance with the requirements of Chapter 62-730, F.A.C. The generator is responsible for determining if the excavated material is a hazardous waste. The Department's Hazardous Waste Regulation Section can be contacted if there are any questions about the hazardous waste determination for this material at 850/245-8790.

If the excavated material is not a hazardous waste and if it is not considered a liquid waste according to Rule 62-701.200(65), F.A.C., then it may be disposed of in a permitted Class I landfill⁹. The landfill owner/operator, however, is not required to accept this material for disposal. The generator of the waste should contact the landfill owner/operator before transporting the material to ensure it can be received at the landfill for disposal.

Some wastes may qualify for disposal in a permitted Class III landfill, provided they are not putrescible household wastes or other Class I wastes, and meet the definition of Rule 62-701.200(14), F.A.C. which reads as follows:

"Class III waste" means yard trash, construction and demolition debris, processed tires, asbestos, carpet, cardboard, paper, glass,

⁹ While not typically expected to be an option, the wastes could also be disposed of at a Waste-to-Energy (WTE) facility if the WTE facility is authorized by its permit to process it and the material is not a hazardous waste.

plastic, furniture other than appliances, or other materials approved by the Department that are not expected to produce leachate which poses a threat to public health or the environment.

Some of the wastes removed from old disposal sites may meet the definitions of the specific items listed in the rule and may be suitable for disposal in a Class III landfill if they are not contaminated with other wastes. However, the definition of Class III wastes also allows the Department to approve "other materials" for disposal in Class III landfills if the wastes are "not expected to produce leachate which poses a threat to public health or the environment." Many of the wastes from these old disposal sites may qualify for this "other materials" category at a Class III landfill¹⁰. But the burden will be on the generator to show entitlement to this determination by the Department. These determinations will be made on a case-by-case basis.

Some waste may be considered C&D debris and qualify for disposal in a C&D debris disposal facility or a Class III landfill, however, this determination may be difficult. There are essentially three tests that must be satisfied. The first two deal with the definition of C&D debris contained in Section 403.703(6), F.S., and the third deals with the problem of mixing. First, the material must be "not water-soluble and nonhazardous in nature" including a list of included materials¹¹. In other words, it must be of a certain "type." Second, the material must be "from the construction or destruction of a structure as part of a construction or demolition project," meaning that it must also be from a certain "source." Third, the law says that mixing of C&D debris with other types of waste will cause it to be classified as other than C&D debris.

Thus, for wastes from an old disposal site to be classified as C&D debris, the generator will have the burden to demonstrate that the waste met the "type" and "source" requirements and also show that it had never been mixed with other types of solid waste. If these three criteria cannot be satisfied, then the waste may not be disposed of at a C&D debris facility. However, it may still be allowed for disposal at a Class III landfill if the Department approves it as an "other material" according to Rule 62-701.200(14), F.A.C. Otherwise, it will have to be disposed of at a Class I landfill.

Vegetative waste that meets the definition of "yard trash" contained in Rule 62-701.200(135), F.A.C., may not be disposed of in a Class I landfill (see Section 403.708(12)(c), F.S.). However, it may be disposed of in a permitted Class III landfill. Yard trash may also be disposed of in a permitted C&D debris disposal facility, while land clearing debris may be disposed of in a permitted land clearing debris disposal facility. The definition of yard trash reads as follows:

¹⁰ More information can be found in policy memorandum SWM-04.39 which is available at the following web site address:

http://www.dep.state.fl.us/waste/quick_topics/publications/shw/solid_waste/policymemos/SWM-04-39.pdf

¹¹ These included materials are generally items such as: (1) steel, glass, brick, concrete, asphalt material, pipe, gypsum wallboard and lumber; (2) rocks, soils, tree remains, trees, and other vegetative matter which normally results from land clearing or land development operations for a construction project; and (3) clean cardboard, paper, plastic, wood, and metal scraps from a construction project.

"Yard trash" means vegetative matter resulting from landscaping maintenance or land clearing operations and includes materials such as tree and shrub trimmings, grass clippings, palm fronds, trees and tree stumps.

The definition of land clearing debris reads as follows:

"Land clearing debris" means rocks, soils, tree remains, trees, and other vegetative matter which normally results from land clearing or land development operations for a construction project. Land clearing debris does not include vegetative matter from lawn maintenance, commercial or residential landscape maintenance, right-of-way or easement maintenance, farming operations, nursery operations, or any other sources not related directly to a construction project.

4.4 Recycling Wastes or Vegetative Matter

In some cases, the owner of a site may wish to recycle some of the excavated waste or the vegetative matter generated during land clearing operations. This recycling might be on-site or the wastes may be sorted from non-recyclable wastes and transported off-site for recycling. If the only waste to be sorted and recycled is uncontaminated concrete, then, as stated earlier, this waste may be used as a raw material or as fill material without a permit¹², i.e. used as clean debris. But it must meet the definition of clean debris contained in Rule 62-701.200(15), F.A.C. before it can be used as fill or raw material. If other wastes are planned for sorting or recycling, then the requirements become more complicated.

If the waste is excavated and transported off-site for recycling, then it may be suitable for processing at a Waste Processing Facility¹³ (WPF). Likewise, the vegetative materials generated during the operation and transported off-site may be suitable for recycling at a yard trash processing facility.

If the excavated wastes are sorted on-site for the purpose of recycling them either on-site or at a permitted or registered facility located off-site, then the owner of the landfill will be required to obtain written approval by the Department before beginning the sorting operations. The owner must contact the Department's District office in which the landfill is located to determine the exact requirements.

A WPF that recycles the waste must have a solid waste permit to operate according to the requirements of Rule 62-701.710, F.A.C. No excavated waste should be transported to a WPF unless the facility is authorized by permit to receive this

¹² For the Department's requirements on this use, see Rules 62-701.220(2)(f) and 62-701.730(15), F.A.C.

¹³ The requirements for Waste Processing Facilities are contained in Rule 62-701.710, F.A.C.

material and the owner or operator of the WPF is willing to process it. The characterization of the waste in Section 4.3.2 of this document should help clarify if the waste can be processed by the WPF.

Yard trash¹⁴ from the site may be recycled at yard trash processing facilities. These facilities will not normally need a solid waste permit provided they meet the criteria for a yard trash processing facility in Rule 62-709.330, F.A.C. and register with the Department in accordance with Rule 62-709.320(3), F.A.C.

The excavation, on-site sorting or recycling, transportation and off-site recycling of wastes or vegetative materials may be allowed, with prior written approval by the Department, provided the following occur.

- (a) A Recycling Plan must be submitted for review and approval to the Department's District office in the District where the disposal site is located. It should include the following:
- a site map showing where the waste staging, sorting and screening areas will be located and which areas of the disposal site will be excavated;
 - an estimate of the total volume of wastes to be sorted or recycled and the time needed to complete the project;
 - a description of how the excavation will occur;
 - a description of how the recyclable wastes will be sorted from the excavated wastes including operation of the staging areas;
 - a description of how the screened waste will be managed in accordance with the recommendations of Section 4.5;
 - a description of how odors will be minimized and how surface water and leachate resulting from the excavation, staging, sorting and screening activities will be controlled;
 - a description of how dust from the recycling operation will be controlled¹⁵;
 - a description of the permitted facilities where the recyclable wastes shall be transported to and processed; and
 - a description of how the excavated areas will be back-filled, covered, compacted and revegetated.
- (b) Should any hazardous wastes be encountered, they must be managed as a hazardous waste according to Chapter 62-730, F.A.C.
- (c) If it is determined that the waste at the site is causing ground water contamination, then some water quality monitoring, and possibly corrective actions, will be required according to Section 4.6.

¹⁴ Yard trash is defined in Section 4.3.2 of this document.

¹⁵ The owner should also be aware that the Department may regulate this dust as a fugitive particulate emission. The Department's Air Section, in the District where the landfill is located, can be contacted for further details.

4.5 Use of Screened Solid Waste

Screened solid waste (SSW) refers to the fines fraction of material that is produced by screening excavated wastes. This would normally occur during the on-site recycling operations. If the wastes that are screened meet the criteria for being C&D debris wastes in Section 4.3.2, then the fines fraction generated by this screening shall be considered Recovered Screen Material (RSM) and should be managed in accordance with the Department's RSM guidance¹⁶ dated September 28, 1998 (DEP, 1998). Screened material from any other wastes shall be designated as SSW rather than RSM. For the purposes of this document, most of the screened material from recycling wastes at old disposal sites will be treated as SSW rather than RSM¹⁷.

In order to use any SSW, the owner will have to provide reasonable assurances to the Department that the proposed use is protective of human health and that applicable Department standards and criteria will not be violated. The main goals that must be accomplished for owners to use the SSW are summarized as follows:

- (a) The SSW must be managed and used so that it will not cause violations of applicable Department air, ground water, or surface water standards or criteria.
- (b) The use of the SSW must not pose a significant threat to human health, which, for the purposes of this document, means an incremental risk of no greater than 1×10^{-6} for carcinogens and a health hazard index (hazard quotient) of no greater than one (1.0) for non-carcinogens¹⁸.
- (c) The use of the SSW must not create a public nuisance.

In some cases, it will be easy to provide a satisfactory demonstration that the proposed use of the SSW will be safe. In other cases, chemical testing may be required and evaluations of the proposed uses may be more difficult. The following discussion attempts to clarify some of these issues for use in back-filling excavated areas and in off-site applications.

4.5.1 Back-filling Excavated Areas

Back-filling on-site excavated areas can be placed into two categories. The first, and easiest to address, occurs when the SSW is placed in the excavated areas of the original waste disposal footprint (above the water table), compacted, covered with two

¹⁶ This guidance can be found at the following web site address:
http://www.dep.state.fl.us/waste/quick_topics/publications/shw/solid_waste/RSMFINALTotal.pdf. In addition, memorandum SWM-21.38 has some information on arsenic sampling. It is found at:
http://www.dep.state.fl.us/waste/quick_topics/publications/shw/solid_waste/policymemos/SWM-21-38.pdf.

¹⁷ The Department assumes that it will be difficult to classify old waste as C&D debris according to the three tests in Section 4.3.2. Therefore, the screened material from these wastes should be treated as SSW rather than RSM.

¹⁸ For additional information, see Chapter 62-777, F.A.C.

feet of clean fill¹⁹ and re-vegetated. In this case, the Department considers the likelihood of direct human exposure with the SSW to be negligible. Also, since the SSW is placed within the boundaries of the original waste disposal footprint, the leachability concerns are probably similar to the waste before it was disturbed. Therefore, no further action will be required if this method of backfilling is used unless it is determined that the residual waste at the site is causing ground water contamination. Then some water quality monitoring, and possibly corrective actions, will be required according to Section 4.6.

The second category of backfilling occurs when SSW is placed on the ground surface or mixed within the top 24 inches of soil at the site (above the water table). In these cases, the owner needs to ensure that all the goals of Section 4.5 are achieved. When showing the risks from these uses will not exceed the human health risk goals of Section 4.5, Item (b), the owner may choose to conduct a separate human health risk assessment (HRA) to determine the potential risks from the proposed uses of SSW. The owner may also elect to use the Department's soil cleanup target levels (SCTLs) contained in Table II of Chapter 62-777, F.A.C. as a guide for evaluating the potential risks. To use the Department's SCTLs, the following testing will be required.

- (a) Representative discrete and composite samples shall be collected of the SSW as it will be used at the minimum frequency indicated in TABLE 1. Sampling and analysis must meet the requirements of Chapter 62-160, F.A.C. and the Department's Standard Operating Procedures.
- (b) Total analysis shall be conducted on the composite samples for the eight Resource Conservation and Recovery Act (RCRA) metals²⁰ using the approved EPA Methods and for semi-volatile organic compounds using EPA Method 8270C, and pesticides using EPA Method 8081A.
- (c) Total analysis shall be conducted on the discrete samples for volatile organic compounds using EPA Method 8260B.
- (d) The leaching potential for detected parameters in the total analyses of the samples can be estimated by comparing the total concentrations of those parameters to the Department's corresponding SCTL leachability values. To further evaluate leaching potential, the samples can also be prepared using the Synthetic Precipitation Leaching Procedure (SPLP), EPA Method 1312. The extracts prepared from this procedure can then be analyzed²¹, using the approved EPA methods with the results compared to the Department's ground water standards and criteria.

¹⁹ For the purposes of this document, "clean fill" means soil which has not become contaminated by human activity or soil which meets the "cleaned soil" criteria of Chapter 62-713, F.A.C. Soil may include other similar materials if approved by the Department.

²⁰ These metals are: arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver.

²¹ When analyzing for parameters such as sulfates and TDS, it is likely that de-ionized water will need to be used as the extraction fluid in the SPLP test rather than the extraction fluid specified in the method itself.

- (e) Laboratories conducting the analyses must be certified by an accrediting authority recognized by the National Environmental Laboratory Accreditation Program (NELAP) and must submit their results in an acceptable electronic format. Analysis of the SPLP extracts must be conducted using detection limits at or below the Department's ground water standards and criteria.

Based on the results of the above testing, possible uses for SSW can then be considered. SSW may be used as backfill on-site above the water table without further restrictions provided: (1) the total concentrations of detected chemicals are below the Department's corresponding residential direct exposure SCTLs; and (2) the detected chemicals are not expected to be a leaching concern. However, filling jurisdictional surface waters or wetlands is not allowed unless a permit specifically authorizing this use of the SSW is issued by the Department. If these conditions cannot be met, then the Department should be contacted about appropriate uses for the SSW.

4.5.2 Off-site Uses

SSW must not be used as fill material in jurisdictional surface waters or wetland unless a permit specifically authorizing this use has been issued by the Department. SSW may be suitable for use as initial and intermediate cover at permitted Class I, II or III landfills provided it meets the criteria of Rules 62-701.200(59) and (61), F.A.C. These uses of SSW may require approval by the Department's District office in the District where the disposal site is located as part of its landfill permit.

Other potential uses of SSW will depend on the chemical nature of the material. Testing similar to that contained in Section 4.5.1, Items (a) through (e) must be conducted to evaluate total and leachable concentrations of chemicals in the SSW. The Department must be consulted before using any SSW off-site from the disposal area.

4.6 Water Quality Evaluations

When wastes are removed or left in-place, water quality monitoring will generally be needed to ensure there are no adverse affects to ground water from the wastes. The actual requirements for water quality evaluations will vary depending upon the site-specific circumstances.

4.6.1 Wastes Removed

If all the wastes are removed from the site, then limited water quality sampling (usually one to three sampling events) will usually be required in the area where the wastes were previously disposed to determine if there are any violations of the Department's water quality standards or criteria. The Department recommends preparing a Preliminary Contamination Assessment Plan (PCAP) and getting it approved by the Department. After conducting the activities in the PCAP, then a Preliminary Contamination Assessment Report (PCAR) must be prepared for review by

the Department. If the PCAR demonstrates that no water quality violations are occurring, then no further testing will be required. A description of the tasks required for developing PCAPs and PCARs is included in APPENDIX D.

If the PCAR demonstrates that water quality violations are occurring at the site, then further work will be required. Depending on the level of the contamination and the nature of the site, the Department may allow the owner to initiate a Monitoring Only Plan (MOP) and simply monitor the level of ground water contamination. As an alternative, the Department may require the owner to conduct additional assessment to evaluate the extent of the contamination and based on the results of that additional assessment then implement some form of remedial action. The remedial action may be simply to continue monitoring the site for some period of time, or it may require some ground water control and treatment. The actual requirements are determined on a case-by-case basis. When it is determined that additional assessment is needed, the process described in Chapter 62-780, F.A.C. should be followed.

4.6.2 Wastes Left In-place

If the wastes are left in place or only partially removed, then monitoring of the water quality at the site for some period of time will be required. The Department may allow monitoring wells to be installed according to the PCAP and PCAR requirements described in Section 4.6.1 and then require these wells be sampled for a period of time. As an alternative, the Department may require a Ground Water Monitoring Plan (GWMP) according to the requirements of Rule 62-520.600, F.A.C. and have the wells installed under this plan monitored for a period of time. In either case, the owner must contact the Department to determine which approach will be required. The duration of the monitoring will depend on the site-specific conditions and the results of the water quality testing. If it is determined by the Department that water quality violations are not occurring at the site, then no further water quality evaluations will be required.

If sampling results from the PCAP or the GWMP show there are violations of the Department's water quality standards or criteria, then further work will be required. The owner must follow the additional assessment procedures described in Section 4.6.1 to evaluate the extent of the contamination. Based on the results of the additional assessment, the owner will then be required to implement some form of remedial action. This may be simply to continue monitoring the site for some period of time, or it may require some ground water control and treatment. The actual requirements are determined on a case-by-case basis.

5.0 CONSTRUCTION NEAR WASTE-FILLED AREAS

There have been occasions where construction projects were conducted near old disposal sites without actually disturbing the wastes. The Department encourages caution be used when planning and implementing these projects since their proximity to old disposal areas may result in unacceptable risks to human health and the

environment. At a minimum, the Department encourages implementation of the following recommendations:

- (a) a combustible gas²² survey of ambient air conditions should be conducted periodically at the project site to ensure combustible gases from the disposal area are not exceeding twenty-five percent of their lower explosive limit in structures;
- (b) soil monitoring probes should be installed between the proposed construction and the waste-filled areas to ensure combustible gases exceeding their lower explosive limit are not moving from the disposal area;
- (c) any structures located near the disposal areas which could be impacted by combustible gas should be designed with good ventilation and with explosion proof electrical wiring;
- (d) access to the disposal site should be restricted; and
- (e) shallow potable water wells and irrigation wells should not be installed within 500 feet of the waste-filled areas unless it is confirmed there are no adverse affects to ground water from the wastes in the disposal area.

6.0 CONSTRUCTION OVER WASTE-FILLED AREAS

The appropriate District office must be consulted before any construction activity is conducted over an old disposal site. The goals of this consultation are to ensure that the integrity of the environmental protection measures of the disposal area is not adversely impacted and to protect the health and safety of individuals who may be using the disposal area.

6.1 Cautions For Construction

When considering construction projects over old disposal sites, the Department recommends the following guidelines be used.

- (a) The Department strongly discourages the construction of residential structures over old waste-filled areas. Instances of landfill gas seeping into the structures and structural settlement problems are well documented difficulties with this use of old disposal sites.
- (b) Any construction projects should consider potential impacts from combustible gas. Inside structures, combustible gases must not exceed twenty-five percent of the lower explosive limit for methane. Any structures located on disposal areas must be designed with good ventilation and with explosion proof electrical wiring. Enclosed ground level and underground structures should be avoided

²² Combustible gas meters shall be calibrated to methane.

- unless designed with adequate protection against landfill gas intrusion and accumulation.
- (c) If the construction project may cause combustible gas to migrate off-site, then gas monitoring on a quarterly basis will be required in soil monitoring probes according to Rule 62-701.530(2), F.A.C., i.e., along the property boundary.
 - (d) If any waste is disturbed because of the construction project, then the guidelines in Section 4.0 should be followed, as appropriate.
 - (e) When planning the construction, concentrated weight loading should be avoided, if possible, to prevent uneven settlement of the underlying wastes. Also, disturbance of the landfill cover or barriers should be minimized or avoided when structures are built, particularly if pilings are used. Any disturbance of the cover or barrier must be repaired.
 - (f) Irrigation systems, if installed, must be designed to minimize disturbance to the underlying waste-filled areas and must not withdraw water from areas where ground water may be contaminated.
 - (g) Surface water management systems must not be located over contaminated areas or over waste-filled areas unless they are lined. Also, an Environmental Resource Permit from the Department will be required prior to constructing a surface water system.
 - (h) The disposal site must be maintained. For example, areas that have settled must be filled with clean fill to minimize leachate generation due to rainfall and irrigation and to protect individuals who may walk or play on the site.
 - (i) The landfill cover must be maintained to prevent human contact with the underlying waste materials.
 - (j) Care must be taken during any waste relocation, construction or recreational activities to prevent damage to ground water monitoring and gas monitoring systems.
 - (k) Underground utilities and similar installations that are placed within 200 feet of, or across, any side of the filled areas should be avoided. If they cannot be avoided and if combustible gases are being generated, then a properly located gas barrier or ventilation system must be placed at each waste boundary which is crossed by the utility line to prevent the landfill gas from migrating along the utility line to off-site structures.

6.2 Alternate Uses of Disposal Areas

Some creative alternate uses of closed landfills and old disposal areas have been implemented in recent years. One very successful use is the creation of recreational facilities. Facilities such as ball parks, soccer fields, hiking trails, golf courses and golf driving ranges appear to be acceptable and successful land uses for these old sites. The Department prefers these types of uses be selected for an old site rather than the construction of structures such as residential housing or educational facilities.

Before beginning one of these projects, the owner must develop construction plans and a detailed description of the project and present these for review to the Department's District office where the project is located. A list of contacts and addresses for these offices is provided in APPENDIX A.

In most cases, a permit will not be required, except for an Environmental Resource Permit addressing the surface water control system. The construction plans must show the major features of the project including locations of: waste disposal areas, on-site structures, the surface water management system, irrigation systems and planned utility lines. The description of the project must include how the recommendations for waste disturbance in Section 4.0 will be addressed. It must also address the recommendations of Sections 5.0 and 6.1.

REFERENCES

DEP (Florida Department of Environmental Protection), 1998, Guidelines For The Management Of Recovered Screen Material From C&D Debris Recycling Facilities in Florida, Department of Environmental Protection, Solid Waste Section, Tallahassee, Florida, September 28.

Table 1. Minimum Number of Soil Samples Required

Amount of Soil by Volume, yd ³	Amount of Soil by Weight, tons	Number of Discrete Samples Required for Volatile Organics	Number of Composite Samples Required for non-Volatile Organics
<100	<140	1	1
100 to <500	140 to <700	3	3
500 to <1000	700 to <1400	5	5
For each additional 500 yd ³	For each additional 700 tons	1	1

APPENDIX A

Department Solid Waste Contacts and Addresses

DEPARTMENT OF ENVIRONMENTAL PROTECTION
SOLID WASTE CONTACTS
(updated 08/18/2015)

Northwest District:	Dawn Templin, Professional Engineer Department of Environmental Protection 160 Governmental Center, Suite 308 Pensacola, Florida 32502-5794 850/595-0644 Dawn.Templin@dep.state.fl.us
Northeast District:	Rick Rachal, Program Administrator Department of Environmental Protection 8800 Baymeadows Way West Jacksonville, Florida 32256-7590 904/256-1543 Richard.Rachal@dep.state.fl.us
Central District:	Tom Lubozynski, Environmental Administrator Department of Environmental Protection 3319 Maguire Blvd., Suite 232 Orlando, Florida 32803-3767 407/897-4300 Tom.Lubozynski@dep.state.fl.us
Southwest District:	Steve Morgan, Permitting Manager Department of Environmental Protection 13051 N. Telecom Parkway Temple Terrace, Florida 33637-0926 813/470-5754 Steve.Morgan@dep.state.fl.us
Southeast District:	Amede Dimonnay, Environmental Specialist Department of Environmental Protection 3301 Gun Club Road / MSC7210-1 West Palm Beach, Florida 33406 561/681-6672 Amede.Dimonnay@dep.state.fl.us
South District:	Jennifer Carpenter, Assistant Director Department of Environmental Protection 2295 Victoria Avenue, Suite 364 Fort Myers, Florida 33901-3881 239/344-5676 Jennifer.Carpenter@dep.state.fl.us
Tallahassee:	Richard Tedder, Environmental Administrator Department of Environmental Protection 2600 Blair Stone Road, MS# 4565 Tallahassee, Florida 32399-2400 850/245-8735 Richard.Tedder@dep.state.fl.us

APPENDIX B

**Partial Summary of Landfill Permit, Closure
and Long-term Care Requirements**

PARTIAL SUMMARY OF LANDFILL PERMIT, CLOSURE AND LONG-TERM CARE REQUIREMENTS

(June 30, 2000)

AGENCY "CHAPTER TITLE"	GENERAL DESCRIPTION OF REQUIREMENTS
<p>Dept. of Health and Rehabilitative Services Chapter 10D-12, "Garbage and Rubbish" October 20, 1964</p>	<p><u>Permit:</u></p> <ul style="list-style-type: none"> • None, but an operational work plan approval by the Division of Health was required before receiving waste. <p><u>Ground Water Monitoring:</u></p> <ul style="list-style-type: none"> • None. <p><u>Closure Design:</u></p> <ul style="list-style-type: none"> • Final cover depth of 24 inches of compacted earth. • 2:1 slopes were allowed. <p><u>Long-term Care:</u></p> <ul style="list-style-type: none"> • Maintenance program required to assure prompt repair of cracks, depressions and erosion of the surface and side slopes until the site stabilized.
<p>Dept. of Pollution Control Chapter 17-7, "Resource Recovery and Management Part I: Solid Waste Facilities" October 1, 1974</p>	<p><u>Landfill Permit:</u></p> <ul style="list-style-type: none"> • Permit required after January 1, 1975 to operate, maintain, construct, expand or modify a landfill. • No permits required for closure. • Normal farming operations and persons who dispose of solid waste resulting from their own activities on their own property are specifically exempted from permitting provided no public nuisance or conditions adversely affecting public health is caused and provided the activity does not violate other rules, laws or ordinances. <p><u>Ground Water Monitoring:</u></p> <ul style="list-style-type: none"> • Not required, but the Department had the option to require it at the time of design approval or if ground water contamination was suspected. <p><u>Landfill Closure Design:</u></p> <ul style="list-style-type: none"> • Two feet of earth compacted in 6 inch layers with the top 6 inch layer loosely compacted to promote plant growth. • Side slopes for landfills \geq five feet above grade to be covered with 3.5 feet of compacted earth cover. • Slopes no greater than 3:1 required (2:1 slopes no longer allowed). <p><u>Dump Closure:</u></p> <ul style="list-style-type: none"> • Dumps required to be eliminated or converted to "sanitary landfills" by July 1, 1977. • Dumps were closed by controlling access, taking steps to divert surface water around the site, removing wastes from the water table, and seeding or planting grass to minimize erosion. • No final cover requirement mentioned. <p><u>Long-term Care:</u></p> <ul style="list-style-type: none"> • None.

PARTIAL SUMMARY OF LANDFILL PERMIT, CLOSURE AND LONG-TERM CARE REQUIREMENTS

(June 30, 2000)

AGENCY "CHAPTER TITLE"	GENERAL DESCRIPTION OF REQUIREMENTS
Dept. of Environmental Regulation Chapter 17-7, "Resource Recovery and Management Part I: Solid Waste Facilities" May 25, 1979	<u>Permit:</u> <ul style="list-style-type: none"> • No landfill to be operated, maintained, constructed, expanded, or modified without a valid Department permit. • No permits required for closure. <u>Ground Water Monitoring (by 9 months from eff. date, ~ 2/25/80):</u> <ul style="list-style-type: none"> • Class I landfills required to have a minimum of three monitoring wells. Class II landfills are required to have at least one. • Wells required to be sampled at least every six months for various indicator parameters. <u>Closure Design (for sanitary landfills and open dumps):</u> <ul style="list-style-type: none"> • Two feet of earth compacted in 6 inch layers with the top 6 inch layer loosely compacted to promote plant growth, slopes no greater than 3 to 1. • Site access controlled. • Site seeded or planted with grass or suitable vegetation. <u>Long-term Care:</u> <ul style="list-style-type: none"> • Site to be maintained until stabilized by controlling erosion, maintaining grass cover, prevention of ponding, and prevention of deposited wastes from becoming a hazard or nuisance. • Landfill to be monitored, including collection and treatment of leachates, until the site is stabilized.
Dept. of Environmental Regulation Chapter 17-4 January 1, 1983 (aka: Ground Water Rule)	<u>Ground Water Monitoring:</u> <ul style="list-style-type: none"> • Landfills (domestic or industrial) which are "existing installations" required to submit a ground water monitoring plan by May 1983. • New landfills required to submit a ground water monitoring plan in conjunction with their permit applications.
Dept. of Environmental Regulation Chapter 17-7, "Resource Recovery and Management Part I: Solid Waste Facilities" July 1, 1985	<u>Permit:</u> <ul style="list-style-type: none"> • No landfill to be operated, maintained, constructed, expanded, modified or closed without a valid Department permit. • For the first time, permits were required for closure of Class I, II or III landfills and applied to all landfills receiving waste, portions of landfills not having final cover and all future landfills requiring solid waste permits (but see exceptions in next bullet). • Closure permit requirements did not apply to: (1) a person disposing of their own waste on their own property; (2) any disposal of C&D debris; and (3) a Class I, II or III landfill which had a modification of an operation permit to close or a closure plan approved by the Department by July 1, 1985. <u>Ground Water Monitoring:</u> <ul style="list-style-type: none"> • Monitoring to be in accordance with Rules 17-3.401, 17-4.245 and 17-4.246. <u>Closure Design:</u> <ul style="list-style-type: none"> • Barrier layer must be a geomembrane, soils or chemically/physically amended soils. Minimum final cover thickness must be two feet of soils or one foot of soils plus a geomembrane or soil admixture. <u>Long-term Care:</u> <ul style="list-style-type: none"> • 20 year long-term care period. • Landfill to be monitored and maintained after closure in accordance with approved closure plan. • Language on "use of closed landfill areas" added to rule. Consultation with the Department required before conducting activities at a closed landfill. • Language providing guidance for "construction on closed landfill" areas added to rule.

PARTIAL SUMMARY OF LANDFILL PERMIT, CLOSURE AND LONG-TERM CARE REQUIREMENTS

(June 30, 2000)

AGENCY "CHAPTER TITLE"	GENERAL DESCRIPTION OF REQUIREMENTS
Dept. of Environmental Regulation Chapter 17-701, "Solid Waste Management Facilities" July 19, 1990	<u>Permit:</u> <ul style="list-style-type: none"> • The on-site exemption from permitting by persons disposing of their own waste on their own property is modified. It applies only if: (1) the waste is from their residential property; or (2) is rocks, soils trees, tree remains and other vegetative matter which normally results from land clearing operations; or (3) the environmental effects of the disposal on ground water and surface water are addressed in a permit, site certification or ground water monitoring plan approved by the Department.
Dept. of Environmental Regulation Chapter 17-701, "Solid Waste Management Facilities" January 6, 1993	<u>Ground Water Monitoring:</u> <ul style="list-style-type: none"> • Downgradient well spacing no greater than 500 feet. Upgradient well spacing no greater than 1500 feet. • Specific leachate and surface water sampling added. • Monitoring parameters detailed including addition of EPA Method 601/602 parameters. • Added language for consistency with Federal Subtitle D requirements including detection wells and assessment monitoring with corrective action. <u>Closure Design:</u> <ul style="list-style-type: none"> • If a soil barrier layer is used, it must be 18 inches thick and covered by another 18 inches of soil. The soil barrier layer must have a minimum hydraulic conductivity of 1×10^{-5} cm/sec for Class III landfills or 1×10^{-7} cm/sec for Class I landfills. If a geomembrane is used, it must be covered by a 24-inch thick soil layer. <u>Long-term Care:</u> <ul style="list-style-type: none"> • 30 year long-term care period, per Subtitle D requirements. • Landfill to be monitored and maintained after closure in accordance with approved closure plan. • Language providing guidance for "construction on closed landfill" areas removed from the rule. Language on "use of closed landfill areas" remained in the rule.
Dept. of Environmental Regulation Chapter 17-701, "Solid Waste Management Facilities" January 2, 1994	<u>Ground Water Monitoring:</u> <ul style="list-style-type: none"> • Added requirements for APPENDIX I and II analyses in accordance with Subtitle D requirements. <u>Closure Design:</u> <ul style="list-style-type: none"> • Added language for consistency with Federal Subtitle D requirements. This included requiring a geomembrane in the cap if it was also used in the bottom liner system (bathtub effect), and allowed for alternate closure designs if the applicant could show a substantially equivalent rate of storm water infiltration with the alternate design.
Dept. of Environmental Protection Chapter 62-701, "Solid Waste Management Facilities" May 27, 2001	Current rule. No additional changes to closure requirements. Earlier, the chapter title was changed because of the DER/DNR merger to form DEP. The current rule also included the "rule reduction" exercise.

APPENDIX C

**Partial Summary of Construction and Demolition (C&D) Debris
Permit, Closure and Long-term Care Requirements**

**PARTIAL SUMMARY OF CONSTRUCTION AND
DEMOLITION (C&D) DEBRIS FACILITY PERMIT,
CLOSURE AND LONG-TERM CARE REQUIREMENTS**

(June 30, 2000)

AGENCY "CHAPTER TITLE"	GENERAL DESCRIPTION OF REQUIREMENTS
<p>Dept. of Environmental Regulation Chapter 17-7, "Resource Recovery and Management Part I: Solid Waste Facilities" May 25, 1979</p>	<p><u>Permit:</u></p> <ul style="list-style-type: none"> • First time the definition of C&D Debris appears in the rule. • All C&D disposal sites are specifically exempted from permitting provided no public nuisance or conditions adversely affecting public health is caused and provided the activity does not violate other rules, laws or ordinances. <p><u>Ground Water Monitoring:</u></p> <ul style="list-style-type: none"> • None. <p><u>Closure Design:</u></p> <ul style="list-style-type: none"> • None. <p><u>Long-term Care:</u></p> <ul style="list-style-type: none"> • None.
<p>Dept. of Environmental Regulation Chapter 17-701, "Solid Waste Management Facilities" August 2, 1989</p>	<p><u>Permit:</u></p> <ul style="list-style-type: none"> • General permits now required for off-site disposal of C&D debris, but on-site disposal is still exempt from permitting. • New C&D facilities have to comply by the effective date of rule. • Existing C&D facilities have to comply within 90 days of the effective date or ~November 2, 1989. <p><u>Ground Water Monitoring:</u></p> <ul style="list-style-type: none"> • None. <p><u>Closure Design (both on-site and off-site disposal areas):</u></p> <ul style="list-style-type: none"> • Final cover with a 24-inch thick soil layer required with upper six inches capable of supporting vegetation and graded to eliminate ponding, promote drainage and minimize erosion. <p><u>Long-term Care:</u></p> <ul style="list-style-type: none"> • None.
<p>Dept. of Environmental Protection Chapter 62-701, "Solid Waste Management Facilities" April 23, 1997</p>	<p><u>Permit:</u></p> <ul style="list-style-type: none"> • Regular permits now required for construction or operation (but not for closure) of an off-site C&D disposal facility. • General permits still allowed for off-site disposal of land clearing debris. • On-site disposal is still exempt from permitting provided the site is properly closed. <p><u>Ground Water Monitoring:</u></p> <ul style="list-style-type: none"> • Limited ground water monitoring required for off-site C&D disposal facilities but not for land clearing debris sites. • C&D disposal facilities required to have ground water monitoring plans in place by July 1, 1998. <p><u>Long-term Care:</u></p> <ul style="list-style-type: none"> • C&D disposal facilities to be maintained and monitored (ground water) for five years from the date of closing.

APPENDIX D

Preliminary Contamination Assessment Actions

PRELIMINARY CONTAMINATION ASSESSMENT ACTIONS

1. The owner of the disposal facility, hereinafter referred to as the "Respondent", shall submit to the Department as part of any assessment report documents certification that the organization(s) and laboratory(s) performing the sampling and analysis have used procedures approved by the Department. All field sampling activities and field measurements shall follow the applicable procedures and requirements described in the most current version of DEP-SOP-001/01, per Rule 62-160.210, Florida Administrative Code (F.A.C.). Laboratories conducting analysis must be NELAP certified.

2. Within sixty (60) days of written authorization from the Department, Respondent shall submit a Preliminary Contamination Assessment Plan ("PCAP") to the Department. Applicable portions of the PCAP shall be signed and sealed by an appropriate professional. The PCAP shall describe the tasks that Respondent proposes to perform in order to determine whether the soil, sediment, surface water or ground water are contaminated at Respondent's facility; and, if so, whether such contamination has resulted in a violation of the water quality standards and minimum criteria established in Chapters 62-520 and 62-302, F.A.C. or constitutes a risk to the public health, the environment, or the public welfare. The PCAP shall include a time schedule for each task so that all tasks can be completed and a Preliminary Contamination Assessment Report ("PCAR") can be submitted to the Department within ninety (90) days of approval of the PCAP by the Department.

3. The PCAP shall include provisions for the installation and sampling of, in most cases, a minimum of four (4) monitor wells to determine the groundwater quality and flow direction at the site. Proposal of fewer wells or an alternate well configuration is subject to Department approval. Provision to sample surface waters, sediments and soils shall be included as necessary.

A. One of the wells shall be located in the area suspected of greatest contamination and two wells shall be located downgradient of the area suspected of highest contamination.

B. One of the wells shall be an unaffected background well.

C. The wells, surface waters, sediments and soils, as applicable, shall be sampled and analyzed for the following parameters with the listed method:

- (1) priority pollutant metals using Department approved Methods;
- (2) priority pollutant organic chemicals using EPA methods 624/8240 and 625/8250 or 8270;
- (3) all non-priority pollutant organic chemicals with peaks greater than 10 micrograms per liter (ug/l) using EPA methods 624/8240 and 625/8250 or 8270;
- (4) pesticides and herbicides using EPA methods 8080, 8140, 8150 or 625/8250 or 8270, if applicable, or other Department approved methods for pesticides and herbicides for which the listed methods are not applicable; and,
- (5) others, as applicable.

The proposal of any alternate analytical methods is subject to approval by the Department. The number of contaminants to be analyzed may be reduced if Respondent can demonstrate to the Department's satisfaction that the contaminants proposed to be deleted from the list cannot be attributed to any activities that have taken place at Respondent's facility. The Department shall submit written notification to the Respondent if the number can be reduced.

4. The PCAP shall include provisions for investigation of the following conditions, as applicable, at the disposal site and the surrounding area:
 - A. the presence and thickness of any free product at the site;
 - B. the presence of soil contamination at the site;
 - C. the aquifers present beneath the site and their Chapter 62-502, F.A.C, groundwater classification;
 - D. the number and locations of all public and private potable supply wells within a 1/2 mile radius of the site;
 - E. the presence of surface waters of the State within a 1/2 mile radius of the site and, if applicable, their Rule 62-302, F.A.C., classification; and,
 - F. the geology and hydrogeology of the site focusing on aquifers and confining units which are present, the potential for movement of contaminants both horizontally and vertically, zones that are likely to be affected, and actual and potential uses of the groundwater as a resource.

5. The PCAP shall contain the following site specific information:
 - A. proposed well construction details including methods and materials, well installation depths and screened intervals and well development procedures;
 - B. a description of methods and equipment to be used to quantify soil and sediment contamination;
 - C. a description of water sampling methods;
 - D. name of laboratory to be used for analytical work;
 - E. the parameters to be analyzed for, the analytical methods to be used and the detection limits of these analytical methods;
 - F. site map depicting monitoring well locations and other proposed sampling sites and justification for their selection; and,
 - G. a detailed site history including: a description of past and present property and/or facility owners; a description of past and present operations; a summary of current and past environmental permits; and a summary of known spills or releases of materials which may be potential pollution sources.

6. The Department shall review the PCAP and provide Respondent with a written response to the proposal. In the event that additional information is necessary for the Department to evaluate the PCAP, the Department shall make a written request to Respondent for the information and Respondent shall provide the requested information within sixty (60) days from receipt of said request. The PCAP shall incorporate all required modifications to the PCAP identified by the Department. Any action taken by Respondent with regard to the implementation of the PCAP prior to the Respondent

receiving written notification from the Department that the PCAP has been approved shall be at Respondent's risk.

7. Within (90) days of the Department's approval of the PCAP (unless a written time extension is granted by the Department), Respondent shall submit a written Preliminary Contamination Assessment Report ("PCAR") to the Department. Applicable portions of the PCAR shall be signed and sealed by an appropriate professional. The PCAR shall:

- A. summarize and analyze all "PCAP" tasks;
- B. include, but not be limited to, the following tables and figures:
 - (1) a table with well construction details, top of casing elevation, depth to water measurements, and water elevations;
 - (2) a site map showing water elevations, water table contours and the groundwater flow direction for each aquifer monitored for each sampling period;
 - (3) a table with water quality information for all monitor wells;
 - (4) site maps showing contaminant concentrations and contours of the contaminants; and,
 - (5) cross sections depicting the geology of the site at least to the top of the confining unit. In general there should be at least one north to south cross section and one east to west cross section.
- C. include copies of field notes pertaining to field procedures, particularly of data collection procedures;
- D. specify results and conclusions regarding the objectives of the Preliminary Contamination Assessment;
- E. identify, to the extent possible, the source(s), extent, and concentrations of contaminants, and the existence of any imminent hazards; and,
- F. provide the following quality assurance data along with the analytical data from all media:
 - (1) dates of sample collection, sample preparation including extraction and sample analysis;
 - (2) the detection limits for these analyses;
 - (3) the results from the analyses of field quality control samples; including field equipments, trip blanks and duplicates;
 - (4) the results from reagent water blanks run on that day (5 percent of samples run, minimum);
 - (5) the spike and surrogate percent recoveries for the data set;
 - (6) the actual chromatograms, if requested by the Department;
 - (7) any other QA/QC information Department deems necessary to evaluate validity of the submitted data; and,
 - (8) a water quality data Electronic Data Deliverable (EDD) of the results in an electronic format consistent with requirements for running the data through Florida DEP Automated Data Processing Tool (ADaPT) and importing the data into the Department's databases.

8. The Department shall review the PCAR and determine whether it is adequate to meet the objectives of the PCAP. In the event that additional information is necessary

to evaluate the PCAR, the Department shall make a written request and Respondent shall provide all requested information within sixty (60) days of receipt of said request.

9. Respondent shall provide notification to the Department at least twenty (20) days prior to the installation or sampling of any monitoring wells, and shall allow Department personnel the opportunity to observe installation and sampling and to take split samples. All necessary approvals must be obtained from the appropriate Water Management District before any wells are installed. Raw data shall be exchanged between Respondent and the Department as soon as the data is available.

10. The Respondent is required to comply with all local, state and federal regulations and to obtain any necessary approvals from local, state and federal authorities in carrying out these assessment actions.

11. If the Department's review of the PCAR indicates that the site is not contaminated and does not constitute a risk to the public health or the environment the Department will so notify the Respondent in writing.

12. If the Department's review of the PCAR indicates that the soil, sediments, surface water or ground water is contaminated, or constitutes a risk to the public health, the environment, or the public welfare, the Respondent will be required to initiate risk based corrective actions as required by Chapter 62-780, F.A.C.