
IFB NO. Y19-744-RC

ISSUED: March 1, 2018

INVITATION FOR BIDS

FOR

MAGNOLIA PARK & ECO- TOURISM UTILITY EXTENSION

**PART H
TECHNICAL SPECIFICATIONS**

**PART H
Volume II**

.....

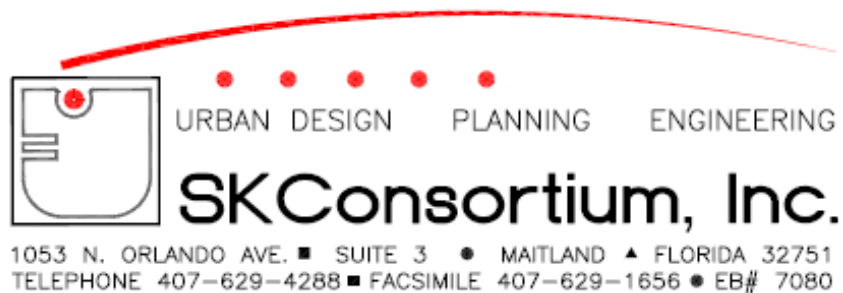
PROJECT MANUAL INCLUDING
SPECIFICATIONS FOR CONSTRUCTION OF:
**Magnolia Park & Eco-Tourism Center
Utility Extension**



ORANGE COUNTY, FLORIDA

Bid & Permit Set

Jan 19, 2018



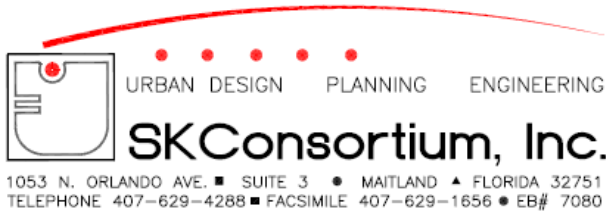


TABLE OF CONTENTS

ORANGE COUNTY-Magnolia Park Eco-Tourism Center Utility Extension

DIVISION 1

- Section 01001
- Section 01005
- Section 01010
- Section 01027
- Section 01035
- Section 01040
- Section 01045
- Section 01070
- Section 01095
- Section 01200
- Section 01300
- Section 01410
- Section 01500
- Section 01600
- Section 01631
- Section 01700
- Section 01740

GENERAL REQUIREMENTS

- Project Directory
- Administrative Provisions
- Summary of the Work
- Application for Payment
- Modification Procedures
- Project Coordination
- Cutting & Patching
- Abbreviations
- Reference Standards and Defenitions
- Project Meetings
- Submittals
- Testing Laboratory Services
- Temporary Facilities
- Materials and Equipment
- Products Substitutions
- Project Close-out
- Warranties and Bonds

DIVISION 2

- Section 02110
- Section 02200
- Section 02210
- Section 02214
- Section 02270
- Section 02510
- Section 02511
- Section 02512
- Section 02513
- Section 02520
- Section 02580
- Section 02666
- Section 02730
- Section 02831
- Section 02910
- Section 02920

SITE WORK

- Site Clearing
- Earthwork
- Earthwork - Underground Utilities
- Pavement Removal and Replacement
- Erosion & Sedimentation
- Subgrade Stabilization
- Soil Cement
- Limerock
- Asphalt Concrete Paving
- Portland Cement Concrete Paving
- Concrete Curbs and Walks
- Potable Water Systems
- Sanitary Sewage Systems
- Chainlink Fence
- Sewage Force Mains
- Sewage Pump Station - Duplex Submersible

DIVISION 26

ELECTRICAL

Section 26 05 00	Common Work for Electrical
Section 26 05 19	Low Voltage Electrical Power Conductors and Cables
Section 26 05 26	Grounding and Bonding for Electrical Systems
Section 26 05 33	Raceways and Boxes for Electrical Systems
Section 26 05 53	Identification for Electrical Systems
Section 26 24 16	Panelboards
Section 26 27 13	Electricity Metering
Section 26 27 26	Wiring Devices
Section 26 28 16	Enclosed Switches and Circuit Breakers

END – TOC

ORANGE COUNTY – Magnolia Park and Eco-Tourism Center Utility Extension

SECTION 01001 - PROJECT DIRECTORY

Prime Consultant/Civil Eng.

S.K. Consortium, Inc.
1053 North Orlando Avenue
Suite 3
Maitland, Florida 32751
(407) 629-4288 / Fax (407) 629-1656

Electrical Engineer

Bobes Associates
150 Circle Drive
Maitland, FL 32751
(407) 628-0882

END SECTION - 01001

SECTION 01005-ADMINISTRATIVE PROVISIONS

PART I GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

- A. Work of this Contract comprises of providing sanitary sewer and water service to existing facilities at Magnolia Park, including related construction work to produce a complete and functional facility

1.02 CONTRACT METHOD

- A. Construct the work under a single lump sum contract (or as otherwise defined in bid documents).

1.03 COORDINATION

- A. Coordinate work of the various Sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.
- B. Verify characteristics of elements of interrelated operating equipment are compatible; coordinate work of various Sections having interdependent responsibilities for installing, connecting to and placing in service such equipment. Differences shall be brought to the Owner's attention during bid process or remain the responsibility of the Contractor.
- C. Coordinate space requirements and installation of items, such as but not limited to, mechanical, plumbing, systems and electrical work, which are indicated diagrammatically or otherwise on drawings. Follow routing shown for pipes, ducts and conduits, as closely as practicable; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for facility maintenance and for future repairs.
- D. In finished areas (except as otherwise shown), conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Execute cutting and patching to integrate elements of work, uncover ill timed, defective and nonconforming work, provide openings for penetrations of existing surfaces and provide samples as specified in individual sections for testing. Seal penetrations through floors, walls and ceilings, and fire safe where necessary as part of the lump sum price.

1.04 FIELD ENGINEERING SURVEYING

- A. Provide field engineering surveying services; establish grades, lines and levels, by use of engineering survey practices recognized as standard by the survey industry. Said work shall be required to be provided by a Professional Land

Surveyor, registered as such in the State of Florida.

B. "ARTICLE 7 - REFERENCE POINTS

Unforeseen Subsurface Conditions: The Contractor will promptly notify the Project Manager in writing of any subsurface or latent physical conditions at the site which may differ materially from those indicated in the Contract Documents. The Project Manager will promptly investigate those conditions and advise the Contractor in writing if further surveys or subsurface tests are necessary. Promptly thereafter, if needed, the Project Manager will obtain the necessary additional surveys and tests and furnish copies to the Contractor. If the Project Manager finds that the results of such surveys or tests indicate subsurface or latent physical conditions differing significantly from those indicated in the Contract Documents, a Change Order shall be issued incorporating the necessary revisions, in accordance with Article 12.

Reference Points: The Contractor shall be responsible for all field survey work coincidental with completion of this Work as specified herein. All survey work shall be done under the supervision of a Registered Professional Surveyor and Mapper. The County shall furnish, one time, a set of permanent reference markers along the line of work to form the basis for the above Contractor's survey.

All Section Corners and corners falling within the limits of this Work shall be perpetuated by a Florida Registered Surveyor and Mapper.

- A. All such corners falling within or on the boundaries of this project shall have reference ties made, certified to and submitted to the County Surveyor, Orange County, Florida, prior to the commencing of construction.
- B. Upon completion of construction and prior to Final Completion, certified corner records shall be submitted to the Department of Natural Resources in compliance with Florida Statutes, Chapter 177.507 and a copy of said certified corner record shall also be submitted to the Orange County Surveyor. Said corner records shall reflect the corner as perpetuated and which shall meet these minimum standards.
 1. If the corner falls in asphalt or concrete construction, the corner shall be a 2 1/4" metal disc marked according to standard government practices and set in concrete no less than 18" in depth and shall be encased in an adjustable 5 1/4" diameter or larger valve box raised to the finished surface of construction.
 2. If the corner falls at any other location, it shall be a 4" x 4" concrete monument no less than 23" long with a 2 1/4" metal disc marked according to standard government practices. The top of said monument shall be set flush with the ground ($\pm 0.5'$ depending on conditions).
- C. Any U.S.C. and G.S. monument within limits of construction are to be protected. If monuments are in danger of damage, the Contractor shall contact the Project Manager and the Orange County Surveyor prior to the

commencing of construction.

- D. Payment for all necessary survey work shall be included in the bid as part of other items of work.”

1.05 REFERENCE STANDARDS

- A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. The date of the standard is that in effect when a specified date is specified and if no date is specified, use the latest edition.
- C. Obtain copies of referenced standards listed in individual specification sections. Maintain copy at job site during progress of the specific work.

END OF SECTION 01005

SECTION 01010-SUMMARY OF WORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 PROJECT DESCRIPTION

- A. Performance of all tasks specified in the contract documents shall be the responsibility of the contractor unless specified otherwise. The description of the project is as follows: Placement of sanitary sewer collection and transmission system including lift station and force and gravity main, and provisions for extension of drinking water system to Magnolia Park to serve existing and future Eco-Tourism Center. Incidental work will include provisions for site clearing and tree removal, removal and replacement of pavement, directional bore under pavement, coordination with City of Apopka, and Orange County.

1.03 WORK UNDER OTHER CONTRACTS

- A. Separate contracts may be issued to perform certain construction operations at the site.

1.04 BUILDING/SITE SECURITY

- A. The site shall be secured by the General Contractor from unwarranted entry at the end of each day.
- B. The construction site shall be secured by means of a construction fence, located around the entire perimeter of the construction site. This construction fence shall be required to be secure from unwarranted entry at the end of each day.

1.05 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises is limited only by the Owners right to perform construction operations with the own forces or to employ separate contractors on portions of the project.
- B. General: Limit use of the premises to construction activities in areas indicated within the limit of the premises the Contractor may use any portion of the site for storage or work areas or any legal purpose.
 - 1. Confine operations to areas within Contract limits indicated on the Drawings. Portions of the site beyond areas in which construction

operations are indicated are not to be disturbed.

2. Keep driveways and entrances serving the premises clear and available to the Owner and the Owners employees at all times. Do not use these areas for parking or storage of materials.
3. Burial of Waste Materials: Do not dispose of construction debris, vegetation and hazardous material on site, either by burial or by burning.

1.06 DISTRIBUTION OF RELATED DOCUMENTS

- A. The Contractor is solely responsible for the distribution of ALL related documents/drawings/specifications to ALL appropriate vendors/subcontractors to insure proper coordination of all aspects of the project and its related parts during bidding and construction.

1.07 CONTRACT DOCUMENT FILE

- A. Copies of the Contract Documents, Plans, Specifications, Addenda, Change Orders, Architects Supplemental Instructions, approved Shop Drawings, Substitution Approvals, etc. shall be placed and maintained in the Contractors field office at the project site by the Contractor throughout the entire contract period. Said these documents shall be filed in a manner that allows for ease of retrieval. Documents shall be made available to the Architect/Engineer and the County's representatives throughout this same period.

PART 2 PRODUCTS

2.01 ASBESTOS FREE MATERIAL

- A. Contractor shall provide a written and notarized statement on company letterhead(s) to certify and warrant that ONLY ASBESTOS FREE MATERIALS AND PRODUCTS were provided as required in this section. Such statement shall be submitted with the final payment request. Final payment shall not be made until such statement is submitted. Contractor agrees that if materials containing asbestos are subsequently discovered at any future time to have been included in the construction, the contractor shall be liable for all costs related to the redesign or modification on the construction of the project so that materials containing asbestos are removed from the facility. If construction has begun or has been completed pursuant to a design that includes asbestos containing materials, the Contractor shall also be liable for all costs related to the abatement of such asbestos.

PART 3 EXECUTION (Not applicable).

END OF SECTION 01010

SECTION 01027- APPLICATION FOR PAYMENT

PART I GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractors Applications for Payment.
- B. The Contractors Construction Schedule and Submittal Schedule are included in Section 01300 - SUBMITTALS.

1.03 SCHEDULE OF VALUES

- A. Coordinate preparation of the Schedule of Values with preparation of Contractors Construction Schedule.
 - 1. Submit the Schedule of Values to the Owner at the earliest feasible date, but in no case later than Preconstruction Meeting. Refer to Section 01200.
 - 2. Sub-Schedules: Where the Work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.
- B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of the Architect
 - c. Project Number
 - d. Contractors Name and Address
 - e. Date of Submittal
 - 2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:

- a. Generic Name
 - b. Related Specification Section
 - c. Change Orders (numbers) that have affected value
 - d. Dollar Value
 - e. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent
3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items:
- a. A value will be given for at least every major specification section (subsections can logically be grouped together).
 - b. A single material subcontractor (i.e. sod, window blinds) will not be required to be broken down into labor and material unless it is anticipated the materials will be stored and invoiced prior to installation.
 - c. All multiple item subcontracts or work items (i.e. concrete, roofing, painting, mechanical, electrical items, etc.) will be shown broken down at least in labor and material (all taxes, burden and overhead and profit included).
 - d. Mobilization (move-on, bond, insurance, temporary office and sanitary service installation) shall not exceed 2 1/2% of contract price.
 - f. Concrete broken down at least into foundation, slab on grade, columns, beams and suspended slabs.
 - g. Masonry divided into C.M.U. stem walls, exterior walls, interior walls.
 - h. Plumbing broken down at least into underslab rough-in, vents and stacks, supply piping, equipment items (each listed separately), fixtures and trim.
 - i. HVAC: Typically shown per specification section, labor and material, per floor.
 - j. Electrical: same as HVAC.
 - k. Fire protection broken down at least into underground, rough-in and trim. Labor and material.
 - l. Logical grouping of specification subsections are permitted.
4. Round amounts off the nearest whole dollar; the total shall equal the Contract Sum.
5. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of

Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

6. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
 - a. At the Contractors option, temporary facilities and other major cost items that are not direct cost of actual work-in place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.
7. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the contract sum.

1.04 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as reviewed by the Owners Representative and paid for by the Owner.
 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the Final Application for Payment involve additional requirements. See items G, I, J and K of this section.
- B. Payment Application Times: The period of construction Work covered by each Application of Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use the County's most updated Form as the form for Application for Payment. Form given at the Preconstruction Conference.
- D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
 1. Entries shall match data on the Schedule of Values and Contractors Construction Schedule. Use updated schedules if revisions have been made.

2. Include amounts of Change Orders and Construction Change Directives issued to the last day of the construction period covered by the application.
- E. Transmittal: Submit six (6) original executed copies of each Application for Payment to the Project Manager by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.
1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Project Manager.
- F. Waivers of Mechanics Lien: With each Application for Payment submit waivers of mechanics liens from subcontractors of sub-subcontractors and suppliers for the construction period covered by the previous application.
1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
 2. When an application shows completion of an item, submit final or full waivers.
 3. The Owner reserves the right to designate which entitles involved in the work must submit waivers.
 4. List all Subcontractor start and finish dates to substantiate any Notice to Owner received by the Project Manager.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
1. List of principal subcontractors
 2. List of principal suppliers and fabricators
 3. Schedule of Values
 4. Approved Contractors Construction Schedule (preliminary if not final)
 5. Schedule of principal products
 6. Schedule of unit prices (if applicable)
 7. Submittal schedule (preliminary if not final)
 8. List of Contractors staff assignments
 9. List of Contractors principal consultants
 10. Copies of building permits for trades requiring separate permits
 11. Copies of authorizations and licenses from governing authorities for performance of the Work
 12. Initial progress report
 13. Report of Pre-Construction Meeting

14. Initial settlement survey and damage report, if required
 15. Listing of all long lead procurement items monthly applications for payment will be accompanied with updated schedule and review of as-built drawings.
- H. Interim Application for Payment: Payment will be processed once a month. No applications will be processed without receipt of previous months waiver of lien described in subsection F above. Payment for item will be based on percentage completed as determined and approved by the County Project Manager or invoice for stored materials. Retainage (10%) will be held for all interim applications.
- I. Applications for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. Application shall also include all items listed in Part H above.
- J. Administrative actions and submittals that shall proceed or coincide with Substantial Completion Payment. Substantial Completion as defined per General Conditions Section F application include:
1. Occupancy permits and similar approvals
 2. Warranties (guarantees) and maintenance agreements
 3. Test/adjust/balance records
 4. Maintenance instructions
 5. Start-up performance reports
 6. Change-over information related to Owners occupancy, use, operation and maintenance
 7. Final cleaning
 8. Application for reduction of retainage, and consent of surety
 9. List of incomplete Work, recognized as exceptions to Project Managers Certificate of Substantial Completion
- K. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
1. Completion of Project Close-out requirements
 2. Completion of items specified for completion after Substantial Completion
 3. Assurance that unsettled claims will be settled
 4. Assurance that all work has been completed and accepted
 5. Proof that taxes, fees and similar obligations have been paid
 6. Removal of temporary facilities and services
 7. Removal of surplus materials, rubbish and similar elements

8. Change of door locks to Owners access

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01027

SECTION 01035 - MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 1 Section 01300 Submittals for requirements for the Contractors Construction Schedule.
 - 2. Division 1 Section 01027 Application for Payment for administrative procedures governing applications for payment.
 - 3. Division 1 Section 01631 Product Substitutions for administrative procedures for handling requests for substitutions made after award of the Contract.

1.03 MINOR CHANGES IN THE WORK

- A. Supplemental instructions authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Project Manager.

1.04 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Project Manager, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
 - 1. Proposal requests, issued by the Project Manager, are for information only. Do not consider them instruction either to stop work in progress, or to execute the proposed change.

2. Unless otherwise indicated in the proposal request, within 7 days of receipt of the proposal request, submit to the Project Manager from the Owners review, an estimate of cost necessary to execute the proposed change.
 - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
 - d. Contractor and subcontractors will provide a complete detailed labor of material breakdown to justify change order request amount.

- B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions in mutual accord with the Owner Representatives findings require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
 1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
 2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Comply with requirements in Section 01631 AProduct Substitutions if the proposed change in the Work requires the substitution of one product or system for a product or system not specified.
 5. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amounts.

- C. Proposal Request Form: Project Manager will transfer the information to the appropriate forms for approval. Use AIA Document G 709 for Change

Order Proposal Requests.

- D. Proposal Request Form: Use forms provided by the Owner for Change Order Proposals.

1.05 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Project Manager may issue a Construction Change Directive instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.06 CHANGE ORDER PROCEDURES

- A. Upon the Owners approval of a Change Order Proposal Request, the Project Manager will issue a Change Order for signatures of the Owner and Contractor on County's Change Order form, as provided in the Conditions of the Contract.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01035

SECTION 01040 - PROJECT COORDINATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
 - 1. Coordination
 - 2. Administrative and supervisory personnel
 - 3. General installation provisions
 - 4. Cleaning and protection
- B. Progress meetings, coordination meetings and pre-installation conferences are included in Section 01200 Project Meetings.
- C. Requirements for the Contractors Construction Schedule are included in Section 01300 Submittals.

1.03 COORDINATION

- A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
 - 1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
 - 2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.

- B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 - 1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Schedules
 - 2. Installation and removal of temporary facilities
 - 3. Delivery and processing of submittals
 - 4. Progress meetings
 - 5. Project Close-out activities
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment (if any) involved in performance of, but not actually incorporated in, the Work.
- E. Lack of coordination as specified if this and other sections of the contract documents in grounds for assessment of back charges and/or termination in order to remediate the situation.

1.04 SUBMITTALS

- A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 - 1. Show the interrelationship of components shown on separate Shop Drawings.
 - 2. Indicate required installation sequences.
 - 3. Comply with requirements contained in Section 01300 Submittals.
 - 4. Refer to Division Division 16 Section Basic Electrical Requirements

for specific coordination Drawing requirements for mechanical and electrical installations.

- B. Staff Names: At the Preconstruction Conference submit a list of the Contractors principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturers Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to Project Manager for final decision.
- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

- I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect/Project Manager for final decision.

3.02 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as directed by the Project Manager and as frequently as necessary to insure its integrity and safety through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where the applicable, such exposures include, but are not limited to, the following:
 1. Excessive static or dynamic loading
 2. Excessively high or low temperatures
 3. Excessively high or low humidity
 4. Air contamination or pollution
 5. Water
 6. Solvents
 7. Chemicals
 8. Soiling, staining and corrosion
 9. Rodent and insect infestation
 10. Combustion
 11. Destructive testing
 12. Misalignment
 13. Excessive weathering
 14. Unprotected storage
 15. Improper shipping or handling
 16. Theft
 17. Vandalism

END OF SECTION 01040

SECTION 01045 - CUTTING AND PATCHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

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. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

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 buildings 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. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service.

Indicate how long service will be disrupted.

6. 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.
7. Approval by the Architect to proceed with cutting and patching does not waive the Architect'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.

1. Obtain written approval of the cutting and patching proposal before cutting and patching the following structural elements.
 - a. Foundation construction
 - b. Bearing and retaining walls
 - c. Structural concrete
 - d. Structural steel
 - e. Lintels
 - f. Timber and primary wood framing
 - g. Structural decking
 - h. Miscellaneous structural metals
 - i. Stair systems
 - j. Exterior curtain wall construction
 - k. Equipment supports
 - l. Piping, ductwork, vessels and equipment

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. Refer to Division 16 regarding Fire Rated Penetrations.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems.
 - a. Shoring, bracing and sheeting
 - b. Primary operational systems and equipment
 - c. Air or smoke barriers
 - d. Water, moisture, or vapor barriers
 - e. Membranes and flashings

- f. Fire protection systems
 - g. Noise and vibration control elements and systems
 - h. Control systems
 - l. Communication systems
 - j. Conveying systems
 - k. Electrical wiring systems
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architects opinion, reduce the buildings aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.
- 1. If possible retain the original installer or fabricator to cut and patch the following categories or exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:
 - a. Processed concrete finishes
 - b. Preformed metal panels
 - c. Window wall system
 - d. Stucco and ornamental plaster
 - e. Acoustical ceilings
 - f. Carpeting
 - g. Wall covering
 - h. HVAC enclosures, cabinets or covers
 - l. Roofing systems

PART 2 PRODUCTS

2.01 MATERIALS

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect unless otherwise indicated by Architect/Owner. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 EXECUTION

3.01 INSPECTION

- A. 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.

1. Before proceeding, meet at the site with all parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: 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, but scheduled to be removed or relocated until provisions have been made to bypass them.

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. Where possible review proposed procedures with the original installer; comply with the original installers recommendations.
 1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 3. Cut through concrete and masonry using a cutting machine such

as a Carborundum saw or diamond core drill.

4. Comply with requirements of applicable Sections of Division 2 where cutting and patching requires excavating and backfilling.
 5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- 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. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials if necessary to achieve uniform color and appearance.
 - a. Where patching occurs in a smooth painted surfaces, extend final coat over entire unbroken surfaces containing the patch, after the patched area has received primer and second coat.

3.04 CLEANING

- A. Thoroughly clean area and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged materials to their original condition.

END OF SECTION 01045

SECTION -01070 ABBREVIATIONS

PART 1 GENERAL

A. General:

A	Area Square Feet; Ampere
AAMA	Architectural Minimum Manufacturer's Association
ABS	Acrylonitrile Butadiene Styrene
A.C.	Alternating Current; Air conditioning; Plywood Grade A & C
A.B.	Anchor Belt
A.C.I.	American Concrete Institute
Acous.	Acoustical
AD	Plywood, Grade A & D
A.D.	Area Drain
Adh.	Adhesive
Addit	Additional
Adj.	Adjustable
af	Audio-frequency
Aff	Above Finished Floor
Afg	Above Finished Grade
A.G.A.	American Gas Association
Agg.	Aggregate
A.H.	Ampere Hours
A hr.	Ampere-hour
A.H.U.	Air Handling Unit
A.I.A.	American Institute of Architects
A.I.C.	Alternating Interrupting Capacity
AIC	Ampere Interrupting Capacity
AISC	American Institute of Steel Construction
Allow.	Allowance
ALT.	Alternate
Alt.	Altitude
Alum.	Aluminum
a.m.	Ante Meridiem
Amp.	Ampere
Anc.	Anchor
Anod.	Anodized
ANSI	American National Standards Institute
A.P.	Access Panel
Appd.	Approved
Approx.	Approximately

SECTION 01070
ABBREVIATIONS

Apt.	Apartment
Arch.	Architectural
Asb.	Asbestos
A.S.B.C.	American Standard Building Code
A.S.H.R.A.E.	American Society of Heating, Refrig. & AC Engineers
A.S.M.E.	American Society of Mechanical Engineers
A.S.T.M.	American Society for Testing and Materials
Attchmt.	Attachment
Auto.	Automatic
Avg.	Average
A.W.G.	American Wire Gauge
AWI	American Wood Institute
AWS	American Welding Society
Bbl.	Barrel
B.C.	Bare Copper
B.& B.	Grade B. and Better;Balled and Burlapped
B.& S.	Bell and Spigot
B.& W.	Black and White
b.c.c.	Body-centered Cubic
Bd	Board
BE	Bevel End
B.F.	Board Feet
BF.	Bottom Face
Bg. Cem	Bag of Cement
BHP	Boiler Horsepower, Brake Horsepower
B.I.	Black Iron
Bit. ;Bitum	Bituminous
Bk.	Backed
Bkrs.	Breakers
Bldg.	Building
Blk.	Block
Blkg.	Blocking
Bm.	Beam
B.M.	Benchmark
B.O.C.	Bottom of Curb
BOT.	Bottom
Boil.	Boilermaker
B.P.M.	Blows Per Minute
BR	Bedroom
Brg.	Bearing
Brhe.	Bricklayer Helper
Bric.	Bricklayer
Brk.	Brick
Brkt.	Bracket
Brng.	Bearing
Brs.	Brass

SECTION 01070
ABBREVIATIONS

Brz.	Bronze
Bsmt.	Basement
Bsn.	Basin
Btr.	Better
BTU	British Thermal Unit
BTUH	BTU per hour
Btwn.	Between
B.U.R.	Built up Roofing
BX	Interlocked Armored Cable
c	Conductivity
C	Hundred; Centigrade
C.	Course
C/C	Center to Center
Cab.	Cabinet
Cair.	Air Tool Laborer
Calc.	Calculated
Cap.	Capacity
Carp.	Carpenter
C.B.	Circuit Breaker
C.BD.	Chalk Board
C.C.A.	Chromate Copper Arsenate
C.C.F.	Hundred Cubic Feet
cd	Candela
cd/sf	Candela per Square Feet
CD	Grade of Plywood Face & Back
CDX	Plywood, grade C & D, exterior glue
Cefi.	Cement Finisher
Cem.	Cement
Cer.	Ceramic
CF	Hundred Feet
C.F.	Cubic Feet
CFM	Cubic Feet per Minute
c.g.	Center of Gravity
CG	Corner Guard
CHW	Chilled Water
C.I.	Cast Iron
C.I.P.	Cast in Place
Circ.	Circuit
C.J.	Control Unit
C.L.	Carload Lot
Clab.	Common Laborer
Clec.	Clock Equipment Cabinet
C.L.F.	Hundred Linear Feet
CLF	Current Limiting Fuse
Clg.	Ceiling
Clkg.	Caulking
Clo.	Closed

SECTION 01070
ABBREVIATIONS

CLP	Cross Linked Polyethylene
Clr.	Clear
cm	Centimeter
CMP	Corr. Metal Pipe
C.M.U.	Concrete Masonry Unit
Cntr.	Counter
C.O.	Cleanout
Col.	Column
Conn.	Connection
Cont.	Continuous
Cont.	Contractor
C.Opng.	Cased Opening
CO ₂	Carbon Dioxide
Comb.	Combination
Compr.	Compressor
Conc.	Continuous; Continued
Cond.	Conductor
Corr.	Corrugated
Cos	Cosine
Cot	Cotangent
Cov.	Cover
CPA	Control Point Adjustment
Cplg.	Coupling
C.P.M.	Critical Path Method
CPVC	Chlorinated Polyvinyl Chloride
C.Pr.	Hundred Pair
CRC	Cold Rolled Channel
Creos.	Creosote
Crpt.	Carpet & Linoleum Layer
CRT	Cathode Ray Tube
CS	Carbon Steel
Csc	Cosecant
C.S.F.	Hundred Square Feet
CSI	Construction Specifications Institute
C.T.	Current Transformer
CTS	Copper Tube Size
Cu	Cubic
Cu. Ft.	Cubic Foot
cw	Continuous Wave
C.W.	Cool White; Cold Water
C. Wall	Curtain Wall
Cwt.	100 Pounds
C.W.X.	Cool White Deluxe
C.Y.	Cubic Yard (27 cubic feet)
C.Y./Hr.	Cubic Yard per Hour
Cyl.	Cylinder
d	Penny (nail size)

SECTION 01070
ABBREVIATIONS

D	Deep; Depth; Discharge
Dis; Disch	Discharge
Db.	Decibel
Dbl.	Double
DC	Direct Current
Demob.	Demobilization
d.f.u.	Drainage Fixture Units
D.H.	Double Hang
DHU	Domestic Hot Water
Diag.	Diagonal
Diam.	Diameter
Distrib.	Distribution
Dk.	Deck
D.L.	Deck Load
Do.	Ditto
Dp.	Depth
D.P.S.T.	Double Pole, Single Throw
Dr.	Driver
Drink.	Drinking
D.S.	Double Strength
D.S.A.	Double Strength A Grade
D.S.B.	Double Strength B Grade
Dty.	Duty
DWV	Drain Waste Vent
DX	Deluxe White, Direct Expansion
dyn	Dynbe
e	Eccentricity
E	Equipment only; East
Ea	Each
E.B.	Encased Burial
Econ.	Economy
EDP	Electronic Data Processing
E.D.R.	Equiv. Direct Radiation
Eq.	Equation
Elec.	Electrician; Electrical
Elev.	Elevator; Elevating
EMT	Electrical Metallic Conduit; Thin Wall Conduit
Eng.	Engine
EPDM	Ethylene Propylene Diene Monomer
Eqhv.	Equip. Oper., heavy
Eqlt.	Equip. Oper., light
Eqmd.	Equip. Oper., medium
Eqmm.	Equip. Oper., Master Mechanic
Equol.	Equip. Oper., Oilers
ERW	Electric Resistance Welded
Est.	Estimated

SECTION 01070
ABBREVIATIONS

esu	Electrostatic Units
E.W.	Each Way
EWT	Entering Water Temperature
Excav.	Excavation
Exp.	Expansion, Exposure
Ext.	Exterior
Extru.	Extrusion
f.	Fiber Stress
F	Fahrenheit; Female; Fill
Fab.	Fabricated
F.B.C.	Florida Building Code
FBGS	Fiberglass
F.C.	Foot candles
f.c.c.	Face Centered Cubic
f'c	Compressive Stress in Concrete; Extreme Compressive Stress
F.E.	Front End
FRP	Fluorinated Ethylene Propylene (Teflon)
F.G.	Flat Grain
F.H.A.	Federal Housing Administration
Fig.	Figure
Fin	Finished
Fixt.	Fixture
Fl. Oz.	Fluid Ounces
Flr.	Floor
F.M.	Frequency Modulation; Factory Mutual
Fmg.	Framing
Fndtn.	Foundation
Fori.	Foreman; Inside
Fount.	Fountain
FPM	Feet Per Minute
Fr.	Frame
F.R.	Fire Rating
FRK	Foil Reinforced Kraft
FRP	Fiberglass Reinforced Plastic
FS	Forged Steel
FSC	Cast Body; Cast Switch Box
Ft.	Foot; Feet
Ftng.	Fitting
Ftg.	Footing
Ft.Lb.	Foot Pound
Furn.	Furniture
FVNR	Full Voltage Non-Reversing
FXM	Female by Male
Fy.	Minimum Yield Stress of Steel
g	Gram
G	Gauss

SECTION 01070
ABBREVIATIONS

Ga.	Gauge
Gal.	Gallon
Gal./Min.	Gallon Per Minute
Galv.	Galvanized
Gen.	General
G.F.I.	Ground Fault Interrupter
Glaz.	Glazier
GPD	Gallons per Day
GPH	Gallons per Hour
GPM	Gallons per Minute
GR	Grade
Gran.	Granular
Grnd.	Ground
H	High; High Strength Bar Joist; Henry
H.C.	High Capacity
H.D.	Heavy Duty; High Density
H.D.O.	High Density Overlaid
Hdr.	Header
Hdwe.	Hardware
Help.	Helper Average
HEPA	High Efficiency Particular Air Filter
Hg.	Mercury
HIC	High Interrupting Capacity
H.O.	High Output
Horiz.	Horizontal
H.P.	Horsepower; High Pressure
H.P.F.	High Power Factor
Hr.	Hour
Hrs./Day	Hours per Day
HSC	High Short Circuit
Ht.	Height
Htg.	Heating
Htrs.	Heaters
HVAC	Heating, Ventilating & Air Conditioning
Hvy.	Heavy
HW	Hot Water
Hyd.;Hydr.	Hydraulic
Hz.	Hertz (cycles)
I.	Moment of Inertia
I.C.	Interrupting Capacity
ID	Inside Diameter
I.D.	Inside Dimension; Identification
I.F.	Inside Frosted
I.M.C.	Intermediate Metal Conduit
In.	Inch
Incan.	Incandescent
Incl.	Included; Including

SECTION 01070
ABBREVIATIONS

Int.	Interior
Inst.	Installation
Insul.	Insulation
I.P.	Iron Pipe
I.P.S.	Iron Pipe Size
I.P.T.	Iron Pipe Threaded
I.W.	Indirect Waste
J	Joule
J.I.C.	Joint Industrial Council
K	Thousand; Thousand Pounds; Heavy Wall Copper Tubing
K.A.H.	Thousand Amp. Hours
KCMIL	Thousand Circular Mils
KD	Knock Down
K.D.A.T.	Kiln Dried After Treatment
Kg	Kilogram
kG	Kilogauss
kgf	Kilogram force
kHz	Kilohertz
Kip	1000 Pounds
KJ	Kiljoule
K.L.	Effective Length Factor
Km	Kilometer
K.L.F.	Kips per Linear Foot
K.S.F.	Kips per Square Feet
K.S.I.	Kips per Square Inch
K.V.	Kilovolt
K.V.A	Kilovolt Ampere
K.V.A.R.	Kilovolt (Reactance)
KW	Kilowatt
KWh	Kilowatt-hour
L	Labor only; Length; Long; Medium Wall Copper Tubing
La.	Labor
lat	Latitude
Lath.	Lather
Lav.	Lavatory
lb,;#	Pound
L.B.	Load Bearing; L Conduit Body
L. & E.	Labor & Equipment
lb./hr.	Pounds per Hour
lb./L.F.	Pounds Per Linear Foot
L.C.L.	Less than Carload Lot
Ld.	Load
LE	Lead Equivalent
L.F.	Linear Foot
Lg.	Long; Length; Large

SECTION 01070
ABBREVIATIONS

L. & H.	Light and Heat
L.H.	Long Span high Strength Bar Joist
L.J.	Long Span Standard Strength Bar Joist
L.L.	Live Load
L.L.D.	Lamp Lumen Depreciation
lm	Lumen
lm/sf	Lumen per Square Feet
lm/W	Lumen per Wall
L.O.A.	Length Over All
log	Logarithm
L.P.	Liquified Petroleum; Low Pressure
L.P.F.	Low Power Factor
L.R.	Long Radius
L.S.	Lump Sum
Lt.	Light
Lt.Ga	Light Gauge
L.T.L.	Less than Truckload Lot
Lt. Wt.	Lightweight
L.V.	Low Voltage
M	Thousand; Material; Male; Light Wall Copper Tubing
m/hr; M.H.	Man Hour
mA	Milliampere
Mach	Machine
Mag. Str.	Magnetic Starter
Maint.	Maintenance
Marb.	Marble Setter
Mat. Mat'l	Material
Max	Maximum
MBF	Thousand Board Feet
MBH	Thousand BTU's per hr.
MC	Metal Clad Cable
M.C.F.	Thousand Cubic Feet
M.C.F.M.	Thousand Cubic Feet per Minute
M.C.M.	Thousand Circular Mils
M.C.P.	Motor Circuit Protector
MD	Medium Duty
M.D.O.	Medium Density Overlaid
Med.	Medium
MF	Thousand Feet
M.F.B.M.	Thousand Feet Board Measure
Mfg.	Manufacturing
Mfrs.	Manufacturers
mg	Milligram
MGD	Million Gallons per Day
MGPH	Thousand Gallons per Hour
MH:M.H.	Manhole; Metal Halide; Man-Hour

SECTION 01070
ABBREVIATIONS

MHz	Megahertz
Mi.	Mile
MI	Malleable Iron; Mineral Insulated
mm	Millimeter
Mill.	Millwright
Min.;min.	Minimum; minute
Misc.	Miscellaneous
mi	Millimeter
M.L.F.	Thousand Linear Feet
Mo.	Month
Mobil.	Mobilization
Mog.	Mogul Base
MPH	Miles Per Hour
MPT	Male Pipe Thread
MRT	Mile Round Trip
ms	Millisecond
M.S.F.	Thousand Square Feet
Mstz.	Mosaic & Terrazzo Worker
M.S.Y.	Thousand Square Yards
Mtd.	Mounted
Mthe.	Mosaic & Terrazzo Helper
Mult.	Multi; Multiply
M.V.A.	Million Volt Amperes
M.V.A.R.	Million Volt Amperes Reactance
MV	Megavolt
MW	Megawatt
MXM	Male by Male
MYD	Thousand Yards
N	Natural; North
nA	Nanoampere
NA	Not Available; Not applicable
N.B.C.	National Building Code
NC	Normally Closed
N.F.M.A.	National Electrical Manufacturers Association
NEHB	Bolted Circuit Breaker to 600V
N.L.B.	Non-Load-Bearing
NM	Non-Metallic Cable
nm	Nanometer
No.	Number
N.O.C.	Not Otherwise Classified
Nose.	Nosing
N.P.T.	National Pipe Thread
NQOB	Bolted Circuit Breaker to 240V
N.R.C.	Noise Reduction Coefficient
N.R.S.	Non Rising Stem
ns	Nanosecond

SECTION 01070
ABBREVIATIONS

nW	Nanowatt
OB	Opposing Blade
OC	On Center
OD	Outside Diameter
O.D.	Outside Dimension
ODS	Overhead Distribution System
O & P	Overhead and Profits
Oper.	Operator
Opng.	Opening
Orna.	Ornamental
O.S. & Y.	Outside Screw and Yoke
Ovhd.	Overhead
OWG	Oil, Water or Gas
Oz.	Ounce
P.	Pole; Applied Load; Projection
p.	Page
Pape.	Paperhanger
P.A.P.R.	Powered Air Purifying Respirator
PAR	Weatherproof Reflector
Pc.	Piece
P.C.	Portland Cement; Power Connector
P.C.M.	Phase Contract Microscopy
P.C.F.	Pounds Per Cubic Feet
P.E.	Professional Engineer; Porcelain Enamel; Polyethylene; Plain End
Perf.	Perforated
Ph.	Phase
P.I.	Pressure Injected
Pile.	Pile Driver
pkg.	Package
Pl.	Plate
Plah.	Plaster Helper
Plas.	Plasterer
Pluh.	Plumbers Helper
Plum.	Plumber
Ply.	Plywood
p.m.	Post Meridiem
Pord.	Painter Ordinary
pp	Pages
PP;PPL	Polypropylene
P.P.M.	Parts per Million
Pr.	Pair
Prefab.	Prefabricated
Prefin.	Prefinished
Prop.	Propelled
PSF;psf	Pounds per Square Foot
PSI;psi	Pounds per Square Inch

SECTION 01070
ABBREVIATIONS

PSIG	Pounds per Square Inch Gauge
PSP	Plastic Sever Pipe
Pspr.	Painter, Spray
Psst.	Painter, Structural Steel
P.T.	Potential Transformer
P. & T.	Pressure & Temperature
Ptd.	Painted
Ptns.	Partitions
Pu	Ultimate Load
PVC	Polyvinyl Chloride
Pvmt.	Pavement
Pwr.	Power
Q	Quantity Heat Flow
Quan.; Qty	Quantity
Q.C.	Quick Coupling
r	Radius of Gyration
R	Resistance
R.C.P.	Reinforced Concrete Pipe
Rect.	Rectangle
Reinf.	Reinforced
Req'd	Required
Res.	Resistant
Resi	Residential
Rgh.	Rough
R.H.W.	Rubber, Heat & Water Resistant; Residential Hot Water
rms	Root Mean Square
Rnd.	Round
Rodm.	Rodman
Rofc.	Roofer, Composition
Rofp.	Roofer, Prcast
Rohe.	Roofer Helpers (Composition)
Rots.	Roofer, Tile & Sale
R.O.W.	Right of Way
RPM	Revolutions per Minute
R.R.	Direct Burial Feeder Conduit
R.S.	Rapid Start
R.T.	Round Trip
S.	Suction; Single Entrance; South
Scaf.	Scaffold
Sch.;Sched.	Schedule
S.C.R.	Modular Brick
S.D.	Sound Deadening
S.D.R.	Standard Dimension Ratio
S.E.	Surfaced Edge
Sel.	Select
S.E.R.;S.E.U.	Service Entrance Cable

SECTION 01070
ABBREVIATIONS

SF.	Square Foot	
S.F.C.A.	Square Foot Contact Area	
S.F.F.C.M.U.	Split Face Fluted Concrete Masonry Unit.	
S.F.G.	Square Foot of Ground	
S.F. Hor.	Square Foot Horizontal	
S.R.F.	Square Foot of Radiation	
S.F.Shlf.	Square Foot of Shelf	
S4S	Surface 4 Sides	
Shee.	Sheet Metal Worker	
Sin.	Sine	
Skwk.	Skilled Worker	
S.L.	Saran Lined	
S.L.	Slimline	
Sldr.	Solder	
S.N.	Solid Neutral	
S.P.	Static Pressure; Single Pole; Self	Propelled
Spri.	Sprinkler Installer	
Sq.	Square; 100 Square Feet	
S.P.D.T.	Single Pole, Double Throw	
S.P.S.T.	Single Pole, Single Throw	
SPT	Standard Pipe Thread	
Sq.Hd.	Square Head	
Sq.In.	Square Inch	
S.S.	Single Strength; Stainless Steel	
S.S.B.	Single Strength B Grade	
Sswk.	Structural Steel Worker	
Sswl.	Structural Steel Welder	
St.;Stl.	Steel	
S.T.C.	Sound Transmission Coefficient	
Std.	Standard	
STP	Standard Temperature & Pressure	
Stpi.	Steamfitter, Pipefitter	
Str.	Strength; Starter; Straight	
Strd.	Stranded	
Struct.	Structural	
Sty.	Story	
Subj.	Subject	
Subs.	Subcontractors	
Surf.	Surface	
Sw.	Switch	
Swbd.	Switchboard	
S.Y.	Square Yard	
Syn.	Synthetic	
Sys.	System	
t.	Thickness	
T	Temperature; Ton	
Tan	Tangent	

SECTION 01070
ABBREVIATIONS

T.C.	Terra Cotta
T & C	Threaded and Coupled
T.D.	Temperature Difference
T.E.M.	Transmission Electron Microscopy
TFE	Tetrafluoroethylene (teflon)
T.& G.	Tongue & Groove; Tar & Gravel
Th.;Thk.	Thick
Thn.	Thin
Thrded.	Threaded
Tilf.	Tile Layer Floor
Tilh.	Tile Layer Helper
THW	Insulated Strand Wire
THWN;THHN	Nylon Jacketed Wire
T.L.	Truckload
Tot.	Total
T.S.	Trigger Start
Tr.	Trade
Transf.	Transformer
Trhv.	Truck Driver, Heavy
Trir.	Trailer
Trit.	Truck Driver, Light
TV	Television
T.W.	Thermoplastic Water Resistant Wire
UCI	Uniform Construction Index
UF	Underground Feeder
U.H.F.	Ultra High Frequency
U.L.	Underwriters Laboratory
Unfin.	Unfinished
URD	Underground Residential Distribution
V	Volt
V.A.	Volt Amperes
V.C.T.	Vinyl Composition Tile
VAV	Variable Air Volume
VC	Veneer Core
Vent.	Ventilating
Vert.	Vertical
V.F.	Vinyl Faced
V.G.	Vertical Grain
V.H.F.	Very High Frequency
VHO	Very High Output
Vib.	Vibrating
V.L.F.	Vertical Linear Foot
Vol.	Volume
W	Wire; Watt; Wide; West
w/	With
W.C.	Water Column; Water Closet
W.F.	Wide Flange

W.G.	Water Gauge
Wldg.	Welding
W. Mile	Wire Mile
W.R.	Water Resistant
Wrck.	Wrecker
W.S.P.	Water Steam, Petroleum
WT, Wt.	Weight
WWF	Welded Wire Fabric
XRMR	Transformer
XHD	Extra Heavy Duty
XHHW;XLPE	Cross Linked Polyethylene Wire Insulation
Y	Wye
yd	Yard
yr	Year
Δ	Delta
%	Percent
Φ	Phase
@	At
<	Less Than
>	Greater Than

PART 2- PRODUCTS:

Not used.

PART 3- EXECUTION:

Not used.

END SECTION 01070

SECTION 01095 - REFERENCE STANDARDS AND DEFINITIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. Indicated: The term Indicated refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as shown, noted, scheduled and specified are used, it is to help the reader locate the reference; no limitation on location is intended.
- C. Directed: Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the Project Manager, requested by the Architect/Project Manager and similar phrases.
- D. Accepted: This term; Accepted, where used in conjunction with the Architects action on the Contractors submittals, applications, and requests, is limited to the Architects duties and responsibilities as stated in the Conditions of the Contract.
- E. Regulations: The term Regulations includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. Furnish: The term furnish is used to mean supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

- G. Install: The term install is used to describe operations at project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. Provide: The term provide means to furnish and install, complete and ready for the intended use.
- I. Installer: An Installer is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - 1. The term experienced, when used with the term Installer, means having a minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.
 - 2. Trades: Use of titles such as carpentry is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as carpenter. It also does not imply that requirements specified apply exclusively to trades persons of the corresponding generic name.
- J. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- K. Testing Laboratories: testing laboratory is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.03 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institutes 16 Division format and MASTER FORMAT numbering system.

- B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
1. Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Words and meaning shall be interpreted as appropriate. Words that are implied, but not stated shall be interpolated as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the Contract Documents so indicates.
 2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
 - a. The words, shall be shall be included by inference wherever a colon (:) is used within a sentence or phrase.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01095

SECTION 01200 - PROJECT MEETINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
 - 1. Pre-Construction Conference
 - 2. Pre-Installation Conference
 - 3. Coordination Meetings
 - 4. Progress Meetings
- B. Construction schedules are specified Section 1300 Submittals.

1.03 PRE-CONSTRUCTION CONFERENCE

- A. Schedule a pre-construction Conference and organizational meeting at the project site or other convenient location no later than 20 days after execution of the agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attends: The OWNERS, Representative, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
 - 1. Tentative construction schedule
 - 2. Critical Work sequencing and/coordinating
 - 3. Designation of responsible personnel
 - 4. Procedures for processing field decisions and Change Orders
 - 5. Procedures for processing Applications for Payment
 - 6. Distribution of Contract Documents
 - 7. Submittal of Shop Drawings, Product Data and Samples.

8. Preparation of record documents
9. Use of the Premises
10. Office, Work and storage areas.
11. Equipment deliveries and priorities
12. Safety procedures
13. First aid
14. Security
15. Housekeeping
16. Working hours

- D. Contractor must submit at the time of the meeting at least the following items:
1. Schedule of Values
 2. Listing of key personnel including project superintendent and subcontractors with their addresses, telephone numbers, and emergency telephone numbers.
 3. Preliminary Construction Schedule
 4. Submittal Schedule

1.04 PRE-INSTALLATION CONFERENCE

- A. Conduct a Pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise at least 48 hours in advance the Project Manager of scheduled meeting dates.
1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:
 - a. Contract Documents
 - b. Options
 - c. Related Change Orders
 - d. Purchases
 - e. Deliveries
 - f. Shop Drawings, Product Data and Quality Control Samples
 - g. Possible conflicts
 - h. Compatibility problems
 - i. Time schedules
 - j. Weather limitations
 - k. Manufacturers recommendations
 - l. Comparability of materials

- m. Acceptability of substrates
 - n. Temporary facilities
 - o. Space and access limitations
 - p. Governing regulations
 - q. Safety
 - r. Inspection and testing requirements
 - s. Required performance results
 - t. Recording requirements
 - u. Protection
2. Record significant discussions and agreements and disagreements of each conference along with and approved schedule. Distribute the record of the meeting to everyone. Concerned, promptly, including the Owner and Architect.
 3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.05 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project site at weekly intervals or more frequently if necessary as directed by the Project Manager. Notify the Owner at least 48 hours in advance of scheduled meeting time and dates. Coordinate dates of meetings with preparation of the payment request.
- B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities with the Project and authorized to conclude matters relation to progress.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
 1. Contractors Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractors Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

2. Review the present and future needs of each entity present, including such items as:
 - a. Interface requirements
 - b. Time
 - c. Sequences
 - d. Deliveries
 - e. Off-site fabrication problems
 - f. Access
 - g. Site utilization
 - h. Temporary facilities and services
 - i. Hours of work
 - j. Hazards and risks
 - k. Housekeeping
 - l. Quality and work standards
 - m. Change Orders
 - n. Documentation of information for payment requests.

- D. Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, or progress since the previous meeting and report.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01200

SECTION 01300 - SUBMITTALS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:
 - 1. Contractors construction schedule
 - 2. Submittal schedule
 - 3. Daily construction reports
 - 4. Shop Drawings
 - 5. Product Data
 - 6. Samples
- B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
 - 1. Permits
 - 2. Applications for payment
 - 3. Performance and payment bonds
 - 4. Insurance certificates
 - 5. List of Subcontractors with start and finish dates update as necessary
 - 6. Schedule of Values
 - 7. Construction Schedule
- C. The Schedule of Values submittal is included in Section 01027 Application for Payment.
- D. Inspection and test reports are included in Section 01410 "Testing Laboratory Services".

1.03 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with

performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Project Manager reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
 - a. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Project Manager will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
 - b. If an intermediate submittal is necessary, process the same as the initial submittal.
 - c. Allow two weeks for reprocessing each submittal.
 - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractors review and approval markings and the action taken.
 2. Include the following information on the label for processing and recording action taken.
 - a. Project name
 - b. Date
 - c. Name and address of architect
 - d. Name and address of contractor
 - e. Name and address of subcontractor

- f. Name and address of supplier
 - g. Name of manufacturer
 - h. Number and title of appropriate Specification Section
 - l. Drawing number and detail references, as appropriate.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Project Manager using transmittal form as provided by the Project Manager. Submittals received from sources other than the Contractor will be returned without action.
- 1. On the transmittal Record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractors certification that information complies with Contract Document requirements.
 - 2. Transmittal Form: As provide by the Project Manager
- D. Contractor shall be responsible for cost of re-review of rejected submittals, shop drawing, etc. Costs for re-review shall be reimbursed to the County by deducting the cost from the Contractors monthly progress payments. Costs to be determined by applying the consultants standard billing rates, plus 10% handling by the County.
- E. Substitution request to specified products will be made within 45 days of Notice to Proceed. After the 45 day period, no requests for substitution from the Contractor will be considered.
- 1. Substitution submitted within the first 45 days will have product data from specified and requested substitute submitted together and demonstrate better quality, cost savings if of equal quality, or show benefit to the County for excepting the substitute. The Contractor shall include in their bid the cost of using the the specified listed products or those approved by pre-bid addenda. The county will not guarantee it will approve any request for substitution.

1.04 CONTRACTORS CONSTRUCTION SCHEDULE

- A. Critical Path Method (CPM) Schedule: Prepare a fully developed, horizontal bar-chart type Contractors construction schedule. Submit in accordance with Section 01200 project Meetings.
- 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the

Work as indicated in the Schedule of Values.

2. Within each time bar indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
 3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
 5. Coordinate the Contractors construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment request and other schedules.
 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architects procedures necessary for certification of Substantial Completion.
- B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by requirements for phased completion to permit Work by separate contractors and partial occupancy by the Owner prior to Substantial Completion.
- C. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.
- D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.
- E. Cost Correlation: At the head of the schedule, provide a two item cost correlation line, indicating pre-calculated and actual costs. On the line show dollar-volume of Work performed as the dates used for preparation of payment requests.
1. Refer to Section Applications for Payment for cost reporting and payment procedures.

- F. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with schedule dates. Post copies in the Project meeting room and temporary field office.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- G. Schedule Updating: Revise the schedule monthly or activity, where revisions have been recognized or made. Issue the updated schedule concurrently monthly pay request.

1.05 SUBMITTAL LOG

- A. After development and acceptance of the Contractors construction schedule, prepare a complete log of submittals.
1. Coordinate submittals log with the list of subcontracts, schedule of values and the list of products as well as the Contractors construction schedule.
 2. Prepare the log in chronological order; include all submittals required. Provide the following information:
 - a. Scheduled date for the first submittal
 - b. Related Section number
 - c. Submittal category
 - d. Name of subcontractor
 - e. Description of the part of the Work covered
 - f. Scheduled date for resubmittal
 - g. Scheduled date the Architects final release or approval.
 3. All submittals must be received within the first 25% of contract time.
- B. Distribution: Following response to initial submittal, print and distribute copies to the Project Manager, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the

Work and are no longer involved in construction activities.

- C. Log Updating: Revise the log after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.06 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Project Manager at weekly intervals:
 - 1. List of subcontractors at the site
 - 2. Approximate count of personnel at the site
 - 3. High and low temperatures, general weather conditions
 - 4. Accidents and unusual events
 - 5. Meetings and significant decisions
 - 6. Stoppages, delays, shortages, losses
 - 7. Meter readings and similar recordings
 - 8. Emergency procedures
 - 9. Orders and requests of governing authorities
 - 10. Change Orders received, implemented
 - 11. Services connected, disconnected
 - 12. Equipment or system tests and start-ups
 - 13. Partial completion, occupancies
 - 14. Substantial Completion authorized

1.07 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered a Shop Drawing and will be rejected.
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
 - 1. All required dimensions
 - 2. Identification of products and materials included
 - 3. Compliance with specified standards
 - 4. Notation of coordination requirements
 - 5. Notation of dimensions established by field measurement
 - 6. Sheet Size: Except for templates, patterns and similar full-size

Drawings on sheets at least 8" x 11" but no larger than 24" x 36".

7. Initial Submittal: Submit one correctable translucent reproducible print and one blue-or black-line print for the Project Managers review; the reproducible print will be returned.
8. Initial Submittal: Submit 2 blue-or black-line prints for the Architects review; one will be returned.
9. Final Submittal: Submit 2 blue-or black-line prints; submit 2 prints where required for maintenance manuals. 2 prints will be retained; the remainder will be returned.
10. Final Submittal: Submit 3 blue-or black-line prints; submit 2 prints where required for maintenance manuals. 2 prints will be retained; the remainder will be returned.
11. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connections with construction.

C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.

1. Preparation of coordination Drawings is specified in section Project Coordination and may include components previously shown in detail on Shop Drawings or Product Data.
2. Submit coordination Drawings for integration of different construction elements. Show sequence and relationships of separate components to avoid any conflict including conflicts in use of space.
3. Contractor is not entitled to additional payments due to lack of compliance with this Section.

1.08 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturers installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as Shop Drawing.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:

- a. Manufacturers printed recommendations
 - b. Compliance with recognized trade association standards
 - c. Compliance with recognized testing agency standards
 - d. Application of testing agency labels and seals
 - e. Notation of dimensions verified by field measurement
 - f. Notation of coordination requirements
 - g. Manufacturers local representative and phone number.
2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
 3. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.
 4. Submittals: Submit 6 copies of each required submittal. The Project Manager will return two (2) sets to the Contractor marked with action taken and corrections or modifications required.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until an applicable copy of Product Data applicable is in the Installers possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.09 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of materials, color range sets, and swatches showing color, texture and pattern.
 1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architects/Owners Sample. Include the following:
 - a. Generic description of the Sample
 - b. Sample source
 - c. Product name or name of manufacturer

- d. Compliance with recognized standards
 - e. Availability and delivery time
2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
- a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
- a. Preliminary submittals will be reviewed and returned with the Architects/Owners mark indicating selection and other action.
4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.
5. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.
- a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
1. Field Samples specified in individual sections are special types of

Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.

1.10 ARCHITECTS / ENGINEERS ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect/Engineer/Project Manager will review each submittal, mark to indicate action taken, and return promptly.
 - 1. Compliance with specified characteristics is the Contractors responsibility.

- B. Action Stamp: The Architect/Engineer/Project Manager will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, similarly as follows, to indicate the action taken:
 - 1. Final Unrestricted Release: Where submittals are marked No Exceptions Taken, that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.

 - 2. Final-But-Restricted Release: When submittals are marked Make Corrections Noted that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.

 - 3. Returned for Resubmittal: When submittal is marked Revise and Resubmit, do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked Revise and Resubmit to be used at the Project site, or elsewhere where Work is in progress.

 - 4. Rejected: Submittal does not comply with requirements of the Contract Documents. Submittal must be discarded and entirely new submittal shall be forward to the Project Manager without delay.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

PART 4 - SCHEDULE

4.1 SCHEDULE OF SUBMITTALS DESCRIPTION (SD) AND SUBMITTAL REGISTER

A. General: The following is a description of each submittal type, specified in other Sections, required for the Project. Include each submittal description (SD) in the Submittal Register included as part of this Section.

1. SD-01: Product Data; submittals which provide calculations, descriptions or other documentation regarding the work.
2. SD-02: Manufacturer's Catalog Data (Product Data); data composed of information sheets, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with requirements of the Contract Documents.
3. SD-03: Manufacturer's Standard Color Charts (Product Data); preprinted illustrations displaying choices of color and finish for a material or product. A type of product data.
4. SD-04: Shop Drawings; graphic representations which illustrate relationship of various components of the work, schematic diagrams of systems, details of fabrications, layout of particular elements, connections, and other relational aspects of the work.
5. SD-05: Design Data (Shop Drawings); design calculations, mix designs, analyses, or other data written and pertaining to a part of the work.
6. SD-06: Instructions (Product Data); preprinted material describing installation of a product, system, or material, including special notices and Material Safety Data Sheets, if any, concerning impedance, hazards, and safety precautions.
7. SD-07: Schedules (Shop Drawings); a tabular list of data or a tabular listing of locations, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.
8. SD-08: Statements (Shop Drawings); a document, required of the Contractor, or through the Contractor by way of a supplier, installer, manufacturer, or other lower tier contractor, the purpose of which is to

further the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verification of quality.

9. SD-09: Reports (Product Data); reports of inspection and laboratory tests, including analysis, an interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.
10. SD-10: Test Reports (Product Data); a report signed by an authorized official of a testing laboratory that a material, product, or system identical to the material, product or system to be provided has been tested in accordance with requirements specified by naming the test method and material. The test report must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test. Testing must have been within three years of the date of award of this Contract.
11. SD-11: Factory Test Reports (Shop Drawings); a written report which includes the findings of a test required to be performed by the Contractor or an actual portion of the work or prototype prepared for this project before it is shipped to the job site. The report must be signed by an authorized official of a testing laboratory and must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test.
12. SD-12: Field Test Reports (Shop Drawings); a written report which includes the findings of a test made at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation. The report must be signed by an authorized official of a testing laboratory or agency and must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test.
13. SD-13: Certificates (Shop Drawings); statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system, or material meet specified requirements. The statements must be dated after the award of this contract, name the project, and list the specific requirements which it is intended to address.
14. SD-14: Warranties (Product Data); statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system, or material will perform its specific function over a

specified duration of time. The statement must be dated, and include the name of the project, the Owner's name, and other pertinent data relating to the warranty.

15. SD-15: Samples; samples, including both fabricated and non-fabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.
16. SD-16: Color Selection Samples (Samples); samples of the available choice of colors, textures, and finishes of a product or material, presented over substrates identical in texture to that proposed for the work.
17. SD-17: Sample Panels (Samples); an assembly constructed at the project site in a location acceptable to the Owner's Representative and using materials and methods to be employed in the work; completely finished; maintained during construction; and removed at the conclusion of the work or when authorized by the Owner's Authorized Representative.
18. SD-18: Sample Installations (Samples); a portion of an assembly or material constructed where directed and, if approved, retained as a part of the work.
19. SD-19: Records; documentation to ensure compliance with an administrative requirement or to establish an administrative mechanism.
20. SD-20: Operation and Maintenance Manuals (Records); data intended to be incorporated in an Operations and Maintenance Manual
21. SD-21: Test Reports of Existing Conditions; a document describing existing conditions and operations of systems and components prior to the start of any work. Testing shall be held in the presence of the Owner's Authorized Representative. Provide copies of the test reports to the Owner's Authorized Representative.
22. SD-22: Demonstrations; physical operation of equipment and systems by factory authorized representatives to demonstrate to the Owner's facility personnel proper operation of systems. Provide all required documentation that certified completed demonstration.
23. SD-23: Record Drawings; delineated documentation accurately depicting final installation location of components and systems of the building.
24. SD-24: Shop Drawings in Magnetic Medium; when drawings are

required. All materials shall be provided in AUTOCAD Release 2000 or 2002.

- B. Submittal Register: The Contractor is to maintain an accurate updated submittal register and will bring this register to each scheduled progress meeting with the Owner and the Designer. This register should include the following items:
1. Submittal-Description and Number assigned.
 2. Date to Designer.
 3. Date returned to Contractor (from Designer).
 4. Status of Submittal (Accepted/Resubmit/Rejected).
 5. Date of Resubmittal and Return (as applicable).
 6. Date material released (for fabrication).
 7. Projected date of fabrication.
 8. Projected date of delivery to site.
 9. Status of submittal.

SUBMITTAL REGISTER (PART A)

Contract Number: Project

Title:

Spec. Section Number	Submittal Description (SD) Number	Spec. Paragraph Number	Designer Reviewer	Trans Control Number	Planned Submittal Date
(A)	(B)	(C)	(D)	(E)	(F)
02200	SD-12	1.4 A			
02270	SD-02, SD-15	1.3			
02281	SD-01	1.04			
02480	SD-12, SD-07, SD-13				
02513	SD-13	1.3 A			
02520	SD-01, SD-13	1.4A			
02577	SD-01, SD-02	1.3			
02666	SD-01, SD-23, SD-20	1.4A,B,C,D			
02668	SD-01, SD-04, SD-04, SD-23	1.4			
02720	SD-01, SD-20, SD-23	1.4A,B,C,D			
02730	SD-01, SD-20, SD-23	1.4A,B,C,D			
02831	SD-01	1.4A			
03300	SD-05	1.4			
16010	SD-23	1.16			
16010	SD-14	1.18			
16090	SD-12	3.1			
16095	SD-22	1.1			
16098	SD-20	1.2			
16111	SD-02	1.4			
16123	SD-02	1.3			
16131	SD-02	1.3			
16133	SD-01, SD-02	1.3			
16133	SD-23	1.4			
16141	SD-02, SD-06	1.3			
16160	SD-01, SD-02, SD-06	1.3			
16170	SD-23	1.3			
16170	SD-12	3.14			
16180	SD-02	1.4			
16421	SD-04	1.5			
16441	SD-02	1.4			
16471	SD-01, SD-02, SD-04	1.3			
16472	SD-01, SD-02, SD-04	1.3			

SECTION 01300
SUBMITTALS

16510	SD-02	1.4			
16530	SD-02	1.4			
16671	SD-01, 2, 4 & 6	1.4			
Spec. Section Number	Submittal Description (SD) Number	Spec. Paragraph Number	Designer Reviewer	Trans Control Number	Planned Submitta l Date
(A)	(B)	(C)	(D)	(E)	(F)
16671	SD-12	3.4			
16691	SD-01, SD-02	1.3			
16691	SD-14	1.8			
16723	SD-01, 2, 4, 6	1.7			
16723	SD-23	1.8			
16723	SD-20	1.9			
16723	SD-14	1.10			
16723	SD-22	1.13			
16723	SD-12	3.14			
16723	SD-13	3.15			

SUBMITTAL REGISTER (PART B)

Location:

Contractor:

Action Code	Date of Action	Date Rec'd from Contr.	Date FWD to other Reviewer	Date Rec'd from other Reviewer	Action Code	Date of Action	Mailed to Cont.	Remarks
(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)

END SECTION 01300

SECTION 01410 - TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selection and payment
- B. Contractor submittals
- C. Laboratory responsibilities
- D. Laboratory reports
- E. Limits on testing laboratory authority
- F. Contractor responsibilities
- G. Schedule of inspections and tests

1.02 RELATED SECTIONS

- A. Information Available to Bidders: Soil Investigation Data.
- B. General Conditions: Inspections, testing, and approvals required by public authorities.
- C. Individual Specification Sections: Inspections and tests required, and standards for testing.

1.03 REFERENCES

- A. ANSI/ASTM D3740 or as required in Specifications Divisions 2-16 - Practice for Evaluation of Agencies Engages in testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- B. ANSI/ASTM E329 or as required in Specifications Divisions 2-16 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.04 SELECTION AND PAYMENT

- A. Owner will employ and pay for services of an independent testing laboratory to perform specified inspection and testing.
- B. Employment of testing laboratory shall in no way relieve Contractor of

obligation to perform work in accordance with requirements of Contract Documents.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of ANSI/ASTM E329 and ANSI/ASTM D3740
- B. Laboratory: Authorized to operate in state in which Project is located.
- C. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
- D. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards (NBS) Standards or accepted values of natural physical constants.

1.06 CONTRACTOR SUBMITTALS

NOT USED

1.07 LABORATORY RESPONSIBILITIES

- A. Test samples of mixes.
- B. Provide qualified personnel at site when required. Cooperate with Orange County and Contractor in performance of services.
- C. Perform specified inspection, sampling, and testing of Products in accordance with specified standards.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify Orange County and Contractor of observed irregularities or non-conformance of Work or Products.
- F. Perform additional inspections and test required by Orange County.
- G. Attend preconstruction conferences and progress meetings.

1.08 LABORATORY REPORTS

- A. After each inspection and test, promptly submit four copies of laboratory report to Orange County, and to Contractor.
- B. Include:

1. Date issued
2. Project title and number
3. Name of inspector
4. Data and time of sampling or inspection
5. Identification of product and specifications section
6. Location in the Project
7. Type of inspection or test
8. Date of test
9. Results of tests
10. Conformance with Contract Documents

C. When requested by Orange County, provide interpretation of test results.

1.09 LIMITS ON TESTING LABORATORY AUTHORITY

- A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Laboratory may not approve or accept any portion of the Work.
- C. Laboratory may not assume any duties of Contractor
- D. Laboratory has no authority to stop the Work.

1.10 CONTRACTOR RESPONSIBILITIES

- A. Cooperate with laboratory personnel, and provide access to the Work.
- B. Provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.
- C. Notify Orange County and laboratory 48 hours prior to expected time for operations requiring inspection and testing services.
- D. Arrange with laboratory and pay for additional samples and tests required by Contractor beyond specified requirements.

1.11 SCHEDULE OF INSPECTIONS AND TESTS

- A. Backfilling: Requirements for sampling and testing backfilled materials.
- B. Testing required:
 1. Modified proctor maximum density determination tests for each soil

type.

2. Field in-place density tests at intervals not to exceed 300 ft. on sub-base and base material.
3. Thickness test for asphaltic concrete surfacing and concrete parking. Cores shall be taken at a maximum of 250 ft. The minimum thickness allowed shall be 1/4" less than the required average thickness.
4. Extraction stability and gradation of combine aggregate - one test per ~~500~~200 tons or part with minimum of one per day. Bitumen content, stability and gradation of aggregate to conform to intent of job mix formula.
5. Provide concrete mix designs as required under Specifications Sections 02520 and 030300.
6. Strength test for each ~~4~~50 cubic yard of concrete placed per day.
7. Visual inspection of all bar joist bearing ends for compliance with specifications.
8. Visual inspection of all metal roof deck structural welds.

END OF SECTION 01410

SECTION 01500 - TEMPORARY FACILITIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.
- B. Temporary utilities required include but are not limited to:
 - 1. Water service and distribution
 - 2. Temporary electric power and lights
 - 3. Telephone service & DSL Service
 - 4. Sanitary facilities
- C. Temporary construction and support facilities required include but are not limited to:
 - 1. Temporary heat and ventilation as required to facilitate construction process and personnel.
 - 2. Field office and storage sheds.
 - 3. Sanitary facilities, including drinking water.
 - 4. Temporary enclosures.
 - 5. Hoists and temporary elevator use.
 - 6. Temporary Project identification signs and bulletin boards
 - 7. Waste disposal services.
 - 8. Rodent and pest control.
 - 9. Pumps to control water table during construction activities.
 - 9. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities required include but are not limited to:
 - 1. Temporary fire protections
 - 2. Barricades, warning signs, lights
 - 3. Sidewalk bridge or enclosure fence for the site.
 - 4. Environmental protection
 - 5. Fencing, gates

6. Barriers

- a. Contractor shall be responsible for providing a temporary 6' high chain link construction fence around the entire perimeter of the construction site. Fence shall be removed upon completion of the job. Limits of construction fence indicate on the site plan drawings or if not indicated as required to maintain site security and safety.
- b. Contractor shall be responsible for providing security measures as required to prevent public entry to construction areas and adjacent properties from damage from construction operations.
- c. Contractor shall be responsible for providing a protective barrier around trees and plants designated to remain as indicated in plans and as required in zoning ordinances. Provide and maintain silt fences. Protect against vehicular traffic, stored materials, dumping, chemically injurious materials and puddling or continuous running water.

7. Enclosures

- a. Provide temporary weather-tight closures of openings in exterior surfaces to provide acceptable working conditions and protection for materials, to allow for temporary heating, and to prevent entry of unauthorized persons. Provide temporary doors with self-closing hardware and locks.

8. Protection of Installed Work

- a. Provide temporary protection for installed products. Control work and traffic in immediate area to avoid damage.
- b. Provide protective coverings at walls, projections, jambs, sills and soffits of openings. Provide barriers or coverings to protect roof and finished floors and stairs from work and traffic, movement of heavy objects and storage.
- c. Prohibit work, traffic and storage on waterproofed and roofed surfaces, and on lawn and landscaped areas

that is not a part of the work for those surfaces and areas.

9. Security and Maintenance

- a. Vehicular and pedestrian gates shall be securely locked at all times when no work is in progress and when not required for construction activities. During all work hours, gates which must be open shall be continuously monitored by the Contractor to prevent unauthorized personnel or vehicles from entering the construction site.
- b. Fencing shall be as specified in 1.02 D above and shall prevent pedestrian travel through the site for any reason.
- c. Temporary fencing shall be removed only for construction reasons. If temporary fencing removal is required for non-construction reasons, fencing shall be immediately replaced and secured as soon as the activity for which its removal was required is completed, or if the activity cannot be completed by the end of the work day, temporary security measures shall be taken by the Contractor to ensure that there is no breach of security even during off-work periods.
- d. No Trespassing and similar signs shall be posted at gates and along fencing adjacent to public areas to inform non-construction personnel of the reason for the fence and potential hazards of entering the construction site. Said signs shall be of a size and spacing to be legible from any point along the entire perimeter of the construction site.

1.03 SUBMITTALS

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.

1.04 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:

1. Building Code requirements
 2. Health and safety regulations
 3. Utility company regulations
 4. Police, Fire Department and Rescue Squad rules
 5. Environmental Protection regulations
- B. Standards: Comply with NFPA Code 241, ABuilding Construction and Demolition Operations, ANSI-A10 Series standards for Safety Requirements for Construction and Demolition, and NECA Electrical Design Library Temporary Electrical Facilities.
1. Refer to Guidelines for Bid Conditions for Temporary Job Utilities and Services, prepared jointly by AGC and ASC, for industry recommendations.
 2. Electrical Services: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.05 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use for the permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.
- C. Water Control: Grade site to drain. Maintain excavations free of water. Provide and operate pumping equipment if necessary. Provide silt barriers required by the Florida Department of Transportation, St. Johns and any other authority having jurisdiction over the Project.
- D. Cleaning During Construction: Control accumulation of waste materials and rubbish so as to maintain a neat, clean and orderly

and safe project periodically dispose of off-site as needed.

Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

- E. Project Identification: Provide a sign size 4'-0" x 8'-0", shall have 1) County seal, 2) Name of project, 3) Name of County Chairman, 4) Name of County Commissioners, 5) Consultant Team, 6) General Contractor. Locate to provide an unobstructed view from adjoining roadway. Remove project sign upon final completion acceptance.

- G. Protection of Adjacent Properties: Locate on site construction operations that will generate noise and/or dust as far as practical from occupied structures on adjacent properties so as to minimize disturbances to the occupants of these structures or properties.

Prevent dust or other contaminants caused by construction operations for this Project from being carried to adjacent properties by installation of protective barriers and/or suspension of construction operations during high winds.

Dispose of all construction debris which may be carried to adjacent properties by winds. Remove debris daily and/or more often as required to prevent contamination of adjacent properties.

- H. Removal: Remove temporary materials, equipment and construction facilities prior to Substantial Completion inspection.

Remove temporary utility services prior to Final Completion Inspection.

Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations; grade and complete all work on site as indicated.

- I. Conversion to Public Utilities: General Contractor is to coordinate and arrange with the appropriate utility service providing agencies and make arrangements for the installation and connection to final utilities prior to Final Completion inspection.

General Contractor shall provide any and all coordination, scheduling and layouts as may be required by the service utilities.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Provide new materials; if acceptable to the Project Manager, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
- B. Lumber and Plywood: Comply with requirements in Division 6 Section Rough Carpentry.
- D. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosure provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.
- E. Water: Provide portable water approved by local health authorities.
- F. Open-Mesh Fencing: Provide 11-gage, galvanized 2-inch, chain link fabric fencing 6-feet high with galvanized barbed wire top strand and galvanized steel pipe posts, 1 2" I.D. for line posts and 2 2 I.D. for corner posts.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

3.02 SECURITY AND PROTECTIONS FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Project Manager.
- B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities of the types needed to protect against

reasonably predictable and controllable fire losses. Comply with NFPA 10 Standard for Portable Fire Extinguishers, and NFPA 241 Standard for Safeguarding Construction, Alterations and Demolition Operations.

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 2. Store combustible materials in containers in fire-safe locations.
 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- E. Enclosure Fence: When excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs and other animals from easily entering the site, except by the entrance gates.
1. Provide open-mesh, chain-link fencing with posts set in a compacted mixture of gravel and earth.
- F. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.

1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of materials to minimize the opportunity for theft and vandalism.
- G. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.03 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24 hour day basis where required to achieve indicated results and to avoid possibility of damage.
 2. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than substantial completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

END OF SECTION 01500

SECTION 01600 - MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractors selection of products for use in the Project.
 - 1. Multiple Prime Contracts: Provisions of this Section apply to the construction activities of each prime Contractor.
- B. The Contractors Construction Schedule and the Schedule of Submittals are included under Section 01300 Submittals.
- C. Standards: Refer to Section Definitions and Standards for applicability of industry standards to products specified.
- D. Administrative procedures for handling requests for substitutions made after award of the Contract are included under Section 01631 Product Substitution.

1.03 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents such as specialties, systems, structure, finishes, accessories, and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.
 - 1. Products are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term product includes the term material, equipment, system and terms of similar intent.
 - a. Named Products are items identified by manufacturers' product name, including make or model designation, indicated in the manufacturers published product literature that is current as of the date of the Contract Documents.

- b. Foreign Products, as distinguished from domestic products, are items substantially manufactured (50 percent or more of value) outside of the United States and its possessions; or produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens or nor living within the United States and its possessions.
2. Materials are products that are substantially shaped; cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
3. Equipment is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.04 SUBMITTALS

- A. Product List Schedule: Prepare a schedule showing products specified in a tabular form acceptable to the Project Manager. Include generic names of products required. Include the manufacturers name and proprietary product names for each item listed.
 1. Coordinate the product list schedule with the Contractors Construction Schedule and the Schedule of Submittals.
 - a. Related Specification Section Number
 - b. Generic name used in Contract Documents
 - c. Proprietary name, model number and similar designations.
 - d. Manufacturers name and address
 - e. Suppliers name and address
 - f. Installers name and address
 - g. Projected delivery date, or time span of delivery period.
 2. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of an initial product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.
 - a. At the Contractors option, the initial submittal may be limited to product selections and designations that must be established early in the Contract period.
 3. Complete Scheduled: Within 45 days after date of commencement of the Work, submit 3 copies of the completed product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.

4. Architects Action: The Architect will respond in writing to the Contractor within 2 weeks 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. The Architects response will include the following:
 - a. A list of unacceptable product selections, containing a brief explanation of reasons for this action.

1.05 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between two 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. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producers nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
 1. Labels: 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. Equipment Nameplates: 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
 - f. Additional pertinent information

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle products in accordance with the manufacturers' recommendations, using means and methods that will prevent damage, deteriorating 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.
 3. Deliver products to the site in the manufacturers original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
 4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
 6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
 7. 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 manufacturers instructions.

PART 2 PRODUCTS

2.01 PRODUCT SELECTION

- A. General Product Requirements: 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. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situation on other projects.

- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
 - a. Where products or manufacturers are specified by name, accompanied by the term or equal or approved equal comply with the Contractor Document provisions concerning substitutions to obtain approval for use of an unnamed product.
 2. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of those products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning substitutions to obtain approval for use of an unnamed product.
 3. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
 4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated.
 - a. Manufacturers recommendations may be contained in published product literature, or by the manufacturers' certification of performance.
 5. Compliance with Standards, Codes and Regulations: Where the Specifications only requires compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
 6. Visual Matching: Where Specifications require matching an established Sample, the Architects decision will be final on whether a proposed product matches satisfactorily.

- a. Where no product available within the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning substitutions for selection of a matching product in another product category, or for noncompliance with specified requirements.
7. Visual Selection: Where specified product requirements include the phrase ... as selected from manufacturers standard colors, pattern, textures... or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern and texture from the product line selected.
8. Asbestos free materials: No products containing asbestos shall be used for any part of the work for this product. Provide verification.

END OF SECTION 01600

SECTION 01631-PRODUCTS SUBSTITUTIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
- B. The Contractors Construction Schedule and the Schedule of Submittals are included under Section Submittals.
- C. Standards: Refer to Section Definitions and Standards for applicability of industry standards to products specified.
- D. Procedural requirements governing the Contractors selection of products and product options are included under Section Materials and Equipment.

1.03 DEFINITIONS

- A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for substitutions. The following are not considered substitutions:
 - 1. Only these substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
 - 2. Revisions to Contract Documents requested by the Owner or Architect.

3. Specified options of products and construction methods included in Contract Documents.
4. The Contractors determination of and compliance with governing regulations and orders issued by governing authorities.

1.04 SUBMITTALS

- A. Substitution Request Submittal: Request for substitution will be considered if received within ninety (90) days after commencement of the Work. As long as this time allowance will not impact the construction schedule.
 1. Submit three (3) copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
 2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitution, and the following information, as appropriate:
 - a. Product Data, including Drawings, and descriptions of products, fabrication and installation procedures.
 - b. Samples, where applicable or requested.
 - c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
 - d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.
 - e. A statement indicating the substitutions effect on the Contractors Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 - f. Cost information, including a proposal of the net change, if any in the Contract Sum.

- g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractors waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
3. Architects Action: Within two weeks of receipt of the request for substitution, the Architect will request additional information or documentation necessary for evaluation of the request if needed. Within two (2) weeks of receipt of the request, or one week of receipt of the additional information or documentation, which ever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the project specified by name. Decision on the use of a product substitution or its rejection by the Architect is considered final. Acceptance will be in the form of a Change Order.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

- A. Conditions: The Contractors substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.
 1. Extensive revisions to Contract Documents are not required.
 2. Proposed changes are in keeping with the general intent of Contract Documents.
 3. The request is timely, fully documented and properly submitted.
 4. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate

activities properly.

5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 6. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar consideration.
 7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
 8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
 9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
- B. The Contractors submittal and Project Managers acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.
- C. Substitution request constitutes a representation that Contractor:
1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
 2. Will provide the same warranty for substitution as for specified product.
 3. Will coordinate installation and make other changes which may be required for work to be complete in all respects.

4. Waives claims for additional costs which may subsequently become apparent. All costs associated with the substitution will be paid by the Contractor regardless of approvals given, and regardless of subsequent difficulties experienced as a result of substitutions.

END OF SECTION 01631

SECTION 01700 - PROJECT CLOSE-OUT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for project close-out, including but not limited to:
 - 1. Inspection procedures
 - 2. Project record document submittal. (Substantial Completion)
 - 3. Operating and maintenance manual submittal (Substantial Completion Requirements).
 - 4. Submittal of warranties (Substantial Completion Requirement).
 - 5. Final cleaning
- B. Close-out requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.
- C. Final payment to be made when the County has received all required close-out documents.

1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following: List exceptions in the request.
 - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete

construction, and reasons the Work is not complete.

2. Advise Owner of pending insurance change-over requirements.
3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
5. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. Inspection Procedures: On receipt of a request for inspection, the Project Manager will either proceed with inspection or advise the Contractor of unfilled requirements. The Project Manager will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. Results of the completed inspection will form the basis of requirements for final acceptance.
2. Should the project fail to meet the standards required for Substantial Completion as defined in the documents the Contractor will pay the expense of a second inspection by the Project Manager/Consultants and the Owner. Cost will be deducted from the Contractors retainage.

1.04 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following List exceptions in the request:

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit and updated final statement, accounting for final

additional changes to the Contract Sum.

3. Submit a certified copy of the Project Managers final inspection list of item to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Project Manager.
 4. Submit final meter readings for utilities, a measured record of stored fuel and similar data as of the date of Substantial Completion, or when the Owner took possession of the responsibility for corresponding elements of the Work.
 5. Submit consent of surety to final payment.
 6. Submit a final liquidated damages settlement statement
 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure: The Project Manager will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Project Manager.
1. Upon completion of reinspection, the Project Manager will prepare a certification of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

1.05 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Project Managers reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contractor Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements

that would be difficult to measure and record at a later date. Provide for project photographs if deemed necessary by Owners representative.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
 2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
 3. Note related Change Order numbers where applicable.
 4. Organize record drawing sheets, an print. suitable titles, dates and other identification on the cover of each set.
 5. Provide three (3) additional sets of black line drawing sets of As-Builts Drawings.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Project Data.
1. Upon completion of the Work, submit record Specifications to the Project Manager for the Owners records.
- D. Record Project Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variation in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturers installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.
1. Upon completion of mark-up, submit complete set of record Product Data in the three ring binder (indexed) to the Project Manager for the Owners records.

- E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Project Manager and the Owners personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owners Sample storage area.
- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous record and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Project Manager for the Owners records.
- G. Maintenance Manuals: Organize operating and maintenance data into five (5) suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inc, 3-ring vinyl covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
 - 1. Emergency instructions
 - 2. Spare parts list
 - 3. Copies of warranties
 - 4. Wiring diagrams
 - 5. Recommended turn around cycles
 - 6. Inspection procedures
 - 7. Shop Drawings and Product Data
 - 8. Fixture lamping schedule

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 CLOSE-OUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance. If installers are not experienced in procedures, provide instruction by manufacturers representatives. All items to be provided or completed prior to certificate of Substantial Completion being issued by the Owner. Include a detailed review of the following items:

1. Maintenance manuals
2. Record documents
3. Spare parts and materials
4. Tools
5. Lubricants
6. Fuels
7. Identification systems
8. Control sequences
9. Hazards
10. Cleaning
11. Warranties and bonds
12. Maintenance agreements and similar continuing commitments
13. On site instructions to County maintenance personnel on major systems operations such as HVAC as per technical specifications.

B. As part of instruction for operating equipment, demonstrate the following procedures, prior to the Owner issuing Certificate of Substantial Completion:

1. Start-up
2. Shutdown
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments

3.02 PROJECT CLOSE-OUT MANUALS AT SUBSTANTIAL COMPLETION

- A. Submit Project Close-out Manuals prior to issuance of final application for payment. Provide three (3) copies.
- B. Bind in commercial quality 8 ½" x 11" three ring binder, indexed with hardback, cleanable, plastic covers.
- C. Label cover of each binder with typed title PROJECT CLOSE-OUT MANUAL, with title of project; name, address, and telephone number of Contractor and name of responsible Principal.
- D. Provide table of contents: Neatly typed, in the following sequence:
 1. Final Certificate of Occupancy
 2. Warranty Service Subcontractors Identification List
 3. Final Lien Waivers and Releases

4. Warranties and Guarantees
 5. Systems Operations and Maintenance Instruction
 6. Manufacturers Certificates and Certifications
 7. Maintenance Service Contracts
 8. Spare Parts Inventory List
 9. Special Systems Operating Permits or Approvals
 10. Asbestos free materials notarized statement
- E. Provide all documents for each section listed. List individual documents in each section in the table of contents, in the sequence of the Table of Contents of the Project Manual.
- F. Identify each document listed in the Table of Contents with the number and title of the specification section in which specified, and the name of the Product or Work item.
- G. Separate each section with index to sheets that are keyed to the Table of Contents listing.
- H. Warranty Service Subcontractors List shall identify subcontractor supplier, and manufacturer for each warranty with name, address and emergency telephone number.

3.03 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and included in Section Temporary Facilities.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturers instructions.
1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
 - a. Remove labels that are not permanent labels.
 - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - c. Clean exposed exterior and interior hard-surfaced finished to a dust-free condition, free of stains, films

and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces. Apply floor wax to vinyl floors.

- d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface. Remove waste and surplus materials from the site in an appropriate manner.
- C. Pest Control: Engage an experienced exterminator to make a final inspection, and rid the Project of rodents, insects and other pests.
- D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owners property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
- 1. Where extra materials of value remaining after completion of associated Work have become the Owners property, arrange for disposition of these materials as direct.

END OF SECTION 01700

SECTION 01740 - WARRANTIES AND BONDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.
 - 1. Refer to the General Conditions for terms of the Contractors special warranty of workmanship and materials.
 - 2. General close-out requirements are included in Section Project Close-Out.
 - 3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions 2 and 16.
 - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- B. Disclaimers and Limitations: Manufacturers disclaimers and limitations on product warranties to not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required do countersign special warranties with the Contractor.

1.03 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty. When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal

to the original warranty with an equitable adjustment for depreciation.

- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents.
- D. Owners Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligation, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.04 WARRANTY PERIOD

- A. The Contractor shall participate with the County and the Architects representative, at the beginning of the tenth month of the warranty period, in conducting an on site review and evaluation of all items of equipment, materials and workmanship covered by the warranties and guarantees. Contractor shall act promptly and without cost to the County to correct all defects, problems, or deficiencies determined as such by the Architect/Owner during on the site review.
- B. All warranties and guarantees shall commence on the date of Final Completion except for items which are determined by the County to be incomplete or a non-comply status at the time of Substantial Completion. The coverage commencement date for warranties and guarantees of such work shall be the date of the Countys acceptance of that work.
- C. Warranty period shall be manufacturers standard for product specified except where specific warranty periods are specified in individual sections. But in no case less than one year.

1.05 SUBMITTALS

- A. Submit written warranties to the Owner prior to the date certified for Substantial Completion. If the Architects Certificate of Substantial Completion designates a commencement date for warranties other than

the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Project Manager.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Project Manager within fifteen (15) days of completion of that designated portion of the Work.
- B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepared a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.
1. Refer to individual Sections of Divisions 2 and 16 for specific content requirements, and particular requirements for submittal of special warranties.
- C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty and bond properly executed by the Contractor, or by the subcontractor, supplier or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- D. Bind (3) three sets of warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8 1/2" by 11" paper.
1. Provide heavy paper dividers with Celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
 2. Identify each binder on the front and the spine with the typed or printed title WARRANTIES AND BONDS, the Project title or name, and the name of the Contractor.
 3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01740

SECTION 02110 - SITE CLEARING

PART 1. GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of site clearing is shown on drawings.
- B. Site clearing work includes, but is not limited to:
1. Protection of existing trees.
 2. Removal of trees and other vegetation.
 3. Topsoil stripping.
 4. Clearing and grubbing.
 5. Removing above-grade improvements.
 6. Removing below-grade improvements: disconnect and cap utility services.

1.3 JOB CONDITIONS

- A. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.
- B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.
1. Protect improvements on adjoining properties and on Owner's property.
 2. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.
- C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.
1. Water trees and other vegetation to remain within limits of the contract work as required to maintain their health during course of construction operations.
 2. Provide protection for roots over 1-1/2 inches in diameter cut during construction operations. Coat cut faces with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
 3. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to Engineer. Employ licensed arborist to repair damages to trees and shrubs.

SECTION 02110
SITE CLEARING

4. Replace trees which cannot be repaired and restored to full- growth status, as determined by arborist.
- D. Improvements on Adjoining Property: Authority for performing removal and alteration work on property adjoining Owner's property will be obtained by Owner prior to award of contract.
1. Extent of work on adjacent property is indicated on Drawings.
- E. Salvable Improvements: Carefully remove items indicated to be salvaged, and store on Owner's premises where indicated or directed.

PART 2. PRODUCTS (Not applicable.)

PART 3. EXECUTION

3.1 SITE CLEARING

- A. General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions interfering with installation of new construction. Remove such items elsewhere on site or premises as specifically indicated. Removal includes digging out stumps and roots.
1. Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.
- B. Topsoil: Topsoil is defined as surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.
1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.
 - a. Remove heavy growths of grass from areas before stripping.
 - b. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to main root system.
 2. Stockpile topsoil in storage piles in areas shown, or where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent wind-blown dust.
 3. Dispose of unsuitable or excess topsoil same as waste material, herein specified.
- C. Clearing and Grubbing: Clear site of trees, shrubs and other vegetation, except for those indicated to be left standing.
1. Completely remove stumps, roots, and other debris protruding through ground surface.
 2. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.
 3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 - a. Place fill material in horizontal layers not exceeding 6" loose depth, and thoroughly compact to a density equal to adjacent original ground.
- D. Removal of Improvements: Remove existing above-grade and below- grade improvements necessary to permit construction, and other work as indicated.

SECTION 02110
SITE CLEARING

1. Abandonment or removal of certain underground pipe or conduits may be shown on mechanical or electrical drawings, and is included under work of those sections. Removal of abandoned underground piping or conduit interfering with construction is included under this section.
2. Contact local utility companies 48 hours minimum prior to start of demolition work. Confirm verbal and written notices. Verify locations of all utilities entering site and their location on the site.
3. Cooperate with owner, utility companies, adjacent property owners, and other building trades in maintaining, protecting, rerouting or extending of utilities passing through work areas which serve structures located on project site and on adjacent properties.
4. Verify which utilities are to be removed, capped or abandoned are turned off, or are disconnected, or are rerouted to new locations before starting demolition.

3.2 DISPOSAL OF WASTE MATERIALS

- A. Burning on Owner's Property: Burning may be allowed on property with prior approval and permitting from authority having jurisdiction. All burning shall be conducted in a manner to minimize smoke and odor.
- B. Removal from Owner's Property: Remove waste materials and unsuitable, excess topsoil off site in legal manner.

END OF SECTION

SECTION 02200 - EARTHWORK

PART 1. GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 SUMMARY

- A. This Section includes the following:
1. Preparing of subgrade for building slabs, walks, and structures.
 2. For preparation of pavement subgrade.
 3. For pavement subgrade stabilization and base, refer to other Division 2 sections.
- B. Excavating and Backfilling of Utility Trenches: Refer to Earthwork - Underground Utilities, Section 02210.

1.3 DEFINITIONS

- A. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.
- B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.
1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.
 2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.
- C. Additional Excavation: When excavation has reached required subgrade elevations, notify Engineer, who will make an inspection of conditions. If Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Engineer. The Contract Sum may be adjusted by an appropriate Contract Modification.
1. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- D. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.

- E. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

1.4 SUBMITTALS

- A. Test Reports: Submit the following reports directly to Engineer from the testing services, with copy to Contractor:
 1. Test reports on borrow and imported material.
 2. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
 3. Field reports; in-place soil density tests.
 4. One optimum moisture-maximum density curve for each type of soil encountered.
 5. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

1.5 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.
- B. Testing and Inspection Service: Owner will employ and pay for a qualified independent geotechnical testing laboratory to perform soil testing and inspection service during earthwork operations.
- C. Testing Laboratory Qualifications: To qualify for acceptance, the geotechnical testing laboratory must demonstrate to Engineer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct required field and laboratory geotechnical testing without delaying the progress of the Work.

1.6 PROJECT CONDITIONS

- A. Site Information: Data in subsurface investigation reports was used for the basis of the design and are provided at the end of this specification section to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor. The geotechnical report is attached herein for reference at end of this section.
 1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.
 2. Contractor must adhere to procedures and recommendation outlined in the geotechnical investigation and must follow testing procedures as outlined.

- B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
 - 1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
 - a. Provide minimum of 48-hour notice to Engineer, and receive written notice to proceed before interrupting any utility.
 - 2. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies and Owner for shutoff of services if lines are active.
- C. Use of Explosives: Use of explosives is not permitted.
- D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
 - 1. Operate warning lights as recommended by authorities having jurisdiction.
 - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - 3. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

PART 2. PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP.
- B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.
- C. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. Fill material shall consist of sands with less than 6 percent soil fines passing No. 200 sieve.

PART 3. EXECUTION

3.1 EXCAVATION

- A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

3.2 STABILITY OF EXCAVATIONS

- A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.
- B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

3.3 DEWATERING

- A. Control of groundwater is required to achieve the necessary construction including earthwork, excavation, backfilling, placement of foundation and utilities. Contractor shall review the subsurface soil exploration provided for requirements of separation between bottom of any excavation or compaction surface and encountered groundwater table.
- B. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
 - 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 - 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

3.4 STORAGE OF EXCAVATED MATERIALS

- C. Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage.
 - 1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
 - 2. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

3.5 EXCAVATION FOR STRUCTURES

- A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing

and removal of concrete formwork, installation of services, and other construction and for inspection.

1. Excavations for footings and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection. Do not disturb bottom of excavations, intended for bearing surface.

3.6 EXCAVATION FOR PAVEMENTS

- A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

3.7 TRENCH EXCAVATION FOR PIPES AND CONDUIT

- A. Refer to Earthwork - Underground Utilities, Section 02210.

3.8 COLD WEATHER PROTECTION

- A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.9 BACKFILL AND FILL

- A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.
 1. Under grassed areas, use satisfactory excavated or borrow material.
 2. Under walks and pavements, use subbase material, satisfactory excavated or borrow material, or a combination.
 3. Under steps, use satisfactory excavated or borrow material.
 4. Under building slabs, use satisfactory excavated or borrow material.
 5. Under sport fields and a minimum distance of 20 feet beyond the sport field limits use satisfactory fill material with maximum 3% to 5% fines in accordance with geotechnical investigation.
 6. Under playgrounds and exercise area and extending 10 feet beyond use satisfactory fill material with maximum 5% fines.
 7. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
 - a. Concrete is specified in other Division 2 sections.
 - b. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

8. Provide 4-inch-thick concrete base slab support for piping or conduit less than 2'-6" below surface of roadways. After installation and testing of piping or conduit, provide minimum 4-inch-thick encasement (sides and top) of concrete prior to backfilling or placement of roadway subbase.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
 3. Removal of concrete formwork.
 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
 5. Removal of trash and debris from excavation.
 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.10 PLACEMENT AND COMPACTION

- A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
1. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.
- B. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
- E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Engineer if soil density tests indicate inadequate compaction.

1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 1557:
 - a. Under structures, building slabs and steps, and pavements, compact top 12 inches of subgrade and each layer of backfill or fill material at 98 percent maximum density.
 - b. Under lawn or unpaved areas, compact top 6 inches of subgrade and each layer of backfill or fill material at 90 percent maximum density.
 - c. Under walkways, compact top 6 inches of subgrade and each layer of backfill or fill material at 95 percent maximum density.
2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
 - a. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
 - b. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.11 GRADING

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:
 1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
 2. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
 3. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.
- C. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.
- D. Refer to construction drawings for additional requirements for grading of ballfields.
- E. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.12 PAVEMENT SUBBASE COURSE

- A. Refer to other Division 2 sections for preparation of subgrade, subbase, base, and paving specifications.
- B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

3.13 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.
 - 1. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or AASHTO T-180 or ASTM D 2167 (rubber balloon method), as applicable.
 - a. Field density tests may also be performed by the nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D 3017.
 - b. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Engineer.
 - 2. Footing Subgrade: For each strata of soil on which footings will be placed, perform at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Engineer.
 - 3. Building Slab Subgrade: Perform at least one field density test of subgrade for every 2,000 sq. ft. of paved area or building slab, but in no case fewer than three tests. In each compacted fill layer, perform one field density test for every 2,000 sq. ft. of overlying building slab or paved area, but in no case fewer than three tests.
 - 4. Foundation Wall Backfill: Perform at least two field density tests at locations and elevations as directed.
 - 5. Pavement Subgrade: One field density test for each compacted layer per 10,000 sq. ft. of paved area or 250 l.f. of roadways, but no fewer than three tests per paved area.
 - 6. If in opinion of Engineer, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained.

3.14 EROSION CONTROL

- A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.

3.15 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

SECTION 02200
EARTHWORK

- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.
- D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.16 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.

END OF SECTION



UNIVERSAL

ENGINEERING SCIENCES

GEOTECHNICAL EXPLORATION

**MAGNOLIA PARK ECO-TOURISM
APOPKA, ORANGE COUNTY, FLORIDA**

**UES PROJECT No. 0130.1700340.0000
UES REPORT No. 1505681**

PREPARED FOR:

**Capital Projects Division
400 East South Street, 5th Floor
Orlando, Florida 32801**

PREPARED BY:

**Universal Engineering Sciences
3532 Maggie Boulevard
Orlando, Florida 32811
(407) 423-0504**

November 27, 2017

Consultants in: Geotechnical Engineering • Environmental Sciences • Construction Materials Testing • Threshold Inspection
Offices in: Orlando • Daytona Beach • Fort Myers • Gainesville • Jacksonville • Ocala • Palm Coast • Rockledge • Sarasota • Miami
St. Augustine • Panama City • Fort Pierce • Leesburg • Tampa • West Palm Beach • Atlanta, GA



UNIVERSAL ENGINEERING SCIENCES

Consultants In: Geotechnical Engineering • Environmental Sciences
Geophysical Services • Construction Materials Testing • Threshold Inspection
Building Inspection • Plan Review • Building Code Administration

LOCATIONS:

- Atlanta
- Daytona Beach
- Fort Myers
- Fort Pierce
- Gainesville
- Jacksonville
- Kissimmee
- Leesburg
- Miami
- Ocala
- Orlando (Headquarters)
- Palm Coast
- Panama City
- Pensacola
- Rockledge
- Sarasota
- Tampa
- West Palm Beach

November 27, 2017

Capital Projects Division
400 East South Street, 5th Floor
Orlando, Florida 32801

Attention: Mr. Roan Waterbury
roan.waterbury@ocfl.net

Reference: **Geotechnical Exploration**
Magnolia Park Eco-Tourism
Apopka, Orange County, Florida
UES Project No. 0130.1700340.0000
UES Report No. 1505681

Dear Mr. Waterbury:

Universal Engineering Sciences, Inc. (UES) has completed a geotechnical exploration at the above referenced site in Orange County, Florida. The scope of our exploration was planned in conjunction with and authorized by you. This exploration was performed in accordance with our proposal (UES Proposal No. 1485692 dated August 23, 2017) and generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made.

The following report presents the results of our field exploration with a geotechnical engineering interpretation of those results with respect to the project characteristics as provided to us. We have included soil and groundwater conditions at our boring locations and geotechnical recommendations for site preparation, foundation design and stormwater management design.

We appreciate the opportunity to have worked with you on this project and look forward to a continued association. Please do not hesitate to contact us if you should have any questions, or if we may further assist you as your plans proceed.

Respectfully Submitted,
UNIVERSAL ENGINEERING SCIENCES, INC.
Certificate of Authorization No. 549

Megan deArrigoitia, E.I.
Project Engineer



TABLE OF CONTENTS

1.0	PROJECT DESCRIPTION.....	1
2.0	PURPOSE.....	1
3.0	SITE DESCRIPTION.....	2
3.1	SOIL SURVEY.....	2
3.2	TOPOGRAPHY.....	2
4.0	SCOPE OF SERVICES	2
5.0	FIELD EXPLORATION.....	3
6.0	LABORATORY TESTING	3
7.0	SUBSURFACE CONDITIONS.....	4
7.1	GENERALIZED SOIL PROFILES	4
7.2	NOTABLE FINDINGS.....	5
8.0	GROUNDWATER CONDITIONS	5
8.1	EXISTING GROUNDWATER LEVEL.....	5
8.2	SEASONAL HIGH GROUNDWATER LEVEL.....	6
9.0	SHALLOW FOUNDATION DESIGN RECOMMENDATIONS	6
9.1	GENERAL.....	6
9.2	STRUCTURAL AND GRADING INFORMATION	7
9.3	ANALYSIS	7
9.4	BEARING PRESSURE	7
9.5	FOUNDATION SIZE.....	7
9.6	BEARING DEPTH	7
9.7	BEARING MATERIAL	7
9.8	SETTLEMENT ESTIMATES	8
9.9	FLOOR SLABS.....	8
9.10	SITE PREPARATION FOR BUILDING AREAS.....	8
10.0	DEEP FOUNDATION DESIGN RECOMMENDATIONS.....	10
10.1	ANALYSIS	10
10.2	ESTIMATED CAPACITIES	10
10.3	QUALITY CONTROL	10
11.0	STORMWATER SYSTEM DESIGN	11
12.0	DEWATERING AND EXCAVATION CONSIDERATIONS	11
13.0	CONSTRUCTION RELATED SERVICES.....	12
14.0	LIMITATIONS	12



LIST OF TABLES

Table I:	Summary of Published Soil Data.....	2
Table II:	Laboratory Methodologies.....	3
Table IIIA:	Generalized Soil Profile on Shore	4
Table IIIB:	Generalized Soil Profile off Shore	4
Table IV:	Lateral Pile Analysis Results	10
Table V:	Stormwater Management Design Parameters	11

APPENDICES

APPENDIX A

USGS Location Map	A-1
-------------------------	-----

APPENDIX B

Boring Location Plan	B-1
Boring Logs	B-2
Key to Boring Logs Sheet	B-3

APPENDIX C

GBC Document	C-1
Constraints and Restrictions	C-2



1.0 PROJECT DESCRIPTION

We understand that the proposed project will include the construction of a new concession building, restroom building, boat ramp, docks, and stormwater improvements along the eastern shoreline of Lake Apopka in Orange County, Florida. We were provided a copy of the site plan prepared by SK Consortium identifying ten (10) boring locations.

Please note that due to accessibility issues (and as authorized by you), one of the requested borings (B-5) was cancelled and one boring (B-6) was relocated. Additionally, UES was unable to access one of the pond borings (P-3) with the drill rig. Therefore P-3 was performed approximately 55 feet east of the originally requested boring location. However a hand auger boring (designated P-3A) was completed in the originally requested location of P-3. Boring locations are presented on the attached Boring Location Plan

Should any of the above information or assumptions made by UES be inconsistent with the planned development and construction, we request that you contact us immediately to allow us the opportunity to review the new information in conjunction with our report and revise or modify our engineering recommendations accordingly, as needed.

No site or project facilities/improvements, other than those described herein, should be designed using the soil information presented in this report. Moreover, UES will not be responsible for the performance of any site improvement so designed and constructed.

2.0 PURPOSE

The purposes of this exploration were:

- to explore and evaluate the subsurface conditions at the site with special attention to potential problems that may impact the proposed development,
- to provide our estimates of the seasonal high groundwater level at the boring locations and
- to provide geotechnical engineering recommendations for site preparation, foundation design, and stormwater management design

This report presents an evaluation of site conditions on the basis of geotechnical procedures for site characterization. The recovered samples were not examined, either visually or analytically, for chemical composition or environmental hazards. We would be glad to provide you with a proposal for these services at your request.

Our exploration was not designed to specifically address the potential for surface expression of deep geological conditions, such as sinkhole development related to karst activity. This evaluation requires a more extensive range of field services than those performed in this study. We would be pleased to conduct an exploration to evaluate the probable effect of the regional geology upon the proposed construction, if you so desire.



3.0 SITE DESCRIPTION

The subject site is located within Section 30, Township 21 South, Range 28 East in Orange County, Florida. More specifically, the site is located on the eastern shoreline of Lake Apopka, approximately 800 feet northwest of the intersection of South Binion Road and Shear Road in Apopka as shown on the attached Figures A-1 and B-1. At the time of drilling, the site was developed as a park with concession and restroom buildings, a boat dock, volleyball court and paved parking areas. Portions of the site were being used for hurricane debris staging at the time of our exploration.

3.1 SOIL SURVEY

There are three (3) native soil types mapped within the general area of the site according to the USDA NRCS Soil Survey of Orange County. A brief summary of the mapped surficial (native) soil type(s) is presented in Table I.

TABLE I
SUMMARY OF PUBLISHED SOIL DATA

Soil Symbol	Soil Type	Hydrologic Group	Drainage Characteristics	Depth of Published Seasonal High GWT (feet)
47	Tavares-Millhopper complex, 0 to 5 percent slopes	A	Moderately well drained	3½ to 6
49	Terra Ceia muck, frequently ponded, 0 to 1 percent slopes	A/D	Very poorly drained	0+
99	Water	-	-	-

Please note that the SCS soil survey data is based on pre-developmental conditions. The native subsurface conditions depicted on the soil survey have likely been altered during previous development within the vicinity of the site and are not necessarily representative of the current subsurface conditions encountered during our exploration.

3.2 TOPOGRAPHY

Site specific topographic information was not provided by the client for our review at the time of this report preparation. According to information obtained from the United States Geologic Survey (USGS) Apopka, FL quadrangle map, the native ground surface elevation across the site area ranges from approximately +60 to +85 feet National Geodetic Vertical Datum (NGVD). According to the USGS map, the site is located along the eastern bank lake Apopka. A copy of a portion of the USGS Map is included in Appendix A.

4.0 SCOPE OF SERVICES

The services conducted by UES during our geotechnical exploration were as follows:

- Drilled a total of nine (9) Standard Penetration Test (SPT) borings, three (3) within the proposed building footprints to a depth of 15 feet below land surface (bls), three (3) within the proposed boat ramp/dock areas to a depth of 40 feet bls and three within or near the proposed stormwater ponds to a depth of 20 feet bls.



- Performed one (1) hand auger boring to a depth of 5 feet bls within the proposed stormwater pond (due to drill rig accessibility issues).
- Secured samples of representative soils encountered in the soil borings for review, laboratory analysis and classification by a Geotechnical Engineer.
- Measured the existing site groundwater levels and provide an estimate of the seasonal high groundwater level at the boring locations.
- Conducted laboratory testing on selected soil samples obtained in the field to determine their engineering properties.
- Assessed the existing soil conditions with respect to the proposed construction.
- Prepared a report which documents the results of our exploration and analysis with geotechnical engineering recommendations.

5.0 FIELD EXPLORATION

The SPT borings were performed with a truck mounted drilling rig and a barge mounted drilling rig. Horizontal and vertical survey control was not provided for the test locations prior to our field exploration program. UES located the test borings by using the provided site plan, measuring from existing on-site landmarks shown on an aerial photograph, and by using handheld GPS devices. The indicated test locations should be considered accurate to the degree of the methodologies used. The approximate boring locations are shown in Appendix B.

The SPT borings, designated B-1 through B-4, B-6, B-7 and P-1 through P-3 on the attached Boring Location Plan in Appendix B, were performed in general accordance with the procedures of ASTM D 1586 "Standard Method for Penetration Test and Split-Barrel Sampling of Soils". SPT sampling was performed continuously to 10 feet to detect variations in the near surface soil profile and on approximate 5 feet centers thereafter.

In addition to the SPT borings, one (1) hand auger boring, designated P-3A on the attached Boring Location Plan, was performed to a depth of 5 feet bls. The hand auger was performed in general accordance with the latest revision of ASTM D 1452, "Standard Practice for Soil Investigation and Sampling by Auger Borings". In this procedure, the boring was advanced beneath the ground surface by rotating a hand-held bucket type auger until the receiving end of the auger filled with soil. Once the bucket was filled, the auger assembly was removed from the borehole and the sample was retrieved from the bucket, placed in labeled plastic containers, and sealed. After completing the auger boring, the samples obtained from the boring were transported to our laboratory where they were examined by a member of our geotechnical staff.

6.0 LABORATORY TESTING

The soil samples recovered from the test borings were returned to our laboratory and visually classified in general accordance with ASTM D 2487 "Standard Classification of Soils for Engineering Purposes" (Unified Soil Classification System). We selected representative soil samples from the borings for laboratory testing to aid in classifying the soils and to help to



evaluate the general engineering characteristics of the site soils. The results of these tests are shown on the boring logs in Appendix B. A summary of the tests performed is shown in Table II.

**TABLE II
 LABORATORY METHODOLOGIES**

Test Performed	Number Performed	Reference
Grain Size Analysis (#200 wash only)	19	ASTM D 1140 "Amount of Material in Soils Finer than the No. 200 (75 - μ m) sieve"
Moisture Content	19	ASTM D 2216 "Laboratory Determination of Water (Moisture) Content of Soil by Mass"
Organic Content	2	ASTM D 2974 (Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and other Organic Soils)
Permeability Test	3	AASHTO T-215 "Method of Test for Permeability of Granular Soils (Constant Head)"

7.0 SUBSURFACE CONDITIONS

7.1 GENERALIZED SOIL PROFILES

The results of our field exploration and laboratory analysis, together with pertinent information obtained from the SPT borings, such as soil profiles, penetration resistance and groundwater levels are shown on the boring logs included in Appendix B. The Key to Boring Logs, Soil Classification Chart is also included in Appendix B. The soil profiles were prepared from field logs after the recovered soil samples were examined by a Geotechnical Engineer. The stratification lines shown on the boring logs represent the approximate boundaries between soil types, and may not depict exact subsurface soil conditions. The actual soil boundaries may be more transitional than depicted. A generalized profile of the soils encountered at our boring locations is presented in Table III. For detailed soil profiles, please refer to the attached boring logs.

**TABLE IIIA
 GENERALIZED SOIL PROFILE ON SHORE
 (BORINGS B-1 THROUGH B-3 & P-1 THROUGH P-3)**

Typical Depth (feet, bls)		Soil Description	Range of SPT "N" Values (blows/ft)
From	To		
Surface	14 to 15	Very loose to medium dense fine sands [SP, SP-SM].	2 to 16
14 to 15	20*	Medium dense to dense fine sands [SP, SP-SM] and clayey/silty fine sands [SC, SC-SM].	17 to 45

* denotes maximum termination depth of the borings



**TABLE IIIB
 GENERALIZED SOIL PROFILE OFF SHORE
 (BORINGS B-4, B-6 & B-7)**

Typical Depth (feet, bls)		Soil Description	Range of SPT "N" Values (blows/ft)
From	To		
Surface	4½ to 13½	Very loose to loose fine sands [SP, SP-SM], silty organic sands [SM-OL] and organic peat [PT]** .	1/18" to 8
4½ to 13½	18½ to 33½	Medium dense to dense fine sands [SP] and clayey/silty fine sands [SM, SC-SM].	12 to 40
18½ to 33½	40*	Loose to medium dense fine sands [SP-SM] and clayey/silty fine sands [SC-SM]	5 to 14

* denotes maximum termination depth of the borings

** organic soils were encountered to depths of up to 7 feet bls

7.2 NOTABLE FINDINGS

Dense Soils

A notable finding during the exploration program was the presence of dense soils at various boring locations, including borings B-3, B-6, B-7, P-2 and P-3 at depths ranging from 9 about 30 feet below existing grade. The dense soils found on site had SPT "N" blow count values from 30 to 45 blows per foot. It has been our experience that excavations through soils with SPT "N" blow counts in excess of about 25 blows per foot may prove difficult with smaller sized excavation equipment. The site contractor should select their excavation equipment for this site with this in mind.

Organic Soils

It should be noted that highly organic soils were encountered at boring locations B-4 and B-7. The organic were encountered from existing grade to depths of about 7 feet below existing grade. These soils had organic contents ranging from 9 to 79 percent with moisture contents between 72 to 892 percent. These organic soils were only encountered at the proposed boat ramp and dock locations where deep foundations (e.i. timber piles) will be installed and therefore it is not anticipated that they would hinder the proposed development.

8.0 GROUNDWATER CONDITIONS

8.1 EXISTING GROUNDWATER LEVEL

The groundwater table at our on shore boring locations was encountered at depths of approximately 3½ to 15 feet bls at the time of our exploration. The encountered water levels at each of the boring locations are shown on the individual boring logs in Appendix B. Fluctuations



in groundwater levels should be anticipated throughout the year, primarily due to seasonal variations in rainfall, surface runoff, and other factors that may vary from the time the borings were conducted.

8.2 SEASONAL HIGH GROUNDWATER LEVEL

Based on historical data, the rainy season in Central Florida is between June and October of the year. In order to estimate the seasonal high water level at the boring locations, many factors are examined, including the following:

- Measured groundwater level
- Drainage characteristics of existing soil types
- Current & historical rainfall data
- Natural relief points (such as lakes, rivers, wetlands, etc.)
- Man-made drainage systems (ditches, canals, retention basins, etc.)
- On-site types of vegetation
- Review of available data (soil surveys, USGS maps, etc.)
- Redoximorphic features (mottling, stripping, etc.)

Based on the results of our field exploration and the factors listed above, we estimate that the seasonal high groundwater level at the on shore boring locations may form at depths of roughly 2½ feet to depths greater than 10 feet bls. The estimated seasonal high water table at each boring location is presented on the individual boring logs in Appendix B.

It should be noted that the estimated seasonal high water levels do not provide any assurance that groundwater levels will not exceed these estimated levels during any given year in the future. Should the impediments to surface water drainage be present, or should rainfall intensity and duration, or total rainfall quantities, exceed the normally anticipated rainfall quantities, groundwater levels might exceed our seasonal high estimates. Further, it should be understood that changes in the surface hydrology and subsurface drainage from on-site and/or off-site improvements could have significant effects on the normal and seasonal high groundwater levels.

9.0 SHALLOW FOUNDATION DESIGN RECOMMENDATIONS

9.1 GENERAL

The following recommendations are made based upon a review of the attached soil test data, our understanding of the proposed construction, and experience with similar projects and subsurface conditions. The applicability of geotechnical recommendations is very dependent upon project characteristics such as improvement locations, and grade alterations. UES must review the final site and grading plans to validate all recommendations rendered herein.

Additionally, if subsurface conditions are encountered during construction, which were not encountered in the borings, report those conditions immediately to us for observation and recommendations.



9.2 STRUCTURAL AND GRADING INFORMATION

We understand that the proposed project will include the construction a new concession building and a new restroom building at the subject site in Orange County, Florida. Although detailed loading conditions were not provided, we have assumed that maximum loading for the proposed building will not exceed 5 kips per linear foot for structural walls and 75 kips for individual columns. Grade changes are anticipated to be minimal (± 2 feet).

Prior to finalizing any design, the structural/grading information outlined above should be confirmed by a structural/civil engineer. This is crucial to our evaluation and estimates of settlements. If any of this information is incorrect or if you anticipate any changes, please inform UES immediately so that we may review and modify our recommendations as appropriate.

9.3 ANALYSIS

Based on the results of the soil borings, the subsurface soils within the proposed building areas appear to be mostly very loose to loose sands to a depth of 14 feet bls. It is our opinion that proposed structures can be supported on properly designed and constructed shallow foundation systems. Provided that the site preparation recommendations outlined in this report are followed, the parameters outlined below may be used for foundation design.

9.4 BEARING PRESSURE

Provided our suggested site preparation procedures are followed, we recommend designing shallow footing foundations for a **maximum allowable net soil bearing pressure of 2,000 pounds per square foot (psf)**. The allowable net bearing pressure is that pressure that may be transmitted to the soil in excess of the minimum surrounding overburden pressure. The allowable bearing pressure should include dead load plus sustained live load. Per Section 1805.4.1 of the Florida Building Code (FLBC), the foundations should be designed for the most unfavorable effects due to the combinations of loads specified in Section 1605.3 of the FLBC.

9.5 FOUNDATION SIZE

For continuous wall foundations, the minimum footing width should comply with the current FLBC, but under no circumstances should be less than 12 inches. The minimum width recommended for an isolated column footing is 24 inches. Even though the maximum allowable soil bearing pressure may not be achieved, these width recommendations should control the size of the foundations.

9.6 BEARING DEPTH

The base of all footings should be at least 12 inches below finished grade elevation in accordance with the FLBC. We recommend stormwater and surface water be diverted away from the building exterior, both during and after construction, to reduce the possibility of erosion beneath the exterior footings.

9.7 BEARING MATERIAL

The foundations may bear on either the compacted suitable native soils or compacted structural backfill. The bearing level soils should exhibit a density of at least 95 percent of the maximum dry density as determined by ASTM D 1557 (Modified Proctor) **to a depth of at least 2 feet**



below foundation level as described in Section 9.10 of this report. In addition to compaction, the bearing soils must exhibit stability and be free of "pumping" conditions.

9.8 SETTLEMENT ESTIMATES

Post-construction settlement of the structure will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics of the bearing soils to a depth of approximately twice the width of the footing; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundation; (3) site preparation and earthwork construction techniques used by the contractor, and (4) external factors, including but not limited to vibration from off site sources and groundwater fluctuations beyond those normally anticipated for the naturally-occurring site and soil conditions which are present.

Our settlement estimates for the structure are based upon adherence to our recommended site preparation procedures presented in Section 9.10 of this report. Any deviation from these recommendations could result in an increase in the estimated post-construction settlement of the structures. Furthermore, should building loads change from those assumed by us, greater settlements may be expected.

Due to the sandy nature of the surficial soils following the compaction operations, we expect the majority of settlement to be elastic in nature and occur relatively quickly, on application of the loads, during and immediately following construction. Using the recommended maximum allowable bearing pressure, the assumed maximum structural loads, and the field and laboratory test data which we have correlated into the strength and compressibility characteristics of the subsurface soils, **we estimate the total post-construction vertical settlement of the proposed structures to be on the order of 1 inch or less.**

Differential settlement results from differences in applied bearing pressures and the variations in the compressibility characteristics of the subsurface soils. Assuming our site preparation recommendations are followed, **we anticipate post-construction differential settlement of less than ½ inch.**

9.9 FLOOR SLABS

Conventional floor slabs may be supported upon the compacted fill and should be structurally isolated from other foundation elements or adequately reinforced to prevent distress due to differential movements. For the slab design, we recommend using a subgrade modulus (k) of 100 pounds per cubic inches, which can be achieved by compacting the subgrade soils as recommended in this report. We recommend using a sheet vapor barrier (in accordance with Florida Building Code requirements) beneath the building slab-on-grade to help control moisture migration through the slab.

9.10 SITE PREPARATION FOR BUILDING AREAS

We recommend normal, good practice site preparation procedures for the new building areas. These procedures include: stripping/clearing of the site to remove vegetation, roots, topsoil, surface debris, etc. Following stripping, the exposed subgrade soils should be proof-rolled, and all subgrade and subsequent fill soils should be properly densified. A more detailed description of this work is presented in this section.



1. Strip the proposed construction limits of vegetation, topsoil, roots, debris and other deleterious materials within and 5 feet beyond the perimeter of the new construction areas. Expect clearing and grubbing to depths of 6 to 12 inches. We strongly recommend that the stripped/excavated surfaces be observed and probed by representatives of UES.
2. Proof-roll the exposed subsurface soils under the observation of UES, to locate any soft areas of unsuitable soils, and to increase the density of the shallow loose fine sand soils. If deemed necessary by UES, in areas that continue to "yield", remove any deleterious materials and replace with a clean, compacted sand backfill.
3. Place fill as necessary. All fill should consist of clean sand with less than 12 percent soil fines and be free of organics, debris and other deleterious materials. Fill soils containing between 5 and 12 percent fines may require strict moisture control. Place fill in maximum 12-inch loose, uniform lifts and compact each lift at least 95 percent of the Modified Proctor maximum dry density.
4. Within the at-grade (or below grade) building foundation areas, subgrade compaction of at least 95 percent of the Modified Proctor should be achieved to a depth of at least 2 feet below bottom of foundation/slab levels.
5. Test the subgrade and each lift of fill for compaction at a frequency of not less than one test per 2,500 square feet in the building areas, with a minimum of 4 tests in each area.
6. Prior to the placement of reinforcing steel and concrete, verify compaction within the footing trenches to a depth of 2 feet. Re-compaction of the foundation excavation bearing level soils, if loosened by the excavation process, can typically be achieved by making several passes with a walk-behind vibratory sled or jumping jack. We recommend testing every column footing and at least one test every 100 feet of wall footing, with a minimum of 4 tests per building.

Stability of the compacted soils is essential and independent of compaction and density control. If the near surface soils or the structural fill experience "pumping" conditions, terminate all earthwork activities in that area. Pumping conditions occur when there is too much water present in the soil-water matrix. Earthwork activities are actually attempting to compact the water and not the soil. The disturbed soils should be dried in place by scarification and aeration prior to any additional earthwork activities.

Vibrations produced during vibratory compaction operations at the site may be significantly noticeable within 100 feet and may cause distress to adjacent structures if not properly regulated. Provisions should be made to monitor these vibrations so that any necessary modifications in the compaction operations can be made in the field before potential damages occur. UES can provide vibration monitoring services to help document and evaluate the effects of the surface compaction operation on existing structures. It is recommended that large vibratory rollers remain a minimum of 50 feet from existing structures. Within this zone, the use of a static roller or small hand guided plate compactors is recommended.



10.0 DEEP FOUNDATION DESIGN RECOMMENDATIONS

10.1 ANALYSIS

We understand that the proposed project will include the construction of a new boat ramp and docks over Lake Apopka (as shown on Figure B-1). The docks and boat ramp will be supported upon a series of driven timber piles. In order to obtain soil data to aid in estimating pile capacities, three (3) SPT borings (designated B-4, B-6 and B-7) were performed from a floating barge on Lake Apopka, within the proposed ramp and dock areas.

Based on the results of the borings, the soil conditions consist of roughly 3 to 7 feet of very soft/organic lake bottom soils underlain by loose to dense sandy and clayey soils to 40 feet below the “mudline”. Please refer to the attached boring logs for more detailed soil profiles at each boring location.

10.2 ESTIMATED CAPACITIES

Based on the results of our exploration, we estimate that 16 inch round timber piles, driven to a depth of 17 feet below the mudline, would provide allowable compressional and uplift pile capacities of roughly 25 kips and 5 kips per pile, respectively. The pile capacities were estimated using the commercially available AllPile v7 software. A factor of safety of 2.0 was used to calculate the allowable capacities.

We understand that maximum lateral loads will be 1 kip per pile with a maximum exposed height of 8 feet above the mudline. The results of the lateral pile analysis are shown in Table IV. If the loading conditions or exposed heights are greater than those listed, UES should be notified in order to adjust the required pile embedment depth accordingly.

TABLE IV
LATERAL PILE ANALYSIS RESULTS

Pile Embedment Depth	Pile Size/Type	Maximum Moment*	Top Deflection
17 feet below mudline	16 inch tapered timber	10.7 kip-ft	1½ inch

*The maximum moment is an ultimate value and not factored. Appropriate factors of safety should be applied.

Please note that dense soils were encountered at the boring locations below a depth of roughly 10 to 15 feet below the mud line. The pile driving contractor should be aware that difficult driving conditions may be encountered within these dense zones.

We recommend that the timber piles meet the requirements of ASTM D-25 for round timber bearing piles and that the pile size be specified in terms of tip circumference with a minimum butt circumference.

10.3 QUALITY CONTROL

An engineering technician familiar with the installation of driven piles into subsurface soil conditions similar to those at this site and acting under the direction and supervision of the geotechnical engineering firm should witness the installation of the piles.



Specific requirements for driven piles are detailed in the Florida Building Code under Sections 1808 and 1809. These requirements cover group strength, installation methods, and reinforcement cover. We recommend that the piles be designed and constructed in accordance with the requirements outlined therein.

11.0 STORMWATER SYSTEM DESIGN

We understand that this project will include the construction of three (3) dry stormwater ponds. Three (3) SPT borings (designated P-1 through P-3) were performed, one within the vicinity of each of the proposed ponds. In addition to the SPT borings, one hand auger boring (designated P-3A) was performed within one of the ponds. The hand auger was performed at the originally requested location of P-3 due to accessibility issues. Our recommended stormwater management design parameters are shown in Table V.

**TABLE V
 STORMWATER MANAGEMENT DESIGN PARAMETERS**

Design Parameter	Estimated Values		
Relevant Boring Logs	P-1	P-2	P-3 & P-3A
Estimated Depth to Base of Surficial Aquifer (feet)	20.0 ⁺	14.5	11.5 [*]
Estimated Fillable Porosity of Surficial in-situ sands (percent)	25	25	20 [*]
Estimated Seasonal High Groundwater Level (feet)	8.0	6.5	4 [*]
Estimated Horizontal Saturated Hydraulic Conductivity of Surficial Aquifer (feet per day)	30	28	22 [*]
Estimated Vertical Unsaturated Hydraulic Conductivity of Surficial Aquifer (feet per day)	20	19	15 [*]

+ denotes termination depth of boring
 * denotes average of values for P-3 and P-3A

Please note that survey control was not provided at our boring locations. The estimated depths in the above table are referenced to the existing ground surface at the time of our exploration. Appropriate factors of safety should be included in the design.

12.0 DEWATERING AND EXCAVATION CONSIDERATIONS

Based on the groundwater level conditions encountered, some dewatering may be required for the successful construction of this project. Where excavations will extend only a few feet below the groundwater table, a sump pump may be sufficient to control the groundwater table. Deeper excavations may require well points and/or sock drains to control the groundwater table. Regardless of the method(s) used, we recommend drawing down the water level at least 2 feet below the bottom of the excavation. The actual method(s) of dewatering should be determined by the contractor. The design and discharge of the dewatering system must be performed in accordance with applicable regulatory criteria (i.e. water management district, etc.) and compliance with such criteria is the sole responsibility of the contractor.



Excavations should be sloped as necessary to prevent slope failure and to allow backfilling. As a minimum, temporary excavations below 4-foot depth should be sloped in accordance with OSHA regulations. Where lateral confinement will not permit slopes to be laid back, the excavation should be shored in accordance with OSHA requirements. During excavation, excavated material should not be stockpiled at the top of the slope within a horizontal distance equal to the excavation depth. Provisions for maintaining workman safety within excavations is the sole responsibility of the contractor.

13.0 CONSTRUCTION RELATED SERVICES

We recommend the owner retain UES to provide inspection services during the site preparation procedures for confirmation of the adequacy of the earthwork operations. Field tests and observations include verification of foundation and pavement subgrades by monitoring earthwork operations and performing quality assurance tests of the placement of compacted structural fill courses.

The geotechnical engineering design does not end with the advertisement of the construction documents. The design is an on-going process throughout construction. Because of our familiarity with the site conditions and the intent of the engineering design, we are most qualified to address site problems or construction changes, which may arise during construction, in a timely and cost-effective manner.

14.0 LIMITATIONS

This report has been prepared for the exclusive use of **Capital Projects Division** and other designated members of their design/construction team associated with the proposed construction for the specific project discussed in this report. No other site or project facilities should be designed using the soil information contained in this report. As such, UES will not be responsible for the performance of any other site improvement designed using the data in this report.

This report should not be relied upon for final design recommendations or professional opinions by unauthorized third parties without the expressed written consent of Universal Engineering Sciences, Inc. Unauthorized third parties that rely upon the information contained herein without the expressed written consent of Universal Engineering Sciences, Inc. assume all risk and liability for such reliance.

The recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated on the Boring Location Plan and from other information as referenced. This report does not reflect any variations which may occur between the boring locations. The nature and extent of such variations may not become evident until the course of construction. If variations become evident, it will then be necessary for a re-evaluation of the recommendations of this report after performing on-site observations during the construction period and noting the characteristics of the variations.

Borings for a typical geotechnical report are widely spaced and generally not sufficient for reliably detecting the presence of isolated, anomalous surface or subsurface conditions, or reliably estimating unsuitable or suitable material quantities. Accordingly, UES does not recommend relying on our boring information for estimation of material quantities unless our



contracted services **specifically** include sufficient exploration for such purpose(s) and within the report we so state that the level of exploration provided should be sufficient to detect anomalous conditions or estimate such quantities. Therefore, UES will not be responsible for any extrapolation or use of our data by others beyond the purpose(s) for which it is applicable or intended.

All users of this report are cautioned that there was no requirement for UES to attempt to locate any man-made buried objects or identify any other potentially hazardous conditions that may exist at the site during the course of this exploration. Therefore no attempt was made by UES to locate or identify such concerns. UES cannot be responsible for any buried man-made objects or environmental hazards which may be subsequently encountered during construction that are not discussed within the text of this report. We can provide this service if requested.

During the early stages of most construction projects, geotechnical issues not addressed in this report may arise. Because of the natural limitations inherent in working with the subsurface, it is not possible for a geotechnical engineer to predict and address all possible problems. A Geotechnical Business Council (GBC) publication, "Important Information About Your Geotechnical Engineering Report" appears in Appendix C, and will help explain the nature of geotechnical issues.

Further, we present documents in Appendix C: Constraints and Restrictions, to bring to your attention the potential concerns and the basic limitations of a typical geotechnical report.

* * * * *



APPENDIX A





UNIVERSAL
ENGINEERING SCIENCES

GEOTECHNICAL EXPLORATION
MAGNOLIA PARK ECO-TOURISM
AOPKA, ORANGE COUNTY, FLORIDA

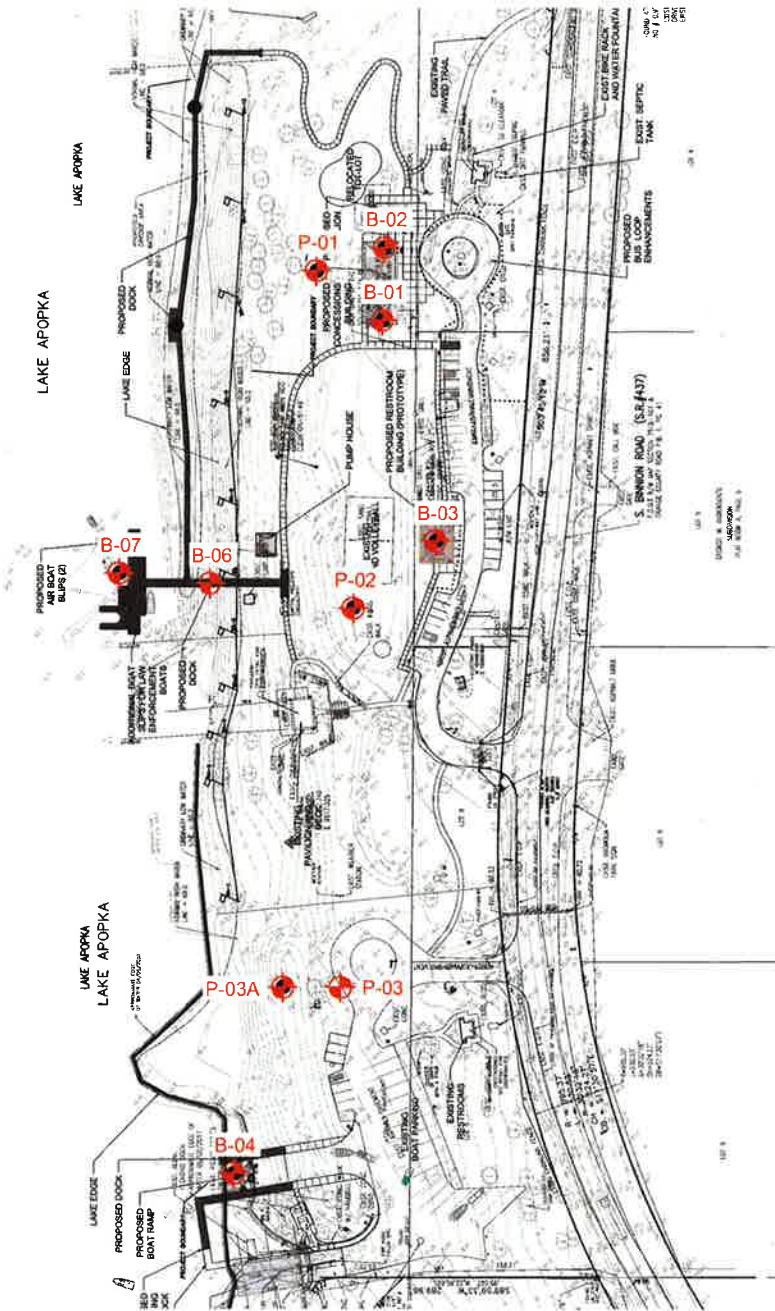
SITE LOCATION MAP

DRAWN BY: N.F.	DATE: 11 - 2 - 17	CHECKED BY: M.D.	DATE: 11 - 13 - 17
SCALE: AS SHOWN	PROJECT NO: 0130.1700340.0000	REPORT NO: 1505681	PAGE NO: A-1

17-0508-01

APPENDIX B

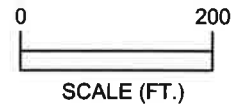




LEGEND

 APPROX. STANDARD PENETRATION TEST BORING LOCATION (SPT)

BORINGS PERFORMED 10/16/17 - 10/17/17



THIS DRAWING CREATED USING PLAN PROVIDED BY CLIENT.



UNIVERSAL
ENGINEERING SCIENCES

**GEOTECHNICAL EXPLORATION
MAGNOLIA PARK ECO-TOURISM
APOPKA, ORANGE COUNTY, FLORIDA**

BORING LOCATION PLAN

DRAWN BY: N.F.	DATE: 11-2-17	CHECKED BY: M.D.	DATE: 11-13-17
SCALE: AS SHOWN	PROJECT NO: 0130.1700340.0000	REPORT NO: 1505681	PAGE NO: B-1

17-0508-01



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.: 0130.1700340.0000

REPORT NO.: 1505681

PAGE: B-2.1

PROJECT: GEOTECHNICAL EXPLORATION
MAGNOLIA PARK ECO-TOURISM
APOPKA, ORANGE COUNTY, FLORIDA

BORING I.D.: **B-01**

SHEET: **1 of 1**

SECTION: 30

TOWNSHIP: 21 S

RANGE: 28 E

CLIENT: CAPITAL PROJECTS DIVISION

G.S. ELEVATION (ft): N.S.

DATE STARTED: 10/17/17

LOCATION: SEE BORING LOCATION PLAN

WATER TABLE (ft): 14.0

DATE FINISHED: 10/17/17

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED, HAND AUGER FIRST 5.5 FEET

DATE OF READING: 10/17/2017

DRILLED BY: ORL - DW/AI

EST. SHGWT (ft): >10

TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT/DAY)	ORG. CONT. (%)
									LL	PI		
0						Dark grey brown fine SAND [SP]						
						-- brown						
5						-- dark orange brown						
		1-2-3	5			-- loose, orange brown	1	3				
		2-3-3	6									
10		2-3-3	6									
15		2-3-5	8			-- very light grey brown						
						BORING TERMINATED AT 15.0 FEET						
20												
25												
30												
35												
40												



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.: 0130.1700340.0000

REPORT NO.: 1505681

PAGE: B-2.2

PROJECT: GEOTECHNICAL EXPLORATION
MAGNOLIA PARK ECO-TOURISM
APOPKA, ORANGE COUNTY, FLORIDA

BORING I.D.: **B-02**

SHEET: **1 of 1**

SECTION: 30

TOWNSHIP: 21 S

RANGE: 28 E

CLIENT: CAPITAL PROJECTS DIVISION

G.S. ELEVATION (ft): N.S.

DATE STARTED: 10/17/17

LOCATION: SEE BORING LOCATION PLAN

WATER TABLE (ft): 15.0

DATE FINISHED: 10/17/17

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT
SURVEYED, HAND AUGER FIRST 5.5 FEET

DATE OF READING: 10/17/2017

DRILLED BY: ORL - DW/AI

EST. SHGWT (ft): >10

TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	S A M P L E	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT/DAY)	ORG. CONT. (%)
									LL	PI		
0						Dark grey brown fine SAND [SP]						
5						-- brown -- dark orange brown	3	4				
6		2-2-4	6			-- loose, orange brown						
7		3-3-4	7			-- shade lighter						
10		3-3-4	7									
15		3-4-4	8	▼		-- light orange grey brown BORING TERMINATED AT 15.0 FEET						
20												
25												
30												
35												
40												

W-09676.GPJ



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.: 0130.1700340.0000

REPORT NO.: 1505681

PAGE: B-2.3

PROJECT: GEOTECHNICAL EXPLORATION
MAGNOLIA PARK ECO-TOURISM
APOPKA, ORANGE COUNTY, FLORIDA

BORING I.D.: **B-03** SHEET: **1 of 1**
SECTION: 30 TOWNSHIP: 21 S RANGE: 28 E

CLIENT: CAPITAL PROJECTS DIVISION
LOCATION: SEE BORING LOCATION PLAN

G.S. ELEVATION (ft): N.S. DATE STARTED: 10/17/17
WATER TABLE (ft): 15.0 DATE FINISHED: 10/17/17
DATE OF READING: 10/17/2017 DRILLED BY: ORL - DW/AI
EST. SHGWT (ft): >10 TYPE OF SAMPLING: ASTM D 1586

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED, HAND AUGER FIRST 5.5 FEET

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT/DAY)	ORG. CONT. (%)
									LL	PI		
0						Dark brown fine SAND with roots [SP]						
5						-- orange brown	3	4				
		2-1-2	3									
		1-1-2	3			-- very loose, dark orange brown, with roots						
10		3-2-2	4			-- orange brown						
15		3-11-19	30	▼		Medium dense light grey, orange red brown clayey fine SAND [SC] BORING TERMINATED AT 15.0 FEET	23	14				
20												
25												
30												
35												
40												

W-09676.GPJ



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.:	0130.1700340.0000
REPORT NO.:	1505681
PAGE:	B-2.4

PROJECT: GEOTECHNICAL EXPLORATION
MAGNOLIA PARK ECO-TOURISM
APOPKA, ORANGE COUNTY, FLORIDA

BORING I.D.: **B-04** SHEET: **1 of 1**
SECTION: 30 TOWNSHIP: 21 S RANGE: 28 E

CLIENT: CAPITAL PROJECTS DIVISION
LOCATION: SEE BORING LOCATION PLAN

G.S. ELEVATION (ft): N.S. DATE STARTED: 10/17/17
WATER TABLE (ft): 0.0 DATE FINISHED: 10/17/17
DATE OF READING: 10/17/2017 DRILLED BY: ORL - KR/JB/CM
EST. SHGWT (ft): TYPE OF SAMPLING: ASTM D 1586

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

DEPTH (FT.)	S A M P L E	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT/DAY)	ORG. CONT. (%)
									LL	PI		
0				▼		WATER						
10		1-0-0	1/18"			Very loose dark brown silty organic SAND [SM-OL]		72				9
10		2-3-5	8			-- loose						
10		5-5-7	12			Medium dense dark brown fine SAND trace of organics [SP]						
10		6-7-9	16			Medium dense brown silty clayey fine SAND [SC-SM]						
15		6-7-7	14			-- light grey brown						
15		5-7-11	18			-- very light grey						
20		7-7-8	15			-- light grey green						
25		3-4-9	13									
30		3-5-8	13				23	37				
35		5-5-7	12									
40		4-3-5	8			-- loose						
45		3-3-5	8									
						BORING TERMINATED AT 47.0 FEET						

W-09676.GPJ



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.: 0130.1700340.0000

REPORT NO.: 1505681

PAGE: B-2.5

PROJECT: GEOTECHNICAL EXPLORATION
MAGNOLIA PARK ECO-TOURISM
APOPKA, ORANGE COUNTY, FLORIDA

BORING I.D.: **B-06** SHEET: **1 of 1**
SECTION: 30 TOWNSHIP: 21 S RANGE: 28 E

CLIENT: CAPITAL PROJECTS DIVISION

G.S. ELEVATION (ft): N.S. DATE STARTED: 10/16/17

LOCATION: SEE BORING LOCATION PLAN

WATER TABLE (ft): 0.0 DATE FINISHED: 10/16/17

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

DATE OF READING: 10/16/2017 DRILLED BY: ORL - AR/DW/AI

EST. SHGWT (ft): TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	S A M P L E	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT/DAY)	ORG. CONT. (%)
									LL	PI		
0						WATER						
5												
10		1-0-0	1/18"			Very loose dark brown fine SAND with silt [SP-SM]						
		2-2-3	5			-- loose, brown						
		2-2-3	5			Loose light brown fine SAND [SP]						
		7-8-7	15			-- medium dense, brown						
		9-10-10	20			-- light brown						
15		12-15-16	31			Dense very light brown silty fine SAND [SM]						
20		10-9-10	19			Dense very light grey silty clayey fine SAND [SC-SM]	31	23				
						-- medium dense						
25		4-5-5	10			-- loose						
30		6-7-7	14			Loose very light brown fine SAND with silt [SP-SM]	11	27				
						-- medium dense						
35		3-2-3	5			Loose light grey green silty clayey fine SAND [SC-SM]						
40		2-3-3	6				33	41				
45		3-4-4	8									
						BORING TERMINATED AT 46.0 FEET						

W-09676.GPJ



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.: 0130.1700340.0000

REPORT NO.: 1505681

PAGE: B-2.6

PROJECT: GEOTECHNICAL EXPLORATION
MAGNOLIA PARK ECO-TOURISM
APOPKA, ORANGE COUNTY, FLORIDA

BORING I.D.: **B-07**
SECTION: 30

TOWNSHIP: 21 S SHEET: **1 of 1**
RANGE: 28 E

CLIENT: CAPITAL PROJECTS DIVISION

G.S. ELEVATION (ft): N.S. DATE STARTED: 10/16/17

LOCATION: SEE BORING LOCATION PLAN

WATER TABLE (ft): 0.0 DATE FINISHED: 10/16/17

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

DATE OF READING: 10/16/2017 DRILLED BY: ORL - AR/DW/AI

EST. SHGWT (ft): TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	S A M P L E	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	S Y M B O L	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT/DAY)	ORG. CONT. (%)
									LL	PI		
0						WATER						
5		1-0-0	1/18"			Very loose dark brown organic PEAT with roots [PT]		892				79
		1-0-0	1/18"									
		1-0-0	1/18"									
10		1-0-1	1									
		3-4-4	8			Loose dark grey brown fine SAND with silt [SP-SM]						
		4-4-4	8			-- grey brown						
15												
		19-18-22	40			Loose light brown silty clayey fine SAND [SC-SM]						
						-- dense						
20												
		9-12-12	24			-- medium dense, very light brown						
25						-- very light grey						
		7-9-7	16				25	25				
30												
		11-17-18	35			Dense brown fine SAND [SP]						
35												
		3-3-6	9			Dense light grey green silty clayey fine SAND [SC-SM]						
40						-- loose						
		3-4-5	9									
45						BORING TERMINATED AT 44.0 FEET						

W-09676.GPJ



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.:	0130.1700340.0000
REPORT NO.:	1505681
PAGE:	B-2.7

PROJECT: GEOTECHNICAL EXPLORATION
MAGNOLIA PARK ECO-TOURISM
APOPKA, ORANGE COUNTY, FLORIDA

BORING I.D.: **P-01** SHEET: **1 of 1**
SECTION: 30 TOWNSHIP: 21 S RANGE: 28 E

CLIENT: CAPITAL PROJECTS DIVISION
LOCATION: SEE BORING LOCATION PLAN

G.S. ELEVATION (ft): N.S. DATE STARTED: 10/17/17
WATER TABLE (ft): 10.0 DATE FINISHED: 10/17/17

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

DATE OF READING: 10/17/2017 DRILLED BY: ORL - DW/AI
EST. SHGWT (ft): 8.0 TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT/DAY)	ORG. CONT. (%)
									LL	PI		
0						Dark grey brown fine SAND [SP]						
						-- brown						
5						-- dark orange brown, with roots						
		1-2-3	5			-- loose, orange brown	2	5			30	
		4-4-5	9	▽								
10		4-5-5	10	▼			1	12				
15		3-5-7	12			-- medium dense, light orange brown						
20		5-7-10	17			-- very light grey brown						
						BORING TERMINATED AT 20.0 FEET						
25												
30												
35												
40												

W-09676.GPJ



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.: 0130.1700340.0000

REPORT NO.: 1505681

PAGE: B-2.8

PROJECT: GEOTECHNICAL EXPLORATION
MAGNOLIA PARK ECO-TOURISM
APOPKA, ORANGE COUNTY, FLORIDA

BORING I.D.: **P-02**

SHEET: **1 of 1**

SECTION: 30

TOWNSHIP: 21 S

RANGE: 28 E

CLIENT: CAPITAL PROJECTS DIVISION

G.S. ELEVATION (ft): N.S.

DATE STARTED: 10/17/17

LOCATION: SEE BORING LOCATION PLAN

WATER TABLE (ft): 8.5

DATE FINISHED: 10/17/17

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED, HAND AUGER FIRST 5.5 FEET

DATE OF READING: 10/17/2017

DRILLED BY: ORL - DW/AI

EST. SHGWT (ft): 6.5

TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT/DAY)	ORG. CONT. (%)
									LL	PI		
0						Dark grey brown fine SAND [SP]						
						-- dark orange brown						
5						-- orange red brown						
		2-3-4	7	▽		-- loose	2	7			28	
		4-4-4	8	▼		-- shade lighter						
10		6-4-3	7				2	18				
15		22-23-22	45			Dense light orange brown clayey fine SAND [SC]						
20		16-19-12	31			BORING TERMINATED AT 20.0 FEET						
25												
30												
35												
40												

W-09676.GPJ



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.: 0130.1700340.0000

REPORT NO.: 1505681

PAGE: B-2.9

PROJECT: GEOTECHNICAL EXPLORATION
MAGNOLIA PARK ECO-TOURISM
APOPKA, ORANGE COUNTY, FLORIDA

BORING I.D.: **P-03**

SHEET: **1 of 1**

SECTION: 30

TOWNSHIP: 21 S

RANGE: 28 E

CLIENT: CAPITAL PROJECTS DIVISION

G.S. ELEVATION (ft): N.S.

DATE STARTED: 10/17/17

LOCATION: SEE BORING LOCATION PLAN

WATER TABLE (ft): 8.0

DATE FINISHED: 10/17/17

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED, HAND AUGER FIRST 5.5 FEET

DATE OF READING: 10/17/2017

DRILLED BY: ORL - DW/AI

EST. SHGWT (ft): 6.0

TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT/DAY)	ORG. CONT. (%)
									LL	PI		
0						Dark grey brown fine SAND [SP]						
5						-- shade lighter						
		3-5-4	9	▽		-- loose						
		2-1-1	2	▼		-- very loose, dark brown						
10		2-2-2	4				5	24				
						Very loose brown fine SAND with silt [SP-SM]						
15		6-8-8	16			Medium dense light brown fine SAND [SP]						
20		20-22-23	45			Dense very light grey brown silty fine SAND [SM]	23	18				
						BORING TERMINATED AT 20.0 FEET						
25												
30												
35												
40												

W-09676.GPJ



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.: 0130.1700340.0000

REPORT NO.: 1505681

PAGE: B-2.10

PROJECT: GEOTECHNICAL EXPLORATION
MAGNOLIA PARK ECO-TOURISM
AOPKA, ORANGE COUNTY, FLORIDA

BORING I.D.: **P-03A** SHEET: **1 of 1**
SECTION: 30 TOWNSHIP: 21 S RANGE: 28 E

CLIENT: CAPITAL PROJECTS DIVISION

G.S. ELEVATION (ft): N.S. DATE STARTED: 10/17/17

LOCATION: SEE BORING LOCATION PLAN

WATER TABLE (ft): 3.5 DATE FINISHED: 10/17/17

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED

DATE OF READING: 10/17/2017 DRILLED BY: ORL - DW/AI





EST. SHGWT (ft): 2.5 TYPE OF SAMPLING: ASTM D 1452

DEPTH (FT.)	SAMPLING	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT/DAY)	ORG. CONT. (%)
									LL	PI		
0						Dark grey brown fine SAND [SP]						
				▽ ▼		-- dark brown	3	17			22	
5						-- brown HAND AUGER TERMINATED AT 5.0 FEET	4	23				
10												
15												
20												
25												
30												
35												
40												

W-09676.GPJ



SYMBOLS AND ABBREVIATIONS

<u>SYMBOL</u>	<u>DESCRIPTION</u>
N-Value	No. of Blows of a 140-lb. Weight Falling 30 Inches Required to Drive a Standard Spoon 1 Foot
WOR	Weight of Drill Rods
WOH	Weight of Drill Rods and Hammer
	Sample from Auger Cuttings
	Standard Penetration Test Sample
	Thin-wall Shelby Tube Sample (Undisturbed Sampler Used)
RQD	Rock Quality Designation
	Stabilized Groundwater Level
	Seasonal High Groundwater Level (also referred to as the W.S.W.T.)
NE	Not Encountered
GNE	Groundwater Not Encountered
BT	Boring Terminated
-200 (%)	Fines Content or % Passing No. 200 Sieve
MC (%)	Moisture Content
LL	Liquid Limit (Atterberg Limits Test)
PI	Plasticity Index (Atterberg Limits Test)
NP	Non-Plastic (Atterberg Limits Test)
K	Coefficient of Permeability
Org. Cont.	Organic Content
G.S. Elevation	Ground Surface Elevation

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than 50% retained on the No. 200 sieve*	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW Well-graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	GP Poorly graded gravels and gravel-sand mixtures, little or no fines
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS 5% or less passing No. 200 sieve	GM Silty gravels and gravel-sand-silt mixtures
		SANDS with 12% or more passing No. 200 sieve	GC Clayey gravels and gravel-sand-clay mixtures
			SW** Well-graded sands and gravelly sands, little or no fines
			SP** Poorly graded sands and gravelly sands, little or no fines
FINE-GRAINED SOILS 50% or more passes the No. 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less	SM** Silty sands, sand-silt mixtures	
		SC** Clayey sands, sand-clay mixtures	
		ML Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	
	SILTS AND CLAYS Liquid limit greater than 50%	CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays	
		OL Organic silts and organic silty clays of low plasticity	
		MH Inorganic silts, micaceous or diamicaceous fine sands or silts, elastic silts	
		CH Inorganic clays or clays of high plasticity, fat clays	
		OH Organic clays of medium to high plasticity	
PT Peat, muck and other highly organic soils			

*Based on the material passing the 3-inch (75 mm) sieve
** Use dual symbol (such as SP-SM and SP-SC) for soils with more than 5% but less than 12% passing the No. 200 sieve

RELATIVE DENSITY

(Sands and Gravels)
Very loose – Less than 4 Blow/Foot
Loose – 4 to 10 Blows/Foot
Medium Dense – 11 to 30 Blows/Foot
Dense – 31 to 50 Blows/Foot
Very Dense – More than 50 Blows/Foot

CONSISTENCY

(Silts and Clays)
Very Soft – Less than 2 Blows/Foot
Soft – 2 to 4 Blows/Foot
Firm – 5 to 8 Blows/Foot
Stiff – 9 to 15 Blows/Foot
Very Stiff – 16 to 30 Blows/Foot
Hard – More than 30 Blows/Foot

RELATIVE HARDNESS

(Limestone)
Soft – 100 Blows for more than 2 Inches
Hard – 100 Blows for less than 2 Inches

MODIFIERS

These modifiers Provide Our Estimate of the Amount of Minor Constituents (Silt or Clay Size Particles) in the Soil Sample

Trace – 5% or less
With Silt or With Clay – 6% to 11%
Silty or Clayey – 12% to 30%
Very Silty or Very Clayey – 31% to 50%

These Modifiers Provide Our Estimate of the Amount of Organic Components in the Soil Sample

Trace – Less than 3%
Few – 3% to 4%
Some – 5% to 8%
Many – Greater than 8%

These Modifiers Provide Our Estimate of the Amount of Other Components (Shell, Gravel, Etc.) in the Soil Sample

Trace – 5% or less
Few – 6% to 12%
Some – 13% to 30%
Many – 31% to 50%

APPENDIX C



Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply this report for any purpose or project except the one originally contemplated.*

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an

assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by:* the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help

others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold-prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical-engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your GBC-Member geotechnical engineer for more information.



8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

Copyright 2015 by Geoprofessional Business Association (GBA). Duplication, reproduction, or copying of this document, or its contents, in whole or in part, by any means whatsoever, is strictly prohibited, except with GBA's specific written permission. Excerpting, quoting, or otherwise extracting wording from this document is permitted only with the express written permission of GBA, and only for purposes of scholarly research or book review. Only members of GBA may use this document as a complement to or as an element of a geotechnical-engineering report. Any other firm, individual, or other entity that so uses this document without being a GBA member could be committing negligent or intentional (fraudulent) misrepresentation.

CONSTRAINTS & RESTRICTIONS

The intent of this document is to bring to your attention the potential concerns and the basic limitations of a typical geotechnical report.

WARRANTY

Universal Engineering Sciences has prepared this report for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering practices, and makes no other warranty either expressed or implied as to the professional advice provided in the report.

UNANTICIPATED SOIL CONDITIONS

The analysis and recommendations submitted in this report are based upon the data obtained from soil borings performed at the locations indicated on the Boring Location Plan. This report does not reflect any variations which may occur between these borings.

The nature and extent of variations between borings may not become known until excavation begins. If variations appear, we may have to re-evaluate our recommendations after performing on-site observations and noting the characteristics of any variations.

CHANGED CONDITIONS

We recommend that the specifications for the project require that the contractor immediately notify Universal Engineering Sciences, as well as the owner, when subsurface conditions are encountered that are different from those present in this report.

No claim by the contractor for any conditions differing from those anticipated in the plans, specifications, and those found in this report, should be allowed unless the contractor notifies the owner and Universal Engineering Sciences of such changed conditions. Further, we recommend that all foundation work and site improvements be observed by a representative of Universal Engineering Sciences to monitor field conditions and changes, to verify design assumptions and to evaluate and recommend any appropriate modifications to this report.

MISINTERPRETATION OF SOIL ENGINEERING REPORT

Universal Engineering Sciences is responsible for the conclusions and opinions contained within this report based upon the data relating only to the specific project and location discussed herein. If the conclusions or recommendations based upon the data presented are made by others, those conclusions or recommendations are not the responsibility of Universal Engineering Sciences.

CHANGED STRUCTURE OR LOCATION

This report was prepared in order to aid in the evaluation of this project and to assist the architect or engineer in the design of this project. If any changes in the design or location of the structure as outlined in this report are planned, or if any structures are included or added that are not discussed in the report, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions modified or approved by Universal Engineering Sciences.

USE OF REPORT BY BIDDERS

Bidders who are examining the report prior to submission of a bid are cautioned that this report was prepared as an aid to the designers of the project and it may affect actual construction operations.

Bidders are urged to make their own soil borings, test pits, test caissons or other investigations to determine those conditions that may affect construction operations. Universal Engineering Sciences cannot be responsible for any interpretations made from this report or the attached boring logs with regard to their adequacy in reflecting subsurface conditions which will affect construction operations.

STRATA CHANGES

Strata changes are indicated by a definite line on the boring logs which accompany this report. However, the actual change in the ground may be more gradual. Where changes occur between soil samples, the location of the change must necessarily be estimated using all available information and may not be shown at the exact depth.

OBSERVATIONS DURING DRILLING

Attempts are made to detect and/or identify occurrences during drilling and sampling, such as: water level, boulders, zones of lost circulation, relative ease or resistance to drilling progress, unusual sample recovery, variation of driving resistance, obstructions, etc.; however, lack of mention does not preclude their presence.

WATER LEVELS

Water level readings have been made in the drill holes during drilling and they indicate normally occurring conditions. Water levels may not have been stabilized at the last reading. This data has been reviewed and interpretations made in this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, tides, and other factors not evident at the time measurements were made and reported. Since the probability of such variations is anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based upon such assumptions of variations.

LOCATION OF BURIED OBJECTS

All users of this report are cautioned that there was no requirement for Universal Engineering Sciences to attempt to locate any man-made buried objects during the course of this exploration and that no attempt was made by Universal Engineering Sciences to locate any such buried objects. Universal Engineering Sciences cannot be responsible for any buried man-made objects which are subsequently encountered during construction that are not discussed within the text of this report.

TIME

This report reflects the soil conditions at the time of exploration. If the report is not used in a reasonable amount of time, significant changes to the site may occur and additional reviews may be required.



SECTION 02210 - EARTHWORK - UNDERGROUND UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. The work consists of excavating and backfilling all trenches and pits required for the installation of all underground utilities, pipelines, culverts, appurtenant structures and other items called for or reasonably implied in the Drawings to include sheeting and bracing, dewatering, supply and transport of fill materials, and disposal of waste materials. Appurtenant structures include headwalls, manholes, lift stations, box culverts, junction boxes, catch basins, inlets and other items related to underground systems.

PART 2 - MATERIALS

- 2.1 Bedding Material - CLASS I: ASTM D 2321, except that sizing shall be 1/4 inch to 3/4 inch. (Angular graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.)
- 2.2 Bedding Material - CLASS II: ASTM D 2321, except that upper size limit shall be 3/4 inch. (Coarse sands and gravels including variously graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Unified Soil Classification System (USCS) soil types GW, GP, SW, and SP are included.)
- 2.3 Bedding Material - CLASS III: ASTM D 2321. (Fine sand and clay gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures, USCS soil types GM, GC, SM, and SC are included.)
- 2.4 Initial Lift Backfill: Clean earth fill composed of sand, clay and sand, sand and rock, crushed rock, or approved combination. Under no circumstances shall any muck, stumps, roots, brush, trash, rubbish or organic material be used in the backfill. Material may be selected from the excavation, or obtained, if necessary, from an approved borrow pit area. The fragment size listed below shall not be exceeded for the following pipe materials.

Fragment Size

SECTION 02210
EARTHWORK -
UNDERGROUND
UTILITIES

A. Pipe Material (Greatest Dimension - Inches)

Concrete	3
Steel	3
Cast Iron	3
Ductile Iron	3
Corrugated Metal	3
Vitrified Clay	1-1/2
Plastic	1
Asbestos Cement	1/2

- 2.5 Final Lift Backfill: As described in the above paragraph, Initial Lift Backfill, except that maximum dimension for any stone or pavement fragment shall be 6 inches.
- 2.6 Sheeting and Bracing: Wood sheeting to be left in place shall be treated with preservatives per FDOT 955.

PART 3 - EXECUTION

- 3.1 General: Trenches shall be excavated to the alignment and elevations required to install utilities with proper foundations and bedding. Open no more trench in advance of pipe laying than is necessary to expedite the work.
- 3.2 Sheeting and Bracing: To prevent damage to property, injury to erosion, cave-ins, of excessive trench widths, or as required by law, adequate sheeting and bracing shall be provided. Sheeting shall be removed when the trench has been backfilled to at least one-half its depth, or when removal would not endanger the construction of adjacent structures. When required, to eliminate excessive trench width or other damage, sheeting, bracing or shoring shall be left in place and the top cut off at an elevation 2.5' below finished grade, unless otherwise specified. Wood sheeting shall not be removed from the trench region below the crown of the pipe.
- 3.3 Trench Width: The minimum width of the trench shall be equal to the outside diameter of the pipe at the joint plus 8 inches for unsheeted trench, or 12 inches for sheeted trench. Trench walls shall be maintained as vertical as possible to the top of the pipes; the maximum width of trench measured at the top of the pipe shall not exceed the outside pipe diameter plus 2', unless otherwise called for in the Drawings.
- 3.4 Unstable Trench/Pit Bottom: Where muck or other deleterious materials are encountered at or below trench grade, they shall be removed and replaced with Bedding Material in layers not to exceed 6 inches in thickness, compacted to at least 95% of maximum (AASHTO T-180) density. The Engineer may elect, depending upon the severity of the unstable soil, to require special foundations.
- 3.5 Over-Excavation: Should the trench be inadvertently over-excavated below a point 6 inches below the bottom of the pipe, but not beyond a point 12 inches below the bottom

SECTION 02210
EARTHWORK -
UNDERGROUND
UTILITIES

of the pipe, fill that area of over-excavation with Bedding Material and compact to 95% of maximum (AASHTO T-180) density. Contractor shall fill any area of over-excavation beyond a point 12 inches below the bottom of the pipe with Class I Bedding material to form an impervious mat at his expense. Where the Engineer approves alternate material, compaction shall be not less than 95% of maximum (AASHTO T-180) density.

- 3.6 Noncushioned Trench Bottom: Where pipe is to be laid in a rock-cut or other noncushioned material, excavation shall allow for 6 inches of bedding beneath the pipe.
- 3.7 Excavated Materials: Ownership of all suitable excavated materials shall remain with the Owner until the final job requirement for fill or backfill materials have been fulfilled. Unless otherwise provided, any surplus materials then remaining and not needed for job requirements shall become the property of Contractor and are to be disposed of by him. Excavated material to be used for backfill shall be neatly and safely deposited at the sides of the trench/pit where space is available. All excavated material shall be stockpiled in a manner that will not endanger the work. Hydrants under pressure, water and gas valves, manhole covers, fire and police call boxes, or other utility controls shall be left unobstructed and accessible. Gutters shall be kept open or other satisfactory provisions made for street drainage, and natural water courses shall not be obstructed. Unless otherwise approved, stockpiles shall not obstruct adjacent streets, walks or driveways. Temporary store of apparent excess suitable materials in areas provided by Owner until such materials are needed in the job or are declared surplus. With the written approval of the Engineer, Contractor may dispose of such apparent excess material with the stipulation that he shall replace any portion of the disposed material required to fulfill the actual job requirements, with equally suitable material, at his own expense.
- 3.8 Dewatering: All utilities and structures shall be laid/placed, "in the dry". Dewatering shall be by well-point unless otherwise approved by the Engineer. Dewatering shall be in accordance with good standard practice and all applicable codes and regulations and must be efficient enough to lower the water level in advance of the excavation and maintain the trench or pit bottom and sides continuously firm and dry through inspection. Discharge from dewatering shall not interfere with the normal drainage of the area in which the work is being performed, create a public nuisance or form ponding.
- 3.9 Bedding: All pipe shall be bedded Class B except where Class A is called for by the Engineer. Bedding shall be in accordance with the Standard Detail Drawings and as described herein.
- A. Class B: Raise trench to above pipe grade by placement and compaction of 4 inches to 6 inches of the bedding material specified for the particular system of installation. Provide bell holes to allow continuous support along the pipe barrel. Place and compact maximum (AASHTO T-180) density to the spring line of the pipe. Where coarse materials with voids have been used for bedding, the same coarse material shall also be used for the zone up to the spring line. Avoid vertical and lateral displacement of the pipe from proper alignment.
- 3.10 Backfill-Initial Lift: Initial Lift Backfill Material, as referenced in the "Initial Lift Backfill" paragraph above, shall be carefully placed and tamped over the upper half of the utility, and shall be carefully continued in layers not exceeding 6 inches in thickness for the full

SECTION 02210
EARTHWORK -
UNDERGROUND
UTILITIES

trench width, until the fill is 12 inches above the utility. Available material from the excavation shall be used if approved. The "Initial Lift" shall be thoroughly compacted and completed before the "Final Lift" is placed. Compact to 95% of maximum (AASHTO T-180) density.

- 3.11 Backfill-Final Lift: The remainder of the trench shall be backfilled with Final Lift Backfill material, as referenced in the "Final Lift Backfill" paragraph above, in layers not exceeding 12 inches. When trenches are cut in pavements or areas to be paved, compaction shall equal 98% of maximum (AASHTO T-180) density. Otherwise, compact to 95%.
- 3.12 Borrow: Should there be insufficient satisfactory material from the excavation to meet the requirements for fill material, and where borrow sites are not provided in the Contract Documents, borrow sites shall be secured by Contractor.
- 3.13 Compaction Method: The above specified compaction shall be accomplished using accepted standard methods (powered tampers, vibrators, etc.), with the exception that the first two feet of backfilling over the pipe shall be compacted by manual tamping devices. Flooding or puddling with water to consolidate backfill is not acceptable, except where sand is encountered.
- 3.14 Material Disposal: Excess, unsuitable, or cleared and grubbed material, resulting from the utility installation, shall be immediately removed from the work site and disposed of. Excess excavated material shall be spread on the disposal site and graded in a manner to drain properly and not disturb existing drainage conditions. Where disposal areas are not provided in the Contract Documents, Contractor shall furnish the disposal area without additional compensation.
- 3.15 Testing: Provide density testing by a qualified independent laboratory at intervals not to exceed 250 feet.

END OF SECTION

SECTION 02214
PAVEMENT REMOVAL AND REPLACEMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work included under this Section consists of cutting, removing, protecting and replacing existing pavements.
- B. Permits: The Contractor shall obtain the necessary permits (Seminole County, "Right-of-Way Utilization Permit", State of Florida, Department of Transportation, "Utility Permit"; and other applicable authorization), prior to any roadway work. Additionally, the Contractor shall provide advance notice to the appropriate authority, as required, prior to construction operations.
- C. Protection of existing improvements: The Contractor shall be responsible for the protection of all pavements, and other improvements within the work area. All damage to such improvements, as a result of the Contractor's operations, beyond the limits of the work of pavement replacement as described herein, shall be repaired by the Contractor at his expense.

1.2 JURISDICTIONAL REQUIREMENTS

- A. Work within the rights-of-way of public thoroughfares which are not under jurisdiction of Seminole County, shall conform to the requirements of the Governmental agency having jurisdiction. Specifically, work within state highway right-of-way shall be in full compliance with all requirements of the permit drawings, and to the satisfaction of the Florida Department of Transportation.
- B. Portions of the Standard Specifications for Road and Bridge Construction of the Florida Department of Transportation, 1977, and Supplement thereto hereinafter referred to as the DOT Specifications, are referred to herein and amended, in part, and the same are hereby made a part of this Contract to the extent of such references, and shall be as binding upon the Contract as though reproduced herein in their entirety.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Street or roadway pavement cut and removed in connection with trench excavation shall be replaced or restored in equal or better condition than the original and as shown on the Drawings. The Drawings indicate minimum requirements.

- B. Materials, including soil cement, bituminous prime and tack coat, and asphaltic concrete for the above work shall meet the requirements established therefore by the DOT Specifications.
 - 1. Soil cement.
 - 2. Bituminous prime coat material shall be cutback asphalt Grade RC-70.
 - 3. Bituminous tack coat material shall be emulsified asphalt Grade RS-2.
 - 4. Asphaltic concrete shall be Type S-III.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Removals:

- 1. Pavement removal:
 - a. Where existing pavement is to be removed, the surfacing shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge, with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal.
 - b. Immediately following the specified backfilling and compaction, a temporary sand seal coat surface shall be applied to the cut areas. This temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained until final restoration. Said surfacing shall remain for 10 days in order to assure the stability of the backfill under normal traffic conditions. Following this period and prior to 15 days after application, the temporary surfacing shall be removed and final roadway surface restoration accomplished.
 - c. In advance of final restoration, the temporary surfacing shall be removed and the existing pavement mechanically sawed straight and clean to the stipulated dimensions. Following the above operation, the Contractor shall proceed immediately with final pavement restoration in accordance with the requirements set forth in the Seminole County, "Right-of-Way Utilization Regulations", and these standards.

B. Restorations:

- 1. Pavement restoration - asphalt:
 - a. Soil cement base course shall be compacted for its full thickness to not less than 95 percent of maximum density as determined by AASHTO Designation T-180. Field density of soil cement base in place shall be determined by AASHTO Designation T-191 or ASTM Designation D2922.

- b. Construction methods and equipment shall generally meet the requirements therefore as established in the DOT Specifications, but shall be modified to meet the relatively narrow strip construction conditions. Any such modifications shall be accepted by the Engineer prior to their use.
- c. After the application of the prime coat on the base, the prime coat shall be allowed to cure without sanding for a period of 24-hours. The Contractor shall take all necessary precautions to protect the primed surface against damage during this interval. If, at the end of 24-hours, it is not proposed to proceed at once with the application of the surface course, primed surface shall be given a light application of clean sand and opened to traffic.
- d. Joints with existing surface and base shall be straight and neat. If necessary to obtain a straight net joint, the Contractor shall cut out sufficient existing material and replace it with new material.

END OF SECTION

SECTION 02270 - EROSION AND SEDIMENTATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. All erosion, sedimentation and water pollution control features shall be in place or relocated as designated on the plans prior to the start of any clearing, grubbing, grading or construction. Contractor shall be responsible for the installation and maintenance of all temporary erosion control features.
- B. Location of the control features shall be in accordance with the Drawings or as required to facilitate drainage and control erosion and sedimentation within and adjacent to the site.
- C. Control features are defined as, but not limited to, swales, berms, silt fences, silt barriers and temporary fences.

1.2 QUALITY ASSURANCE

- A. The provision for prevention, control and abatement of erosion, sedimentation and water pollution shall be as stated in the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Section 104, latest edition.

1.3 SUBMITTALS

- A. Product data: Manufacturers literature, application instructions and samples.
- B. List of materials and their characteristics for other erosion control items.

1.4 CONTROL OF CONTRACTOR'S OPERATIONS WHICH MAY RESULT IN WATER POLLUTION

- A. Take sufficient precautions to prevent pollution of streams, canals, lakes, reservoirs, wetlands and other sensitive areas with silt, sediment, fuels, oils, bitumens, calcium chloride, or other harmful materials. Conduct and schedule operations so as to avoid or otherwise minimize pollution or siltation of such streams, etc. and to avoid interference with movement of migratory fish. Do not dump the residue from dust collectors or washers into any water body.
- B. Construction operations in rivers, streams, lakes, tidal waters, reservoirs, canals, and other impoundments shall be restricted to those areas where it is necessary to

perform filling or excavation to accomplish the work shown in the Contract Documents and to those areas which must be entered to construct temporary or permanent structures. As soon as conditions permit, promptly clear rivers, streams, and impoundments of all obstructions placed therein or caused by construction operations.

- C. Except as necessary for construction, do not deposit excavated material in rivers, streams, canals, or impoundments, or in a position close enough thereto, to be washed away by high water or run-off.
- D. Where pumps are used to remove highly turbid waters from enclosed construction areas such as cofferdams or forms, treat the water prior to discharge into State waters. Pump the water into grassed swales, appropriately vegetated areas, or sediment basins, or confine it by an appropriate enclosure such as siltation curtains when other methods are not considered appropriate. Do not contaminate State waters. The background condition of all waters to be discharged from the site must be tested prior to discharge. All waters discharged from the site must be approved through Orange County Environmental Department by the Engineer.
- E. Do not disturb lands or waters outside the limits of construction, unless approved in advance and in writing by the Owner. No operations within non-permitted wetlands or upland buffers are allowed.

1.5 START OF WORK

- A. Do not start work until erosion control measures are in place.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Silt Barriers:
 - 1. Two types of silt barriers shall be installed in accordance with the plans: silt barriers installed on the ground and floating silt barriers.
 - 2. Silt barriers (filter fabric) shall be synthetic and contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six (6) months of expected usable construction life at a temperature range of 0 to 120EF.
 - 3. Filter fabric shall be a pervious sheet of propylene, nylon or polyester and shall be certified by the manufacturer or supplier to conform to the following specifications:
 - Filter efficiency (Test VTM-51): 75%.
 - Minimum tensile strength at 20% elongation (Test ASTM-D-1682): 120 lbs.
 - Tear strength (Test ASTM D2263): 50 lbs.
 - 4. Contractor shall submit further filter fabric material specifications and installation configuration prior to start of construction.
 - 5. Silt barriers shall be maintained in place.

6. Filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are necessary, filter fabric shall be spliced together only at a support post, with a 6 inch overlap, and securely sealed.
 7. The following items shall be installed and maintained in accordance with the applicable sections of the FDOT Standard Specifications:
 - a. Temporary silt fences and staked silt barriers
 - b. Floating silt barrier
- B. Temporary Fence
1. Brightly colored fence as manufactured by Mirafi, product Mirasafe, or approved equal.
 2. Material shall be 4' high, attached to 6' metal posts at 12' centers. Posts shall be driven 18" into ground.

PART 3 - EXECUTION

3.1 GENERAL

- A. Temporary erosion control features shall consist of, but not be limited to, temporary grassing, temporary sodding, temporary mulching, sandbagging, slope drains, sediment basins, artificial coverings, berms, baled hay or straw, floating silt barriers, staked silt barriers and staked silt fences. Design details for some of these items may be found in the Water Quality Section of the applicable edition of the FDOT Roadway and Traffic Design Standards. All of these items shall be constructed in accordance with applicable sections of the FDOT Standard Specifications.
- B. Incorporate permanent erosion control features into the project at the earliest practical time. Correct conditions, using temporary measures, that develop during construction to control erosion prior to the time it is practical to construct permanent control features.
- C. Construct temporary and permanent erosion and sediment control measures and maintain them to prevent the pollution of adjacent water ways in conformance with the laws, rules and regulations of Federal, State and local agencies.
- D. Copies of approved permits will be provided to the Contractor for his review and use. Contractor shall be required to comply with all General and Special Conditions noted within the permit by the particular permitting agency. The Contractor shall maintain copies of these permits on the job site at all times.

3.2 INSTALLATION

The following items shall be installed in accordance with the FDOT Standard Specification. The procedures are only generally described herein.

- A. Temporary Grassing: This work shall consist of furnishing and placing grass seed.
- B. Temporary Sod: This work shall consist of furnishing and placing sod.
- C. Temporary Mulching: This work shall consist of furnishing and applying a two-inch to four-inch thick blanket of straw or hay mulch and then mixing or forcing the mulch into the top two inches of the soil in order to temporarily control erosion. Only undecayed straw or hay, which can readily be cut into the soil, shall be used. Other measures for temporary erosion control such as hydro-mulching, chemical adhesive soils stabilizers, etc., may be substituted for mulching with straw or hay with the approval of the Owner. When permanent grassing operations begin, temporary mulch materials shall be plowed under in conjunction with preparation of the ground.
- D. Sandbagging: This work shall consist of furnishing and placing sandbags in configurations, so as to control erosion and siltation.
- E. Slope Drains: This work shall consist of constructing slope drains, utilizing pipe, fiber mats, rubble, cement concrete, asphaltic concrete plastic sheeting, or other acceptable materials, in accordance with the details shown in FDOT's Roadway and Traffic Design Standards or as may be approved as suitable to adequately perform the intended function.
- F. Sediment Basins: Sediment basins shall be constructed in accordance with the details shown in FDOT's Roadway and Traffic Design Standards or as suitable to adequately perform the intended function. Sediment basins shall be cleaned out as necessary.
- G. Artificial Coverings: This work shall consist of furnishing and applying fiber mats, netting, plastic sheeting, or other approved covering to the earth surfaces.
- H. Berms: This work shall consist of construction of temporary earth berms to divert the flow of water from an erodible surface.
 - 1. This work shall consist of construction of baled hay or straw dams or earth berms to protect against downstream accumulations of silt. The baled hay or straw dams shall be constructed in accordance with the details shown in FDOT's Roadway and Traffic Design Standards.
 - 2. The berm or dam shall be placed so as to effectively control silt dispersion under conditions present on this project. Alternate solutions and usage of materials may be used if approved.

3.3 SILT BARRIERS

- A. Silt barriers shall be installed and maintained at the locations shown on the plans. The Contractor is required to prevent the possibility of silting onto any adjacent parcel.
- B. Silt barrier shall be of the staked type and stakes shall be installed as indicated in the drawings.
- C. The height of the silt barrier fabric shall be a minimum of 42 inches.
- D. The stakes shall be 2 inch x 4 inch wood, 5 feet long and shall be spaced a maximum of 10 feet apart at the barrier location and driven securely into the ground.
- E. A trench shall be excavated approximately 4 inches wide by 4 inches deep along the line of stakes. The filter fabric shall be tied or stapled to the wooden stakes and 8 inches of fabric shall be extended into the trench. The staples shall be heavy duty wire and at least one-half (1/2) inch long. The trench shall then be backfilled and the soil compacted over the filter fabric.

3.4 FLOATING SILT BARRIERS

- A. Floating silt barriers where required shall be in place prior to the start of any construction or grading.
- B. Floating silt barriers shall meet or exceed the Florida Department of Transportation Roadway and Traffic Design Standards, Index No. 102, Floating Silt Barrier. Contractor shall submit fabric filter material specifications and installation configuration for approval prior to the start of construction.

3.5 TEMPORARY FENCE

- A. Furnish, install and maintain on wetland lines, buffer lines, tree save lines and otherwise as shown on plans. Attach silt barrier to the temporary fence.
- B. Follow manufacturer's installation recommendations.

3.6 MAINTENANCE

- A. Silt barriers and temporary fences shall be inspected immediately after each rainfall and at least once a day during periods of prolonged rainfall. Any repairs shall be made immediately.
- B. Should the fabric on a silt barrier or temporary fence decompose or become ineffective, the installation shall be repaired or replaced immediately at no additional

SECTION 02270
EROSION AND SEDIMENTATION

cost to the Owner. If the Contractor fails to repair or replace the items as above, the Owner shall have the right to stop work without additional cost to the Owner until such time as the repair or replacement has been made.

- C. Sediment deposits shall be removed after each storm event. The Contractor will repair and restore the installations to a working and effective condition to the satisfaction of the Owner.
- D. At the completion of all work, the silt barriers and the temporary fences will be removed if by the Owner.
- E. Any sediment deposits in place after the silt fence or filter barrier is no longer required shall be dressed to conform to the existing grade and prepared for seeding or sodding.

3.7 PROTECTION DURING SUSPENSION OF CONTRACT TIME

- A. In the event that it is necessary that the construction operations be suspended for any appreciable length of time, shape the top of the earthwork in such a manner as to permit run-off of rainwater and construct earth berms along the top edges of embankments to intercept run-off water. Provide temporary slope drains to carry run-off from cuts and embankments which are located in the vicinity of rivers, streams, canals, lakes and impoundments. Should such preventative measures fail, immediately take such other action as necessary to effectively prevent erosion and siltation.

END OF SECTION

SECTION 02510 - SUBGRADE STABILIZATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Stabilize the designated portions of the pavement subgrade in both cut and fill sections to provide a firm and unyielding subgrade to the uniformity, density, bearing value, lines, grades and thicknesses herein specified or shown in the Drawings. The work includes mixing, compacting and grading for a complete job.

PART 2 - MATERIALS

- 2.1 Local Materials: High bearing-soils or sand clay material. The materials passing the #40 mesh sieve shall have a liquid limit not greater than 30, and a plasticity index not greater than 10. Blending materials to meet these requirements will not be permitted unless authorized by the Engineer. When so permitted, the blended material shall be tested and approved before spreading.
- 2.2 Limerock/Limerock Overburden: The percentage of carbonates of Calcium and magnesium shall be at least 70, and plasticity index shall not exceed 10. The gradation shall be such that 97% by weight of the material will pass a 1" sieve.
- 2.3 Crushed Shell: Mollusk shell, but not steamed shell, (i.e., oysters, mussels, clams, cemented coquina, etc.). Gradation shall be such that at least 97% by weight of the total material passes a 1" sieve, and at least 50% by weight is retained on the #4 sieve. Not more than 20% by weight of the total material shall pass (by washing) the #200 sieve.

PART 3 - EXECUTION

- 3.1 Required Florida Bearing Value (FBV): Unless otherwise specified, the subgrade shall have a minimum Florida Bearing Value of 70. Where local material does not conform to the required FBV, stabilize by uniformly mixing with satisfactory local or hauled in material to the depth shown in the Drawings. Perform bearing value determination per FDOT standard specifications for Road and Bridge Construction, section 160-8.1.
- 3.2 Compaction: Compact the stabilized subgrade in both cuts and fills to a minimum density of 98% of maximum (AASHTO T-180) density. The subgrade shall be shaped to within 1/4 inch of the grades shown in the Drawings.

SECTION 02510
SUBGRADE STABILIZATION

- 3.3 Maintenance: After the subgrade has been prepared as specified, Contractor shall maintain it free from ruts, depressions and all damage resulting from hauling or handling of any materials, equipment, tools, etc. All work which may become necessary in order to recompact the subgrade shall be at contractor's expense.
- 3.4 Testing: Provide density and bearing value tests at intervals not to exceed 250 feet for roadways or 10,000 square feet for parking areas.

END OF SECTION

SECTION 02511 - SOIL CEMENT

PART 1.00 - GENERAL

1.01 SECTION INCLUDES

- A. Soil-cement surfacing.

1.02 QUALITY ASSURANCE

- A. Reference specifications and standards:
 - 1. Standard Specifications for Road and Bridge Construction, latest edition, issued by Florida Department of Transportation, specified hereinafter as FDOT.
 - a. Statements in this Specifications Section take precedence over FDOT Standards if there are ambiguities.
 - b. Where paragraphs of the FDOT Standards referenced herein include reference to further paragraphs, the further referenced paragraph(s) are also made a direct part of this Specification.
 - c. All references to "Department," "Engineer," or "District Materials Engineer" in referenced standard shall be construed to mean "Owner" for this Work.
 - d. Method of measurement and method of payment for all Work shall be construed to mean lump sum basis, in accord with terms of Contract.
 - e. Reference to Soil-Cement Base in the cited FDOT standard shall be construed to mean soil-cement surfacing work of this Section.

0.01 SUBMITTALS

- A. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

PART 2.00 - PRODUCTS

2.01 MATERIALS

- A. Soil-cement surfacing: Conform to FDOT Section 270-2 for materials.
- B. Exceptions:
 - 1. Emulsified asphalt shall not be used for curing. Do not use any curing medium other than the natural environment. Expected slight cracking will not be a problem.
 - 2. Color of resulting soil mix shall closely match the color of the soils of the ride path.

2.02 STRENGTH DESIGN

- A. Conform to FDOT Section 270-3.2. Resulting strength of design mix shall be not less than 500 psi.

PART 3.00 - EXECUTION

3.01 SOIL-CEMENT SURFACING

- A. Conform to FDOT Section 270-4 for construction methods.
 - 1. Emulsified asphalt and consequential application of sand to aid in drying shall not be used.
 - 2. The soil-cement surfacing for this work is intended to be the finished wearing surface.
 - 3. Asphaltic concrete shall not be used for patching. If patching is required, use the same type soil-cement materials in the work.

END OF SECTION 02511

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Construct limerock base course on the prepared subgrade as specified herein and in conformance with the lines and grades shown in the Drawings.

PART 2 - MATERIALS

2.1 Limerock: FDOT 200-2.

PART 3 - EXECUTION

- 3.1 Spreading: Uniformly spread limerock by mechanical rock spreader, equipped with a device which strikes off uniformly to laying thickness, and is capable of even distribution. Where a mechanical spreader is not practical such as crossovers, intersections and ramp areas; roadway widths of 20 feet or less; and main roadway areas when forms are used, spreading may be done by bulldozers or blade graders. Remove and replace all segregated areas of fine or coarse rock with properly graded rock.
- 3.2 Transportation: Transport limerock to the point of use over rock previously placed, and dump on the end of the preceding spread. Hauling over the subgrade and dumping on the subgrade will not be permitted.
- 3.3 Courses: Construct bases of specified compacted thickness greater than 6 inches in two courses. The thickness of the first course shall be approximately one-half the total thickness of the finished base, or enough additional to bear the weight of the construction equipment without disturbing the subgrade.
- 3.4 Compacting and Finishing: Clean the lower course (where applicable) of foreign material, blade the surface to a cross-section approximately parallel to the finished base. The lower course shall be tested for density prior to spreading the upper course. After the upper course has been spread, scarify and shape the surface to produce the required grade and cross-section after compaction, free of scabs and laminations.
- 3.5 Moisture Content: Material not having the proper moisture content to insure the required density, shall be wetted or dried as required. Mix-in added water uniformly by disking to the full depth of the course. Wetting and drying operations require manipulation, as a unit, of the entire width and depth of the course which is to be compacted.
- 3.6 Density Requirements: After attaining proper moisture conditions, compact to a density of not less than 98 percent of maximum (AASHTO T-180) density.

- 3.7 Correction of Defects - If, at any time, the subgrade material should become mixed with the base course material, the Contractor shall, without additional compensation, dig out and remove the mixture, reshape and compact the subgrade and replace the materials removed with clean base material, which shall be shaped and compacted as cited herein.

Cracks or checks appearing in the base, either before or after priming, which would impair the structural efficiency of the base, shall be removed by rescarifying, reshaping, adding base material, recompacting and repriming without additional compensation.

- 3.8 Priming and Maintaining: Apply the prime coat only when the base meets the specified density requirements, and the moisture content in the top half of the base does not exceed 90 percent of the optimum moisture of the base material. At the time of priming, the base shall be firm, unyielding and in such condition that no undue distortion will occur.

Maintain the true crown and template, with no rutting or other distortion, and insure that the base meets all requirements at the time the surface course is applied.

- 3.9 Surface Requirement: Irregularities greater than 1/4 inch, when checked with a template cut to the required crown and with a 15-foot straightedge laid parallel to the center of the roadway, shall be corrected by scarifying and removing or adding rock as required and recompacting the entire area as specified.

- 3.10 Thickness Requirement: Where the base is deficient by more than 1/2 inch, it shall be reworked to the area extent specified by the testing laboratory and to a depth of at least 3 inches by scarifying and adding more base material, so that after proper compaction the thickness will conform to the Drawings.

- 3.11 Testing Density: Provide three density determinations on each day's final compaction operation on each course. Blading to grade where required shall be completed prior to density testing.

A. Surface: Check the finish surface of the base course with a template cut to the required crown and with a 15-foot straight edge laid parallel to the center of the roadway.

- 3.12 Thickness: Provide test holes at intervals not to exceed 250 feet for roadways or 10,000 square feet for parking areas.

END OF SECTION

SECTION 02513 - ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of asphalt concrete paving work is shown on drawings.
- B. Prepared aggregate subbase and base is specified in "SUBGRADE STABILIZATION," "LIMEROCK" and "SOIL CEMENT" Sections.
- C. Prepared subgrade is specified in "EARTHWORK" Section.
- D. Saw-cutting of edges of existing pavement is specified in site clearing section.

1.3 SUBMITTALS

- A. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with State highway or transportation department standard specifications, latest edition, and with local governing regulations if more stringent than herein specified.

PART 2 - PRODUCTS

2.1 MATERIALS

General: Use locally available materials and gradations which exhibit a satisfactory record of previous installations.

- A. Type S Asphaltic Concrete: FDOT, 331-2, 3, 4, 5.
- B. Type III Cement Asphaltic Concrete: FDOT, 333-2, 3, 4 and 5.
- C. Asphalt Cement: FDOT, 916-1

SECTION 02513
ASPHALT CONCRETE PAVING

- D. Prime Coat: Cut-back asphalt grade RC-70 or RC-250 per FDOT 916-2; emulsified asphalt grade SS-1 or SS1H, per FDOT 916-4, diluted in equal proportions with water; or other types and grades of bituminous material.
- E. Tack Coat: Emulsified asphalt; RS-2, SS-1, or SS-1H (diluted in equal proportions with water) per FDOT 916-4. Cut-back asphalt RL-70, or asphalt cement, penetration grade 85-100.
- F. Lane Marking Paint: Chlorinated rubber-alkyd type, AASHTO M 248 (FS TT-P-115), Type III or per FDOT 971-12.2.
- G. Thermoplastic Traffic Stripes and Markings: Per FDOT standard specifications for Road and Bridge Construction, Section 711.
- H. Wheel Stops: Precast of 3,500 psi air-entrained concrete, approximately 6 inches high, and 6 feet 0 inches long, with chamfered corners and drainage slots on underside.

2.2 ASPHALT-AGGREGATE MIXTURE AND PREPARATIONS

- A. FDOT 330-5, and FDOT 330-6.

PART 3 - EXECUTION

3.1 WEATHER LIMITATIONS

- A. Mixture shall not be spread when the air temperature is not greater than 40° F, in the shade (away from artificial heat), or there is evidence of a frozen base, or when the wind is blowing to such an extent that proper and adequate compaction cannot be maintained or when sand, dust, etc., are being deposited on the surface being paved.

Any mixture caught in transit by a sudden rain may be laid only at Contractor's risk. Should such mixture prove unsatisfactory, it shall be removed and replaced at Contractor's expense. In no case shall the mixture be laid while rain is falling or when there is water on the surface to be covered.

3.2 PREPARATION OF ASPHALT CEMENT

- A. Heat the asphalt cement in advance of the mixing operations, to within a range of 270° F to 350° F. Maintain the heating operations constant within these limits. Wide temperature fluctuations during the day will not be permitted.

3.3 PREPARATION OF AGGREGATE

FDOT 330-5

3.4 PREPARATION OF MIXTURE

FDOT 330-6

3.5 TRANSPORTATION OF MIXTURE

Transport the mixture in vehicles clean of foreign material properly equipped to be covered during inclement weather. Coat the inside surfaces of the truck with soapy water or approved emulsion containing less than 5 percent oil (not kerosene, gasoline or similar products) and raise beds to drain excess prior to loading.

3.6 PREPARATION OF APPLICATION SURFACES

- A. Cleaning: Thoroughly clean the surface to be covered of all loose and deleterious material before laying any mixture.
- B. Patching and Leveling Courses: Where a surface course is constructed on an existing pavement or base and/or where called for in the Drawings, apply patching or leveling courses to bring the existing surface to proper grade and cross-section. Prior to spreading leveling courses, all depressions in the existing surface more than one inch deep shall be filled by spot patching with leveling course mixture, and then thoroughly compacted.
- C. Coating Surfaces of Contacting Structures: Paint all structures such as manholes, inlet, valve boxes, etc., with a uniform coating of asphaltic cement.
- D. Prime Coat: Prime materials shall be uniformly applied using a pressure distributor at the minimum rates of 0.10 gallons per square yard for limerock, limerock stabilized and local rock bases, and 0.15 gallons per square yard for sand, clay, shell and shell stabilized bases. The actual amount to be applied shall be dependent on the character of the surface and shall be sufficient to coat the surface thoroughly without having any access to form pools or to flow off the base. The temperature of the prime material shall be that temperature between 100° F and 150° F, which will insure uniform distribution. The moisture content of the base shall not be greater than 90 percent of optimum to obtain adequate penetration.

Apply a light uniform application of cover material and roll with a traffic roller for at least 10 passes before opening to traffic. Where an emulsified asphalt is used for prime coat, the Engineer may require that cover material be hot-asphalt coated with two to four percent asphalt-cement, if necessary, to achieve a prime coat which will remain reasonably intact until the surface course is placed; the application rate shall be approximately 10 pounds per square yard.

3.7 TACK COAT

SECTION 02513
ASPHALT CONCRETE PAVING

A tack coat will only be required on primed bases in areas that have become excessively dirty and cannot be cleaned, or in areas where the prime has cured to the extent that it has lost adequate bonding effect. Generally, a tack coat will be required on bituminous base or leveling courses before placing the surface course.

Apply tack, suitably heated, at the minimum rate necessary to bond the wearing surface to the base (between 0.02 and 0.08 gallons per square yard). The upper limit may be exceeded for resurfacing concrete. Apply tack sufficiently in advance of the wearing course to permit drying but not so far in advance to allow loss of adhesiveness from dust and other foreign material. No traffic shall be allowed on the tacked surface.

3.8 PLACING MIXTURE

- A. Mixture shall be placed and spread only after the surface to be overlaid is properly prepared, intact, firm, properly cured and dried. No mixture shall be spread that cannot be finished and compacted during the daylight hours of day of spreading.

Spread the mixture with mechanical spreaders, except where impracticable. A stringline shall be used to obtain an accurate, uniform alignment of the pavement edge. The temperature of the mixture at the time of spreading shall be between 270° F and 350° F.

1. Checking Depth of Layer: The depth of each layer shall be checked by the Contractor at intervals, not to exceed 25 feet. Any deviation from the required thickness, in excess of the allowable tolerance, shall be immediately corrected.

- B. Surface Courses:

1. Spreading and Finishing: Immediately upon arrival, the mixture shall be dumped into the spreader, spread and struck-off to the full width required and to such loose depth to secure the specified thickness. Excess mixture shall be carried ahead of the screed at all times. Hand rake behind the machine as required.
2. Thickness of Layers: Surface courses of thickness greater than two inches, shall be constructed in approximately equal layers and of less than two inches compacted thickness. Each layer shall be thoroughly compacted and shall conform to these specifications prior to overlaying.
3. Correcting Defects: Prior to rolling, the surface shall be checked, and irregularities adjusted. All drippings, fat sandy accumulations from the screed, and fat spots from any source shall be removed and replaced with satisfactory material. No skin patching shall be done. Where a depression is to be corrected while the mixture is hot, the surface shall be well scarified before the addition of fresh mixture.

- C. Leveling Courses:

1. Spreading: The initial and intermediate leveling courses shall be placed by a spreader box, working conjunction with two motor graders. The final leveling course shall be placed by a paving machine. However, if the total quantity of leveling to be applied is less than 150 pounds per square yard, the paving machine may not be required.

SECTION 02513
ASPHALT CONCRETE PAVING

2. Application Rates: The application rate of leveling mixture shall not exceed 50 pounds per square yard per course except Type S-1 asphaltic concrete leveling shall not exceed 75 pounds per square yard per course. The actual application rate shall be as required to establish the finished lines and grades shown in the Drawings and shall not be limited to any average or typical rate or thickness which may be shown in the Drawings.
3. Leveling Over Existing Concrete Pavement: Remove all excess joint filler to flush with the existing pavement. For broken concrete pavement (with or without existing asphalt surface) the first leveling course shall be placed as soon after, but not later than 2 days after, the cracking and resealing operation.

3.9 COMPACTING MIXTURE

Density required for asphaltic concrete pavement, after final compaction, shall be at least 95 percent of the laboratory compacted density of the paving mixture. Tests shall be performed every 500 feet for roadways and 50,000 square feet for parking areas.

- A. Equipment and Sequence: For each paving or leveling train in operation, the Contractor shall furnish a separate set of rollers, with operators. The rolling shall be done in sequence, and with the equipment as follows, unless otherwise permitted by the Engineer:
 1. Seal Rolling - Use tandem steel rollers weighing 5 to 12 tons, following as close behind the spreaders as is possible without pick-up, undue displacement or blistering of the material.
 2. Rolling with Traffic Roller - Use self-propelled pneumatic-tired rollers, 6 to 10 tons and tire pressure to 55 pounds, following as close behind the seal rolling as the mix will permit. The roller shall cover every portion of the surface with at least five passes.
 3. Final Rolling - Use tandem steel roller, weighing 8 to 12 tons after the pneumatic-tired rolling has been completed, but before the pavement temperature has dropped below 140° F.
- B. Compaction of Crossovers, Intersections, etc.: Where a separate paving machine is used to pave crossovers, compaction may be done by one 8 to 10 ton tandem steel roller. If crossovers, intersections and acceleration and deceleration lanes are placed with the main run of paving, a traffic roller shall also be used in the compaction.
- C. Rolling Procedures: The rolling shall be longitudinal. Where the lane being placed is adjacent to a previously placed lane, the center joint shall be pinched or rolled, prior to rolling of the rest of the lane. Continue across the mat, overlapping each previous roller path by at least one-half the width of the roller wheel. The motion of the roller shall be slow enough to avoid displacement of the mixture, and any displacement shall be

SECTION 02513
ASPHALT CONCRETE PAVING

corrected at once by the use of rakes, and the addition of fresh mixture if required. Final rolling shall continue until all roller marks are eliminated.

Self-propelled, pneumatic-tired traffic rollers shall proceed at a speed of 6 to 10 miles per hour; the area covered by each roller shall not exceed 4,000 square yards per hour, except that for Type S-1 Asphaltic Concrete, the maximum shall be 3,000 square yards per hour.

- D. Number of Traffic Rollers Required: A sufficient number of self-propelled pneumatic-tired rollers shall be used to assure that the rolling will not delay any other phase of the laying operation nor result in excessive cooling of the mixture. In the event that the rolling falls behind, the laying operation shall be discontinued until the rolling operations are sufficiently caught up.
- E. Rolling Patching and Leveling Courses: Use self-propelled pneumatic-tired rollers for all patching and leveling courses. Where the initial leveling course is placed over broken concrete pavement, the pneumatic-tired rollers shall weight at least 15 tons. For Type S-I Asphaltic Concrete leveling courses, use a steel-wheeled roller, to supplement the traffic rollers. The use of a steel-wheeled roller will otherwise be at Contractor's option.

Areas which are inaccessible to a roller (such as areas adjacent to curbs, headers, gutters, manholes, etc.) shall be compacted by the use of hand tamps or other satisfactory means.

- F. Correcting Defects: Rollers shall not deposit gasoline, oil or grease onto the pavement. Any areas damaged by such deposits shall be removed and replaced. While rolling is in progress, the surface shall be tested continuously and all discrepancies corrected to comply with the surface requirements. All drippings, fat or lean areas and defective construction of any description shall be removed and replaced. Depressions which develop before the completion of the rolling shall be remedied by loosening the mixture and adding new mixture to bring the depressions to a true surface. Should any depressions remain after the final compaction has been obtained, the full depth of the mixture shall be removed and replaced with sufficient new mixture to form a true and even surface. All high spots, joints and honeycomb shall be corrected. Any mixture remaining unbonded after rolling shall be removed and replaced. Any mixture which becomes loose or broken, mixed or coated with dirt or in any way defective, prior to laying the wearing course shall be removed and replaced with fresh mixture which shall be immediately compacted to conform with the surrounding area. Areas of defective surface may be repaired by the use of the indirect heat. No method of repair involving open-flame heaters shall be used.
- G. Provisions Applicable to Shoulder Pavement Only: Where sand-asphaltic shoulders are constructed within the limits of curb and gutter, compaction shall be done by light weight rolling equipment, which will not displace the previously constructed curb and gutter.

3.10 JOINTS

- A. Fresh mixture shall be laid against the exposed edges at joints (trimmed or formed as provided below) in close contact with the exposed edge so that an even, well-compacted joint will be produced after rolling.
1. Transverse Joints: Placing of the mixture shall be as continuous as possible. The roller shall not pass over the unprotected end of the freshly laid mixture except when the laying operation is to be discontinued long enough to permit the mixture to become chilled. When the laying operation is thus interrupted, a transverse joint shall be constructed by cutting back on the previous run to expose the full depth of the mat.
 2. Longitudinal Joints: Where a portion of the width of pavement is to be laid and opened to traffic, longitudinal joints shall be formed by rolling the exposed edge of the strip first laid. When the adjacent strip is constructed, the Engineer may require the edge of the mixture in place to be trimmed back to expose an unsealed or granular vertical surface. Where the strip first laid is closed to traffic, the edge shall not be sealed but shall be left vertical and the adjacent strip placed against it without trimming.

3.11 SURFACE REQUIREMENTS & CORRECTION:

- A. The finished surface shall not vary more than 3/16 inch when measured by rolling or manual straightedge applied parallel to the center line of the pavement. Any surface irregularities exceeding such limits shall be corrected as specified herein.
1. Manual Straightedging: A 15-foot manual straightedge shall be furnished by the Contractor and shall be available at all times on the work. The Contractor shall designate an employee whose duty it is to handle the straightedge in checking the compacted surfaces.
 2. Texture of Finished Surfaces: The finished surface shall be of uniform texture and compaction. The surface shall have no pulled, torn or loosened portions, and shall be free of sand streaks, sand spots or ripples. (These requirements shall also apply to any areas where it is necessary to apply hand work.) Defective area shall be corrected as follows:
 - a. If the correction is made by replacing of the full thickness, it shall extend to at least 50 feet each side of the defective area.
 - b. If the correction is made by overlaying, the overlay shall consist of at least 100 pounds of mixture per square yard at the defective section and shall taper uniformly down from the full thickness of such weight, to zero thickness (featheredged) at the end of a minimum length of 50 feet each side of the defective area.

3.12 PROTECTION OF FINISHED SURFACE

- A. Finished surfaces including courses to be overlaid shall be kept clean and no dumping of any material onto the surfaces shall be permitted. Protect pavement against damage during shoulder construction by providing proper attachments to grader

blades. Vehicular traffic shall not be permitted until the pavement has set sufficiently to prevent rutting or other distortion.

3.13 TRAFFIC AND LANE MARKINGS

- A. Cleaning: Sweep and clean surface to eliminate loose material and dust.
- B. Striping: Use chlorinated-rubber base traffic lane-marking paint, factory-mixed, quick-drying, and non-bleeding.
 - 1. Color: white and yellow as indicated on drawings.
 - a. Apply paint with mechanical equipment to produce uniform straight edges. Apply in 2 coats at manufacturer's recommended rates.

3.14 WHEEL STOPS

- A. Secure wheel stops to asphalt concrete surface with not less than two 3/4 inch diameter steel dowels embedded in precast concrete at 1/3 points. Size length of dowel to penetrate at least 6 inches into asphalt concrete. Drill placement holes oversize and embed dowels in hot bituminous grout material.

3.15 FIELD QUALITY CONTROL

- A. THICKNESS REQUIREMENTS & CORRECTIONS
 - 1. Pavement thickness shall be determined from the length of the core borings as specified herein. The maximum allowable deficiency from the specified thickness and serious deficiency thickness shall be as follows:
 - a. Pavement of specified thickness 1 1/2 inches or less
 - Maximum allowable deficiency 3/16 inch or more
 - Serious deficiency 1/4 inch or more
 - b. Pavement of specified thickness greater than 1 1/2 inches but less than 2 1/2 inches
 - Maximum allowable deficiency 1/4 inch or more
 - Serious deficiency 3/8 inch or more
 - c. Pavement of specified thickness 2 1/2 inches or greater
 - Maximum allowable deficiency 1/2 inch or more
 - Serious deficiency 3/4 inch or more
 - 2. Contractor shall correct seriously deficient areas either by replacing the full thickness for a length extending at least 50 feet from each end of the deficient area, or (when permitted by the Engineer) by overlaying as specified herein at his own expense.

SECTION 02513
ASPHALT CONCRETE PAVING

As an exception to the above, pavement outside a main roadway area (acceleration and deceleration lanes, crossovers and parking areas) may be left in place, without compensation (except for payment for the bituminous material), when so permitted by the Engineer, even though the thickness deficiency exceeds the serious deficiency tolerance specified above.

Where the deficiency exceeds allowable but does not exceed serious, Contractor will be allowed to leave such pavement in place, but without compensation other than for the bituminous material contained therein. The areas of such pavement for which no square yard payment will be made shall be the product of the total distance between acceptable cores, multiplied by the width of the lane which was laid at the particular pass in which deficient thickness was indicated. To determine the extent of the deficiencies, additional cores will be taken as required.

3. Correcting Deficiency by Adding New Surface Material: For any case of excess deficiency of the pavement, Contractor will be permitted, if approved by the Engineer for each particular location, to correct the deficient thickness by adding new surface material and compacting to the same density as the adjacent surface. The area to be corrected and the thickness of the new material added shall be as specified herein. All costs of the overlaying and compacting shall be borne by the Contractor.

B. CALCULATION FOR THICKNESS OF PAVEMENT

1. Core Borings: The thickness of the pavement shall be determined from the length of cores, at least two inches in diameter, taken at random points along the roadway and the parking areas. Each core shall represent a roadway section not longer than 500 feet or a parking area not less than 10,000 square feet. The average thickness shall be determined from the measured thicknesses, and in accordance with the procedure and criteria specified herein.

If it is found that the specified pavement thickness has not been installed per this specification and if Contractor believes that the number of cores taken by the Owner is insufficient to properly indicate the thickness of the pavement, he may request the owner make additional borings at locations designated by him. The cost of these additional borings shall be deducted from any sums due Contractor unless such borings indicate that the pavement within the questioned area is of specified thickness.

2. Criteria for Calculations:
 - a. Average thickness shall be calculated for the total length of project.
 - b. When the thickness as measured by the cores is more than 1/2 inch greater than the specified thickness, it shall be considered in the calculation as the specified thickness plus 1/2 inch.
 - c. Areas of deficient thickness pavement which are left in place with no compensation shall not be taken into account in the calculations.

SECTION 02513
ASPHALT CONCRETE PAVING

- d. Where areas of defective surface or deficient thickness are corrected by overlaying with additional material, the thickness used in the calculations shall be the specified thickness for such areas.

C. TESTING

- 1. The contractor shall provide, at his expense, the following tests before stating any laying operations:
 - a. Determination of the job mix formula
 - b. Tests of the asphalt cement
 - c. Sieve analysis of the aggregate
 - d. Determination of bitumen content of the asphalt concrete

END OF SECTION

SECTION 02520 - PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of portland cement concrete paving is shown on drawings, including curbs, gutters, walkways and pavement.
- B. Prepared subgrade is specified in "EARTHWORK" section.
- C. Concrete and related materials are specified in other Division 2 sections.

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Comply with local governing regulations if more stringent than herein specified.

1.4 SUBMITTALS

- A. Furnish samples, manufacturer's product data, test reports, and materials' certifications as required in referenced sections for concrete and joint fillers and sealers.

1.5 JOB CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MATERIALS

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

- B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185.
 - 1. Furnish in rolls, unless otherwise acceptable to Architect.
- C. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40.
- D. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 40. Cut bars true to length with ends square and free of burrs.
- E. Metal Expansion Caps: Furnish for one end of each dowel bar in expansion joints. Design caps with one end closed and a minimum length of 3 inches to allow bars movement of not less than 1 inch, unless otherwise indicated.
- F. Hook Bolts: ASTM A 307, Grade A bolts, internally and externally threaded. Design hook bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- G. Concrete Materials: Comply with requirements of applicable Division-3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.
- H. Expansion Joint Materials: Comply with requirements of applicable Division-7 sections for preformed expansion joint fillers and sealers.
- I. Anti-Spalling Compound: 50% (by volume) boiled linseed oil and 50% (by volume) mineral spirits, complying with AASHTO M-233.
- J. Liquid-Membrane Forming Curing Compound: Complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.
 - 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - "Masterseal"; Master Builders.
 - "A-H 3 Way Sealer"; Anti-Hydro Waterproofing Co.
 - "Ecocure"; Euclid Chemical Co.
 - "Clear Seal"; A.C. Horn.
 - "J-20 Acrylic Cure"; Dayton Superior.
 - "Sure Cure"; Kaufman Products Inc.
 - "Spartan-Cote"; The Burke Co.
 - "Sealkure"; Toch Div. - Carboline.
 - "Kure-N-Seal"; Sonneborn-Contech.
 - "Polyclear"; Upco Chemical/USM Corp.
 - "L&M Cure"; L & M Construction Chemicals.
 - "Klearseal"; Setcon Industries.

"LR-152"; Protex Industries.
"Hardtop"; Gifford - Hill.

- K. Bonding Compound: Polyvinyl acetate or acrylic base, rewettable type.
1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"J-40 Bonding Agent"; Dayton Superior Corp.
"Weldcrete"; Larsen Products.
"Everbond"; L & M Construction Chemicals.
"EucoWeld"; Euclid Chemical Co.
"Hornweld"; A. C. Horn.
"Sonocrete"; Sonneborn-Contech.
"Acrylic Bondcrete"; The Burke Co.
- L. Epoxy Adhesive: ASTM C 881, two component materials suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit project requirements.
1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Epoxtite"; A. C. Horn.
"Edoco 2118 Epoxy Adhesive"; Edoco Technical Prod.
"Sikadur Hi-Mod"; Sika Chemical Corp.
"Euco Epoxy 463 or 615"; Euclid Chemical Co.
"Patch and Bond Epoxy"; The Burke Co.
"Sure-Poxy"; Kaufman Products Inc.

2.2 CONCRETE MIX, DESIGN AND TESTING

- A. Comply with requirements of applicable Division-2 sections for concrete mix design, sampling and testing, and quality control, and as herein specified.
- Design mix to product normal-weight concrete consisting of portland cement, aggregate, water-reducing of high-range water-reducing admixture (super-plasticizer), air-entraining admixture and water to produce the following properties:
1. Compressive Strength: 3000 psi, minimum at 28 days, unless otherwise indicated.
 2. Slump Range: 8 inches for concrete containing HRWR admixture (super-plasticizer); 3 inches for other concrete.
 3. Air Content: 5% to 8%.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Remove loose material from compacted subgrade surface immediately before placing concrete.

Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

3.2 FORM CONSTRUCTION

- A. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 12 hours after concrete placement.

Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8 inch in 10 feet.
2. Vertical face on longitudinal axis, not more than 1/4 inch in 10 feet.

Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

3.3 REINFORCEMENT

- A. Locate, place and support reinforcement as specified in Division-3 sections, unless otherwise indicated.

3.4 CONCRETE PLACEMENT

- A. General: Comply with requirements of Division-3 sections for mixing and placing concrete, and as herein specified.

1. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
2. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.

3. Fabricated Bar Mats: Keep mats clean and free from excessive rust, and handle units to keep them flat and free of distortions. Straighten bends, kinks, or other irregularities or replace units as required before placement. Set mats for a minimum 2 inches overlap to adjacent mats.

Place concrete in 2 operations; strike-off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike-off and screed.

- a. Remove and replace portions of bottom layer of concrete which has been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.

3.5 JOINTS

- A. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

1. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:
 - a. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.
2. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2-hour, except where such placements terminate at expansion joints.
 - a. Construct joints as shown or, if not shown, use standard wood or metal keyway-section forms.
 - b. Where load transfer-slip dowel devices are used, install so that one end of each dowel bar is free to move.
3. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.

Locate expansion joints at spacings indicated.

Extend joint fillers full-width and depth of joint, and not less than 1/2 inch or more than 1 inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.

Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

4. Fillers and Sealants: Comply with the requirements of applicable Division-7 sections for preparation of joints, materials, installation, and performance.

3.6 CONCRETE FINISHING

- A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand method only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2 inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Architect.
2. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic.

Do not remove forms for 12 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.

3.7 CURING

- A. Protect and cure finished concrete paving, complying with applicable requirements of Division-3 sections. Use membrane- forming curing and sealing compound or approved moist-curing methods.

3.8 REPAIRS AND PROTECTIONS

- A. Repair or replace broken or defective concrete, as directed by Architect.
- B. Drill test cores where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION

SECTION 02580 - CONCRETE CURBS AND WALKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. General: Furnish all labor and materials to construct concrete curbs and gutters, sidewalks including ramps, and driveways as called for in the Drawings and detailed in the Standard Detail Drawings to include excavation and backfill; foundation; and forming, placing, jointing, form removing, finishing and curing concrete.

PART 2 - MATERIALS

- 2.1 Concrete: FDOT 345-2 (except no pozzolan), 4, 6, 9, 10, 11, 12, 13. Class I concrete with minimum 28-day compressive strength of 3000 psi.
- 2.2 Reinforcement: ASTM A615 - Grade 60.
- 2.3 Joint Materials: FDOT 932-1.
- 2.4 Membrane Curing Compound: FDOT 925-2.
- 2.5 Forms: Forms shall be metal or wooden, straight, and free from warp or bends and of sufficient strength, when staked to resist the pressure of the concrete without deviation from line and grade. Flexible forms shall be used for all items constructed on a radius.

PART 3 - EXECUTION

- 3.1 Foundation (Subgrade Preparation): The subgrade shall be excavated or filled with suitable material to the required grades and lines. All soft, yielding, and otherwise unsuitable material shall be removed and replaced with suitable material. Filled sections shall be compacted to a minimum of 95% of maximum (AASHTO T-180) density and extend to a minimum of 1 foot outside the form lines. The subgrade shall be dense, firm, trimmed to a uniform smooth surface, and in a moist condition when the concrete is placed.
- 3.2 Machine Laid Curb: The slipform/extrusion machine approved shall be so designed as to place a spread, consolidate, screed, and finish the concrete in one complete pass in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogeneous concrete section. The machine shall shape, vibrate, and/or extrude the concrete for the full width and depth of the concrete section being placed. It shall

SECTION 02580
CONCRETE CURBS AND WALKS

- be operated with as nearly a continuous forward movement as possible. All operations of mixing, delivery, and spreading concrete shall be so coordinated as to provide uniform progress, with stopping and starting of the machine held to a minimum.
- 3.3 Forming: Depth of forms shall be equal to the Drawing dimensions for the concrete to be placed against them. Forms shall be staked to resist the pressure of the concrete without deviation from line and grade. They shall be cleaned each time used and shall be oiled or saturated with water prior to placing concrete.
- 3.4 Reinforcement: Reinforcement shall only be required where called for in the Drawings. Set reinforcement for sidewalks above the foundation so concrete will flow under it.
- 3.5 Placing: Place concrete in the forms and tamp and spade to prevent honeycomb until the top of the structure can be floated smooth. Round all edges to 1/2 inch radii unless otherwise shown on the Standard Detail Drawings.
- 3.6 Sidewalk Ramps: Ramps shall be provided at all road/street crossings each way as shown in the Standard Detail Drawings.
- 3.7 Contraction Joints: Unless otherwise shown or noted in the Drawings, weakened plane contraction joints shall be located as follows:
- Curbs - 10 feet maximum intervals.
- Sidewalks - To form squares of uniform size.
- 3.8 Contraction joints may be sawed, hand-formed, or made by 1/8 inch thick division plates in the framework. Sawing shall be done early after the concrete has set to prevent the formation of uncontrolled cracking. The joints may be hand-formed by using a narrow or triangular jointing tool or a thin metal blade to impress a plane of weakness into the plastic concrete. Where division plates are used, the plates shall be removed after the concrete has set and while the forms are still in place.
- 3.9 Expansion (Isolation) Joints: Provide isolation joints between all distinct structures such as between sidewalk and curbs, driveway and sidewalk or curbs, sidewalk or curbs and inlets, around concrete utility poles and at radius points along the curbs and at the end of a continuous pour.
- 3.10 Finishing: Strike off concrete sidewalks and driveways by means of a wood or metal screed, used perpendicular to the forms, to obtain required grade and remove surplus water laitance. Broom finish the surfaces and finish edges with an edging tool having a radius of 1/2 inch.
- 3.11 Remove all curb and gutter forms within 24 hours after concrete is in place, and fill minor defects with mortar composed of one part portland cement and two parts fine aggregate. Plastering is not permitted. Finish all curbs and gutter surfaces while the

cement is still green to a brush finish. For any surface areas that are too rough or where surface defects make additional finishing necessary, the curb shall be rubbed to a smooth surface with a soft brick or wood block, with water used liberally.

3.12 Surface Requirements: Test the gutters with a 20 foot straight edge laid parallel to the centerline of the roadway while the concrete is still plastic. Straight edging shall be done along the edge of the gutter adjacent to the pavement or along other lines on the gutter cross-section. Irregularities in excess of 1/4 inch shall be corrected immediately. Surface variations on sidewalks and driveways shall not exceed 1/4 inch under a 10 foot straight edge, nor more than 1/8 inch on a 5 foot traverse section.

3.13 Curing: Concrete shall be cured by the Membrane Curing Compound Method for a continuous period of 72 hours minimum, commencing after completing the finishing and as soon as the concrete has hardened sufficiently to permit application of the curing material without marring the surface. Immediately replace any curing material that may be removed or damaged during the 72-hour period.

This method requires the application of a clean membrane curing compound or white pigmented curing compound as in the Membrane Curing Compound paragraph above, by a hand sprayer in a single continuous film with uniform coverage of at least one gallon to each 200 square feet. Any cracks, check or other defects shall be recoated immediately. Agitate the curing compound thoroughly in the drum prior to application, and during application as necessary to prevent settlement of the pigment.

3.14 Backfilling and Compaction: After the concrete has set sufficiently, but no later than 3 days after the pouring, the spaces in front and back of the curb and other excavation generated from this work shall be refilled to the required elevation with suitable material, placed and thoroughly compacted in layers not to exceed 6 inches.

3.15 Protection: The Contractor shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting. For slipform construction, materials such as wood planks or forms to protect the edges shall also be required.

3.16 Testing: Provide not less than three 6 inches by 12 inches cylinder compressive strength tests (ASTM C 39) and one slump test (ASTM C 143) for each 75 cubic yards of part thereof poured.

END OF SECTION

SECTION 02666 - POTABLE WATER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of potable water systems work is indicated on drawings and schedules, and by requirements of this section.
- B. Refer to Division-2 Section "EARTHWORK - UNDERGROUND UTILITIES" for excavation and backfill required for potable water systems; not work of this section.

1.3 QUALITY ASSURANCE

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacturer of potable water systems materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Installer's Qualifications:** Firm with at least 3 years of successful installation experience on projects with potable water piping work similar to that required for project.
- C. **Codes and Standards:**
 - 1. AWWA C-600 for Ductile Iron and install PVC as applicable.
 - 2. AWWA C-900 for PVC pipe 4 inch to 12 inch.
 - 3. **Water Purveyor Compliance:** Comply with requirements of Purveyor supplying water to project, obtain inspections from Purveyor as outlined in this section.

1.4 SUBMITTALS

- A. **Product Data:** Submit manufacturer's technical product data and installation instructions for potable water system materials and products.
- B. **Shop Drawings:** Submit shop drawings for potable water systems, showing piping materials, size, locations, and elevations. Include details of underground structures, connections, thrust blocks, and anchors. Show interface and spatial relationship between piping and proximate structures.
- C. **Record Drawings:** At project closeout, submit record drawings of installed potable water system piping and products, in accordance with requirements of Division-1.

- D. Maintenance Data: Submit maintenance data and parts lists for potable water system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division-1, if applicable.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

- A. Underground-Type Plastic Line Markers: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6 inches wide x 4 mils thick. Provide blue tape with black printing reading "CAUTION WATER LINE BURIED BELOW."
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering plastic line markers which may be incorporated in the work include, but are not limited to, the following:
 - a. Allen Systems Inc.
 - b. Seton Name Plate Corp.
 - c. or approved equal
- B. Nonmetallic Piping Label: If nonmetallic piping is used for water service, provide engraved plastic laminate, label permanently affixed to main electrical meter panel stating "This structure has a nonmetallic water service."

2.2 PIPES AND PIPE FITTINGS

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in potable water systems.
- B. Piping: Provide pipes of one of the following materials, of weight/class indicated.
- C. Iron Pipe & Fittings: Pipe shall be ductile iron (DI) with minimum thickness of Class 51 for 3 and 4 inch diameter pipe and Class 50 for larger pipe. Fittings may be ductile iron or gray iron (GI) with pressure rating equal to that of the pipe unless otherwise specified in the Drawings. The materials shall be as follows:
1. Pipe - ANSI A21.51 (AWWA C151)
 2. Fittings - ANSI A21.10 (AWWA C110)
 3. Joints - Mechanical & Push-on, ANSI A21.11 (AWWA C111)
 4. Joints - Flanged ANSI A21.10 & A21.15 (AWWA C110 & C115) Class 125 and 1/8 inch full faced rubber gaskets.
 5. Restrained joints - Ductile iron mechanical joint retainer glands approved equal to American Cast Iron Pipe Co.
 6. Flexible joints - Boltless with 15 joint deflection per applicable portions of ANSI A21.10 (AWWA C110) approved equal to "Flex-Lok" by American Cast Iron Pipe Co.

7. Bolts & Nuts - Bolts, ANSI B18.21; Nuts, B18.2.1; low carbon steel per ASTM A307, Grade B.
- D. Coatings, Linings & Encasement (Iron Pipe): All pipe and fittings shall be cement mortar lined per ANSI A21.4 (AWWA C104) and bituminous coated per above.
1. Where protective interior lining is called for, use 20 mil (minimum dry thickness) virgin polyethylene per ASTM D1248 compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during above ground storage, heat bonded to pipe and fittings, approved equal to "Polybond" by American Cast Iron Pipe Company.
 2. Polyethylene Encasement, where required, shall be per ANSI A21.5 (AWWA C105).
 3. Pipe fittings scheduled for field painting shall not receive an exterior bituminous coating. Instead, the pipe and fitting exterior shall be cleaned thoroughly and given one (1) shop coat of rust-inhibitive primer compatible with the field paint applied in accordance with the manufacturer's recommendations.
 4. Machined surfaces shall be cleaned and coated with a suitable rust-preventative coating at the shop immediately after machining.
- E. Polyvinyl Chloride Pipe (PVC): 4 inch to 12 inch AWWA C900, DR-18 National Sanitation Foundation (NSF) approved for potable water having integral wall-thickened bell ends without increase in DR and outside diameter equivalent to ductile iron pipe. Use iron fitting per above. Joints shall be elastomeric seals per ASTM D3139 and ASTM F477. Lubrication shall be non-toxic, NSF approved for potable water. Polyvinyl chloride pipe less than 4 inches shall be in accordance with ASTM 1785 for schedule 40, 80, 120 or ASTM 2241 for SDR21, minimum PC 200.
- F. Check Valves: Iron body, bronze-mounted, stainless steel hinge pin, outside spring operated, swing non-slam type, and equipped with removable inspection covers. Units shall be rated for 150 psi minimum working pressure and shall permit full flow area equal to that of the connecting pipe. Approved equal to M & H.
- Valves 2 inches and smaller - bronze body and disc, swing check type, with removable inspection covers, rated at 150 psi minimum working pressure, equal to Crane No. 37.
- G. Valve Boxes: Cast iron, adjustable, with minimum interior diameter of 5 inches. The word "Water" shall be legibly cast into the cover. Boxes to conform to applicable surface loading and valve size approved equal to Clow.
- H. Valves-General: The manufacturer shall clearly mark the valve type, size, rating and flow direction arrow. Valves shall open to the left (counter-clockwise) with an arrow cast in the metal of the operating handwheels and nuts indicating the direction of opening. Above ground installations shall have flanged joints; below ground shall be mechanical joints.
- I. Gate Valves: Iron body, bronze-mounted double disc, O-ring seal, per AWWA C500. Valves for underground service shall be non-rising stem (NRS) type equipped with 2

inch square cast iron wrench nuts. Valves for above ground service shall be outside screw and yoke (OS & Y) rising stem type equipped with cast iron band wheels or chain operators with galvanized steel chains as noted in the Drawings.

1. Tapping valves - per the above, compatible with the connecting sleeve or saddle and specially designed for wet tapping installations.
 2. Actuators - Equip all valves 16-inch and larger with approved gearing actuators, with sealed enclosures for buried or submerged service, and shall be furnished by the valve manufacturer. Position indicators as required.
 3. Horizontal Installation - Valves 16-inches in diameter or larger, to be installed horizontally, shall be additionally equipped per the applicable Section of AWWA C500 and as follows:
 - a. Installed in vertical pipe with horizontal stem-fitted with approved slides, tracks and shoes to assist the travel of the gate assembly.
 - b. Installed in Horizontal pipe with horizontal stem - equipped with approved rollers, tracks and scrapers to assist the travel of the gate assembly and to clear the tract of obstructions.
 4. Valves 3-inches and smaller - Bronze, wedge disc, non-rising stem type, 150 psi minimum working pressure, equipped with wrought steel or cast iron operating handwheels, approved equal to Crane No. 437.
- J. Butterfly Valves: Cast iron body, allow cast or ductile iron disc, body mounted at seat, one-piece stainless steel shaft, short or long body type, AWWA C504, with the valve class, shaft size and other special requirements selected in accordance with the specific design, "Rubber-Seated Butterfly Valves". Valve operation by approved gear actuators, with sealed enclosures for buried or submerged service. Position indicators furnished as required. Equip units with actuating nuts, cast iron handwheels or chain operators, with galvanized steel chains for the given installation. All appurtenances furnished by valve manufacturer.
- K. Backflow Prevention Device: Type and manufacturer shown in the Drawings, otherwise per AWWA C-506, however the device shall be acceptable to the local jurisdiction. Approved equal to Hersey (Beeco), CLa-Val, Febco, Grinnel.
- L. Meter Box: Cast-iron or concrete standard types, appropriately sized for utilization and installation requirements.
- M. Expansion Joints: Pipe expansion joints shall be minimum 150 psi working pressure equal to style N. 500, manufactured by Mercer Rubber Company.
- N. Flanged Coupling Adapters: Equal to Smith Blair Type 912 for pipe size to 12 inches and Type 913 for larger sizes. Conformance with ANSI Standard B16.1 (125 lb flanges).

- O. Cast Couplings: Equal to Smith Blair, Type 431 (connecting equal outside diameter pipes), Type 433 (connecting equal size pipes with variations in outside diameter), and Type 435 (reducing coupling).
- P. Cast Iron Sleeves and Wall Pipes: Shall have integral annular ring water-stops, and conform to requirements for Cast Iron fittings noted herein. Sleeves and Wall Pipes to have laying length and ends required for proper installation.
- Q. Tapping Saddles: Ductile Iron, suitable for either wet or dry installation double strapped as manufactured by the American Cast Iron Pipe Company. Provide an "O"-ring type sealing gasket. Provide tie straps and bolts of a corrosive resistant alloy steel.
- R. Tapping Sleeves and Crosses: mechanical joint type, with outlet flange ANSI B16-1, 125 lb standard, approved equal to M & H.
- S. Service Saddle: Double strap units with straps of corrosion resistant alloy steel and "O"-ring type sealing gasket. Ductile iron for ductile iron pipe, equal to Smith Blair Type 3.3. Type 342 or 352 for plastic pipe.
- T. Service Line Materials: AWWA C800 and the Appendix thereto where applicable. The minimum pressure class for plastic piping/tubing shall be 200 psi.
- U. Concrete: FDOT 345 - 2, 4, 6, 9, 10, 11, 12 and 23. Class II concrete, minimum 28 day compression strength of 3400 psi.

2.3 ACCESSORIES

- A. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
 - 1. Clamps, Straps, and Washers: Steel, ASTM A 506.
 - 2. Rods: Steel, ASTM A 575.
 - 3. Rod Couplings: Malleable-iron, ASTM A 197.
 - 4. Bolts: Steel, ASTM A 307.
 - 5. Cast-Iron Washers: Gray-iron, ASTM A 126.
 - 6. Thrust Blocks: Concrete, 3,000 psi, as indicated on drawings.
- B. Yard Hydrants: Provide non-freeze yard hydrants, 3/4 inch inlet, 3/4 inch hose outlet, bronze casing, cast-iron or cast-aluminum casing guard, key-operated, and tapped drain port in valve housing.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering yard hydrants which may be incorporated in the work include, but are not limited to, the following:
 - a. Josam Mfg. Co.
 - b. Smith (Jay R.) Mfg. Co.

- c. Tyler Pipe.
- d. Zurn Industries, Inc.; Hydromechanics Div.

2.4 FIRE HYDRANTS

- A. AWWA C502, and shall be equipped with a minimum of one pumper outlet nozzle 4-1/2 inches in diameter and two hose nozzles 2-1/2 inches in diameter. Paint hydrant with two coats of oil paint using the local color code based on fire flow tests. Threads, nozzle caps, operating nuts and color shall conform to requirements of the local jurisdiction. Units shall be traffic type with breakable safety clips, or flange, and stem, with safety coupling located below barrel break line to preclude valve opening. Hydrants shall be dry top, low profile design with a maximum height of 30 inches. Outlet nozzles shall be on the same plane, with minimum distance of 18 inches from center of nozzles to ground line. Valve shall be compression type with 5-1/2 inches minimum opening and shoe inlet connection to be 6 inches minimum.

PART 3 - EXECUTION

3.1 INSPECTION

- A. General: Examine areas and conditions under which potable water system's materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF IDENTIFICATION

- A. General: During back-filling/top-soiling of underground potable water piping, install continuous underground-type plastic line markers, located directly over buried lines at 24 inches below finish grade.
- B. Insulation: Insulate all above ground piping for freeze protection.
- C. Pipe Laying: Lay all pipe "in the dry" along straight lines and grades between fittings, manholes, or other defined points, unless definite alignments deflections or grade changes are noted in the Drawings. Maintain a 3 foot minimum depth of cover over the top of pipe, unless otherwise noted in the Drawings. Maintain all materials, clean and protect all coatings from damage. Maintain the interior of the pipe, clean and free of dirt and debris. When work is not in progress, plug all open ends. Underground piping shall not be driven to grade by striking it with an unyielding object. Provide bell holes in the bedding to allow uniform load bearing along the pipe barrel.

Subaqueous pipe laying may be permitted with prior approval of the Engineer where conditions make it impracticable to lay pipe "in the dry".

Provide proper provisions for pipe expansions or contraction by installing expansion joints or other suitable methods. Also provide flexible connections to expedite equipment or piping system removal.

- D. Push-On Joints: The pipe bell and spigot shall be thoroughly cleaned immediately prior to inserting the gasket and jointing. Assure that the gasket is properly faced and positioned. Lubricate in accordance with manufacturer's recommendations. Protect pipe against damage from jointing equipment by using timber headers, etc.
- E. Mechanical Joints: Wipe clean the socket and plain end. The plain end, socket, and gasket shall be washed with a soap solution immediately prior to jointing. Maintain the joint straight during assembly with the gasket pressed firmly and evenly into the recess. Bolts shall be tightened such that the gland remains reasonable parallel to the flange by alternating from bolt to bolt in cycles. The required bolt size (pipes 4 inch to 24 inch diameter) is 3/4 inch torqued to 75 - 90 ft-lbs.
- F. Flange Joints: Make all flanged joints tight, without applying undue strain upon the joint or other appurtenances. Fit joints such that contact surfaces bear uniformly on the gasket with relatively uniform bolt stresses.
- G. Pipe Cutting: Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat workmanlike manner without damaging pipe, coatings or linings. Cut the pipe with an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw or milling wheel saw, and per manufacturer's recommendations. Cut ends and rough edges shall be ground smooth, and for push-on joint connections the cut end shall be beveled.
- H. Pipe Restraint: All plugs, caps, tees, and bends, unless otherwise specified, shall be restrained by thrust block reaction backing and/or the use of tie rods, retainer glands and/or restrained joints as shown in the Drawings and Standard Detail Drawings. Thrust blocking shall be placed between solid ground and the fitting to be anchored. Where concrete is to be placed around bolted joints, provide a sheet of 3 mil (minimum) polyethylene between the fitting and the concrete. Where soil bearing is inadequate to provide proper thrust blocking, Contractor shall provide mechanical restraint as directed by the Engineer. Protect tie rods, clamps, or other components of dissimilar metal against corrosion by hand application of a bituminous coating. Backfilling over pipe restraints shall not proceed until inspected by the Engineer.
- I. Polyethylene Encasement: When polyethylene encasement is specified for ductile iron pipe it shall be installed in accordance with ANSI A21.5 (AWWA C105).
- J. Support of Exposed Pipework: Support exposed systems as necessary to hold the piping and appurtenances in a firm, substantial manner to the required line and grades indicated on the Drawings, with no undue piping stresses transmitted to equipment or other items. Support all piping in buildings from the floors, wall, ceiling and beams adequately. Supports from the floor shall be by suitable saddle stands or piers.

Support piping along walls by wall brackets, saddles or by wall brackets with adjustable hanger rods. When piping is supported from the ceiling, use approved rod hanger of a type capable of screw adjustment after erection. Support all pipe above ground outside of buildings by concrete supports.

Where floor stands and extension stems are required for exposed valves, furnish adjustable wall bracket and extension stems. In general, brackets shall be not more than 6 feet apart, with floorstands and guides set firmly in concrete.

- K. Tapping: Tapping shall be by tapping sleeve (or cross) and valve installed with a tapping device designed for the pipe material.
- L. Service Connections: All connections less than 1 2-inches are considered service connections. New services shall be no less than 3/4-inches in diameter, unless noted otherwise on the drawings. Service lines serving a double connection shall be no less than 1-inch in diameter, unless noted on the drawings. Connection to main 4-inch and larger shall be by drilling the appropriate size hole and installation of service saddle with services to smaller mains by means of in-line fittings. Place a corporation stop at the saddle or fitting, extend service line to property line (perpendicular from the Main), and terminate with a plugged curb-stop pending meter installation. The contractor shall mark the location of each water service at its upper end by chiseling a letter "W" - 1 2-inches high on the top of the curb. If the curb does not exist, place a 4" x 4" x 3'-0" wood stake extending 2-inches above the ground at the end of the service.
- M. Valves: Carefully inspect all valves, opened wide, and then tightly closed, and all the various nuts and bolts for tightness. Take special care to prevent joint materials, stones, and other substances from becoming lodged in the valve seat. Any valve that does not operate correctly shall be replaced. Install at the locations, to the sizes, and elevations called for in the Drawings. Install buried valves vertically centered over the pipe. Provide extension stems on all buried valves to place the operating nut not more than 3 feet below grade.
- N. Valve Boxes: Center all valve boxes over the operating nut of underground valves to permit a valve wrench to be easily fitted to the nut. Set top of boxes to final grade. The valve box shall not transmit surface loads directly to either the pipe or valve. Use excessive care to prevent earth and other materials from entering the boxes. Any valve box that becomes out of alignment or is not to grade, shall be dug out and adjusted. A concrete collar shall be provided as shown in the Drawings.

3.3 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered, and after thrust blocks have sufficiently hardened. Fill pipeline 24- hrs prior to testing, and apply test pressure to stabilize system. Use only potable water.

- B. Hydrostatic Tests: Test at not less than 150 psi for 2 hours.

This test shall be performed by the Contractor with his labor and equipment in the presence of the Engineer and Owner/Purveyor Representative. No testing will proceed until all thrust blocks are cured or restraining devices installed. Clean and flush all piping thoroughly prior to testing. During filling of water all air will be carefully permitted to escape through release cocks installed as required.

$$L = \frac{(N) (D) (P)^2}{3700} = \text{allowable leakage in gallons per 2 hour test.}$$

L = 0.00331 ND; for 150 psi test for 2 hours.

N = Number of joints in the section tested.

D = Nominal pipe diameter in inches.

P = Average test pressure maintained during the leakage test in psig (gauge).

During the two (2) hour period of the test, the Contractor shall maintain a continuous pressure of 150 psi, by means of a pump taking supply from a container suitable for the measurement of water loss. Should the test fail, the leak will be located and repaired and the test performed again until it meets the above specified limits.

- C. Disinfection - Following the hydrostatic leakage test, Contractor shall provide all labor and materials to disinfect all sections of water systems, and receive approval from the appropriate agencies before placing the system in service. Disinfection shall be performed per AWWA C651 and Florida Department of Environmental Protection requirements.
- D. Chlorination - Apply the chlorination agent at the beginning of the section adjacent to the feeder connection, by injecting it through a corporation cock, hydrant or other connection ensuring treatment of the entire system. The chlorination agent may be any compound specified in AWWA C651. Feed water slowly into the new line and induce chlorine to produce a dosage and a residual as a dosage of between 40-50 ppm and a residual of not less than 25 mg/1 in all parts of the line after a 24-hour time period. During the chlorination process operate all valves and accessories.
- E. Flushing - Flush the system carefully until the chlorine concentration in the discharged water is equal to that generally prevailing or less than 1mg/1.
- F. Bacteriological Testing - After disinfecting the system, Contractor shall have samples collected for bacteriological analysis and submit as directed by Florida Department of Environmental Protection or local governing authority.

SECTION 02666
POTABLE WATER SYSTEMS

- G. Inspection of Work - All work is subject to inspection by the Water Purveyor, Owner's Representative and Engineer. The following phases of construction shall be inspected by the Owner's Representative and Engineer:

Placing of pipe, fittings and appurtenances.
Hydrostatic Test
Backfill
Sterilization
Placing in Service

END OF SECTION

SECTION 02730 - SANITARY SEWAGE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of Sanitary sewage systems work is indicated on drawings and schedules, and by requirements of this section.
- B. Refer to Division-2 section "Earthwork - Underground Utilities" for excavation and backfill required for sanitary sewage systems; not work of this section.
- C. Refer to Division-2 sections for concrete work required for sanitary sewage systems; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of sanitary sewage system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with sanitary sewage work similar to that required for project.
- C. Codes and Standards:
 - 1. Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to selection and installation of sanitary sewage system materials and products.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for sewage system materials and products.
- B. Shop Drawings: Submit shop drawings for sanitary sewage systems, showing piping materials, size, locations, and inverts. Include details of underground structures, connections, and cleanouts. Show interface and spatial relationship between piping and proximate structures.

SECTION 02730
SANITARY SEWAGE SYSTEMS

- C. Record Drawings: At project closeout, submit record drawings of installed sanitary sewage piping and products, in accordance with requirements of Division-1.
- D. Maintenance Data: Submit maintenance data and parts lists for sewage system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division-1.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

- A. Underground-Type Plastic Line Markers: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6 inches wide x 4 mils thick. Provide green tape with black printing reading "CAUTION SEWER LINE BURIED BELOW."
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering identification markers which may be incorporated in the work include, but are not limited to, the following:
 - a. Allen Systems, Inc.
 - b. Emed Co., Inc.
 - c. Seton Name Plate Corp.

2.2 PIPES AND PIPE FITTINGS

- A. Polyvinyl Chloride Pipe & Fittings (PVC): Pipe and fittings, ASTM D3034, SDR 35 and shall have integrally formed bell and spigot with factory installed rubber sealing ring gaskets. Pipe shall be in maximum laying length of 12.5 feet. Joints, ASTM D3212, push-on type elastomeric compression gaskets. Field solvent weld joints are not acceptable. PVC materials shall be approved equal to "Ring-Tite" as manufactured by Johns-Manville.
- B. Ductile Iron Pipe & Fitting (DI): Pipe shall be ductile iron (DI) with minimum thickness of Class 51 for 3 and 4 inch and Class 50 for larger pipe. ANSI 21.51 (AWWA C151); Fittings, ANSI 21.10 (AWWA C110); Joints, ANSI 21.11 (AWWA C111).
- C. Gray Iron Pipe & Fittings (GI): Pipe, ANSI 21.6 (AWWA C106); Fittings, ANSI 21.10 (AWWA C110); Joints, ANSI 21.11 (AWWA C111).
- D. Pipe Coupling & Bushing Adapter: Rubber couplings with stainless steel ring clamps at both ends and stainless steel shear ring and rubber bushings as required, approved equal to Mission Rubber Company, Inc.

SECTION 02730
SANITARY SEWAGE SYSTEMS

- E. PVC - Manhole Connector: Asbestos-cement manhole adapter, approved equal to Johns-Manville.
- F. Non-shrink Mortar: Embeco 167 or approved equal.
- G. Precast Manholes: Precast reinforced concrete per ASTM C478, except wall thickness shall be 1 inch per foot of inside diameter plus 1 inch but 5 inch minimum. All openings shall have minimum steel hoop of #4 wire. Cement shall be Portland Type II. Manholes shall be in accordance with the Standard Detail Drawings.
- H. Concrete: FDOT 345-2 (except no pozzolan), 4, 6, 9, 10, 11, 12 and 13. Class I, Class II, and Class III shall have minimum 28 day compressive strengths of 2500 psi, 4000 psi, and 5000 psi, respectively.
- I. Reinforcement: FDOT 415
- J. Curing: FDOT 925
- K. Brick: ASTM C32, grade MC (hard brick).
- L. Mortar: For brick sections of manholes mix one (1) part Portland Cement Type II and three (3) parts of sand per FDOT 902-2.2. For Mortar plaster use one (1) part cement, two (2) parts sand.
- M. Manhole Joint Sealer: Pre-formed plastic joint sealer per Federal Specification SS-S-00210 (GSA-PSS), "Ram-Nek" as manufactured by the K.T. Snyder Col, Inc., or approved equal.
- N. Manhole Frame & Cover: Gray cast iron per ASTM A48, Class 30 without perforations and suitable for addition of cast iron or steel rings for upward adjustment of top. The word "SANITARY" shall be cast into the face of the cover equal to that shown in the Standard Detail drawings in 1 1/2 to 2 inch letters raised flush with the top of the cover. Frame and cover shall be approved equal to U.S. Foundry and Manufacturing Corp. No. 430 (old No. 32 with Type G cover). Frames and covers shall have machine ground seats and have a coating of coal tar pitch varnish.

Where prefabricated adjustable frames are called for the Drawings, they shall be approved equal to U.S. Foundry No. 560 (old No. 23 with Type G cover) and comply with the above requirements.

Where manholes are subjected to periodic flooding or lie within the 100 year flood plain, or as designated by the Engineer, frames and covers shall be made watertight by means of gaskets and bolted covers approved equal to U.S. Foundry.
- O. Bitumastic: Koppers No. 300M, or approved equal.

SECTION 02730
SANITARY SEWAGE SYSTEMS

- P. Bedding Material: Bedding materials shall be as specified in Section 02210 of these Standard Specifications, "Earthwork - Underground Utilities".

PART 3 - EXECUTION

3.1 INSTALLATION OF IDENTIFICATION

- A. General: During back-filling/top-soiling of sanitary sewage systems, install continuous underground-type plastic line marker, located directly over buried line at 24 inches below finished grade.

3.2 INSTALLATION OF PIPE AND FITTINGS

- A. Pipe Laying & Jointing: Lay pipe with spigot ends pointing in the direction of flow starting at the lowest point. Clean joint contact surfaces immediately prior to jointing. Use lubricants, primers and adhesives as recommended by the joint manufacturer.
- B. Branches: Wye branches are to be installed in conjunction with the laying of the sewer pipe. Install wyes to serve all existing and future dwelling units, as noted in the Drawings. The longitudinal barrel of branch fittings shall conform to the line and grade, diameter, and quality of the sewer main. All service laterals shall be perpendicular to the longitudinal axis of the pipe.
- C. Laterals: Install service laterals and wye branch fittings as shown in the Standard Detail Drawings and as sized and located in the Drawings. Laterals shall be located between 3 feet minimum and 5 feet maximum below right-of-way finished grade at the service. Laterals shall be run perpendicular to the sewer main at a minimum grade of 1 percent from the main to the right-of-way line. Provide a wye branch fitting for each service lateral; double wyes are not acceptable. Plug all laterals and service wyes at the last joint and securely seal to withstand the internal pressure of leakage or air pressure testing, but the plug shall also be capable of removal without injury to the socket. Chisel an "S" in the top of the curb directly over the lateral location. If curbing is not part of the work, install a 4" x 4" X 3'0" wooden stake at the end of the connection.
- D. Transition Connections: Where pipes of different materials are to be connected between manholes, suitable transition couplings shall be installed. Couplings as cited herein are the only acceptable materials.
- E. Connections to Existing Lines: Use a collar wye saddle for 4 inch and 6 inch diameter connections into existing sewer lines. The existing line shall be cut using a template to accomplish a true and clean opening for the saddle. Gasketed saddles with stainless

SECTION 02730
SANITARY SEWAGE SYSTEMS

steel straps shall be used where available from the manufacturer. The sewer main shall be protected and cleaned of debris.

- F. Chimney Connections: Provide chimney connections, as shown in the Standard Detail Drawings where the depth of sewer main invert exceeds 10 feet below the finished grade of the street, unless otherwise required by the Engineer. One chimney may only serve 4 connections -double to each side or less. Chimney shall be encased in Class I Concrete.
- G. Connections to Manholes: Connections shall be in accordance with the Standard Detail Drawings. PVC connections shall be made using an asbestos-cement adapter pre-cast or mortared into the structure. Clay pipe and iron pipe (and asbestos-cement adapters when mortared) shall be mortared into structures with non-shrinking mortar applied and cured in strict conformance with manufacturer's recommendations such that no leakage through the annular joint occurs. Finish mortar smooth and flush with the adjoining interior and exterior wall surfaces. Clay pipe shall have a short nipple (18 inch or 24 inch) between the manhole fitting and the first full length of pipe. All openings for pipes into existing structures shall be made by cutting with a power driven abrasive wheel or saw.
- H. Connections to Wet wells: Provide one (1) joint (18 - 20 feet) of ductile iron pipe to extend outward from the structure. Mortar the connections as per above.
- I. Conflicting Structures: Where it becomes necessary to extend sewers through structures, such as conflicting manholes, junction boxes, etc., the pipe within shall be ductile iron with no joints inside the conflicting structure.
- J. Manholes: Manholes shall be in accordance with the Standard Detail Drawings. Manholes shall be precast with integral slab and lower ring, or poured in place slab with precast ring wall or mortared brick wall construction. All manholes shall have bitumastic coating as specified herein.

Brick manholes shall be true and symmetric with all courses level. Bricks shall be placed by shoving into a full bed of mortar with 1/4 to 1/2 inch joints completely filled. Courses shall be laid continuously with alternating joints and with whole headers every sixth course. Excess mortar shall be carefully struck off. Portland cement plaster (1/2 inch minimum) shall be applied to the interior and exterior brick surfaces. Brick manholes shall be protected and kept moist for at least 48 hours following completion during hot or dry weather.
- K. Manhole Foundation: Compact the soil beneath the manhole to 95% of maximum (AASHTO T-180) density. Additionally provide 9 inches of gravel beneath precast manhole bases.
- L. Manhole Base: Poured in place with Type II Portland cement concrete per Standard

SECTION 02730
SANITARY SEWAGE SYSTEMS

Detail Drawings or cast as an integral part of the precast section. If the base is poured, from a groove in the base with an accurate manhole ring, shape with a wood float and finish with a hard steel trowel prior to setting. The base shall set a minimum of 24 hours before the manhole construction proceeds. Precast base shall have a minimum of three lifting hooks set in and shall have a 6-inch lip.

- M. Manhole Invert: Shape invert channels to a trowel finish conforming to the sizes and shapes of the lower 0.8 diameter of the inlets and outlets called for in the Drawings. Changes in direction of the sewer and entering branch or branches shall have a true curve, with a centerline radius of at least three times the pipe diameter or channel width. Straight-through channels may be formed with pre-cut half pipes.
- N. Manhole Coating: Two (2) coats of bitumastic applied to the internal surfaces at a minimum rate of 120 square feet per gallon per coat and one coat to external surfaces at a minimum rate of 375 square feet per gallon. External surfaces shall be pre-painted. Internal surfaces shall be painted in the field after installation and after inspection.
- O. Top Elevation: Adjust precast manhole top between 6 inches and 12 inches by means of precast concrete rings or bricks laid in mortar.
- P. Manhole Frames and Covers: Set manhole frames and covers to conform to the grades in the Drawings. Set all frames securely in a cement mortar bed and fillet. All covers shall be made flush with existing permanent surfaces except outside the limits of the traveled ways where they should be set approximately 0.2 foot above the existing ground unless otherwise noted in the Drawings.
- Q. Stubs and Stoppers: Install pipe stoppers to all manhole stubs noted in the Drawings. When connecting to an existing stub, prior to removing the existing stopper, brick the inside opening to prevent any flow until the new system has been tested and cleaned. The brick shall not be removed until final inspection.
- R. Bulkheading Stub Channels: Bulkhead the downstream end of all outlets in the manholes of stub-out-channels not in use, to prevent the creation of a septic condition resulting from ponding of sewage or debris up the used channel.
- S. Protection of Water System at Crossings: Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be laid closer horizontally than 10 feet to a water main or service line. Pressure sewer lines shall only pass beneath water lines, with the top of the sewer line being at least 2 feet below bottom of water line. Where sanitary sewer lines pass above water lines, the sewer shall be encased in concrete for a distance of 10 feet on each side of the crossing, or rubber-gasketed pressure pipe shall be substituted for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, no joint in the sewer line shall be closer than 3 feet, horizontal distance, to the water line. Each pipe shall be

SECTION 02730
SANITARY SEWAGE SYSTEMS

carefully inspected before and after it is installed and defective pipe shall be rejected. Proper facilities shall be provided for lowering sections of pipe into trenches.

- T. Downstream Protection: Pipe shall not be flushed downstream. Open end of pipe shall be closed daily to prevent foreign matter from entering.
- U. PVC Ring Deflection: Maximum diametric ring deflection shall not exceed 5 percent of the internal pipe diameter throughout the warranty period when tested by a mandrel.

3.3 FIELD QUALITY CONTROL

- A. Testing - Low Pressure Air Leakage: All sanitary sewers shall be tested by means of a low pressure air leakage test. When tested by this method, the pipe is first pressure stabilized at 4 psig greater than the average groundwater back-pressure: Subsequent leakage shall not exceed the following:

0.0015 cubic feet per minute per square foot for PVC.
0.0030 cubic feet per minute per square foot for VCP.

- B. Testing - Infiltration or Exfiltration: If approved by Engineer, infiltration or exfiltration test may be performed in lieu of the air pressure test. When tested a minimum of three (3) days after the cessation of dewatering, the maximum allowable leakage shall not exceed the following rates per mile of main line (not laterals):

50 gallons per day per nominal inch for PVC
100 gallons per day per nominal inch for VCP

- C. Testing - Manhole Watertightness: Contractor shall test manhole watertightness by plugging all inlets and the outlet and filling the manhole to within one foot of the cone section. With a minimum depth of 4 feet and maximum depth of 20 feet, the maximum allowable drop of the water surface shall be 1/2 inch per 15 minute interval. Contractor shall plug all leaks by method approved by Engineer.
- D. Lamping: Contractor shall lamp between manholes. The concentricity at the lamp image received shall be such that the diameter of said image shall have no vertical reduction from that of the pipe inside diameter and not more than 20 percent horizontal reduction.
- E. Resurfacing: All test shall be completed and accepted by Engineer before any trench or pavement is surfaced/resurfaced.
- F. Final Inspection: After all manholes are raised to grade and paving operations completed, a final visual inspection will be made. Contractor shall assist the engineer by providing labor as required. Additional lamping may be required if it appears that lines are unclean. Contractor will be present to note required corrections, if any, and

SECTION 02730
SANITARY SEWAGE SYSTEMS

schedule their remedial action immediately before the work is accepted.

END OF SECTION 02730

SECTION 02831 - CHAIN LINK FENCING AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of chain link fences and gates is indicated on drawings.

1.3 QUALITY ASSURANCE

- A. Provide chain link fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data, and installation instructions for metal fencing, fabric, gates and accessories.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Dimensions indicated for pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

- 1. Galvanized Steel Fencing and Fabric:

- a. Allied Tube and Conduit Corp.
 - b. American Fence Corp.
 - c. Anchor Fence, Inc.

- 2. Aluminized Steel Fencing and Fabric:

- a. Page Fence Div./Page-Wilson Corp.
 - b. Cyclone Fence/United States Steel Corp.
 - c. or approved equal

- 3. Aluminum Fencing and Fabric:

SECTION 02831
CHAIN LINK FENCING AND GATES

- a. Chain Link Fence Company of Pennsylvania.
- b. Security Fabricators, Inc.
- c. or approved equal

4. Barbed Type:

- a. American Fence Corp.
- b. Man Barrier Corp.

2.2 STEEL FABRIC

A. Fabric: No. 9 ga. Core wire (0.148" + 0.005") size steel wires, 2" mesh, with top selvages knuckled for fabric 60" high and under, and both top and bottom selvages twisted and barbed for fabric over 60" high. Vinyl Coating shall be class 2b thermally fused & bonded per ASTM 668.

1. Furnish one-piece fabric widths for fencing up to 12' high.
2. Fabric Finish: Galvanized, ASTM A 392, Class II, with not less than 2.0 oz. zinc per sq. ft. of surface.
3. Fabric Finish: Aluminized, ASTM A 491, Class II, with not less than 0.40 oz. aluminum per sq. ft. of surface.

2.3 FRAMING AND ACCESSORIES

A. Steel Framework, General: Galvanized steel, ASTM A 120 or A 123, with not less than 1.8 oz. zinc per sq. ft. of surface.

1. Fittings and Accessories: Galvanized, ASTM A 153, with zinc weights per Table I.

B. End, Corner and Pull Posts: Minimum sizes and weights as follows:

1. Up to 6' fabric height, 2.375" OD steel pipe, 3.65 lbs. per lin. ft., 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.
2. Over 6' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft., or 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.

C. Line Posts: Space 10' o.c. maximum, unless otherwise indicated, of following minimum sizes and weights.

1. Up to 6' fabric height, 1.90" OD steel pipe, 2.70 lbs. per lin. ft. or 1.875" x 1.625" C-sections, 2.28 lbs. per lin. ft.
2. 6' to 8' fabric height, 2.375" OD steel pipe, 3.65 lbs. per lin. ft. or 2.25" x 1.875" H-sections, 2.64 lbs. per lin. ft.

SECTION 02831
CHAIN LINK FENCING AND GATES

3. Over 8' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft. or 2.25" x 1.875" H-sections, 3.26 lbs. per lin. ft.

D. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

1. Leaf Width	Gate Post	lbs./lin. ft.
Up to 6'	3.5" x 3.5" roll-formed section or 2.875" OD pipe	4.85 5.79
Over 6' to 13'	4.000" OD pipe	9.11
Over 13' to 18'	6.625" OD pipe	18.97
Over 18'	8.625" OD pipe	28.55

E. Top Rail: Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end post.

1. 1.66" OD pipe, 2.27 lbs. per ft. or 1.625" x 1.25" roll-formed sections, 1.35 lbs. per ft.

F. Tension Wire: 7-gage, coated coil spring wire, metal and finish to match fabric.

1. Locate at bottom of fabric.

G. Wire Ties: 11 ga. galvanized steel or 11 ga. aluminum wire, to match fabric core material.

H. Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.

I. Post Tops: Provide weathertight closure cap with loop to receive tension wire or top rail; one cap for each post.

J. Stretcher Bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into post.

K. Stretcher Bars Bands: Space not over 15" o.c., to secure stretcher bars to end, corner, pull, and gate posts.

L. Barbed Wire Supporting Arms: Manufacturer's standard barbed wire supporting arms, metal and finish to match fence framework, with provision for anchorage to posts and attaching 3 rows of barbed wire to each arm. Supporting arms may be

SECTION 02831
CHAIN LINK FENCING AND GATES

either attached to posts or integral with post top weather cap and must be capable of withstanding 250 lbs. downward pull at outermost end. Provide following type:

1. Single 45 deg. arm; for 3 strands barbed wire, one for each post.
- M. Barbed Wire: 2 strand, 12-1/2 ga. wire with 14 ga. 4-point barbs spaced not more than 5" o.c., metal and finish to match fabric.
- N. Barbed Tape: Continuous helical coils of barbed stainless steel tape, fabricated from .025" thick x 1" wide austenitic stainless steel with 4 needle sharp barbs on 4" centers and permanently clenched to .098" diameter core wire of high tensile zinc-coated steel. Adjacent loops clipped together to limit extension of coil. Provide coil diameter, type and configuration as indicated; if not otherwise indicated, provide 24" diameter, single concertina type coil.

2.4 GATES

- A. Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets, for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8' apart unless otherwise indicated.
1. Provide same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretchers bars to gate frame at not more than 15" o.c.
 2. Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.
 3. Where barbed wire is indicated above gates, extend end members of gate frames 1'-0" above to member and prepare to receive 3 strands of wire. Provide necessary clips for securing wire to extensions.
- B. Swing Gates: Fabricate perimeter frames of minimum 1.90" OD pipe.
- C. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:
1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 deg. gate opening. Provide 1-1/2 pair of hinges for each leaf over 6' nominal height.
 2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

SECTION 02831
CHAIN LINK FENCING AND GATES

- 3. Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.
- 4. Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.
- D. Sliding Gates: Provide manufacturer's standard heavy-duty inverted channel track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, hardware, and accessories as required.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Do not begin installation and erection before final grading is completed, unless otherwise permitted.
- B. Excavation: Drill or hand excavate (using post hole digger) holes for posts to diameters and spacings indicated, in firm, undistributed or compacted soil.
 - 1. If not indicated on drawings, excavate holes for each post to minimum diameters as recommended by fence manufacturer, but not less than 4 times largest cross-section of post.
 - 2. Unless otherwise indicated, excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.
- C. Setting Posts: Center and align posts in holes 3" above bottom of excavation.
 - 1. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
 - a. Unless otherwise indicated, extend concrete footings 2" above grade and trowel to a crown to shed water.
- D. Top Rails: Run rail continuously through post caps, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.
- E. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.
- F. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

SECTION 02831
CHAIN LINK FENCING AND GATES

- G. Tension Wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than 6 ga. galvanized wire. Fasten fabric to tension wire using 11 ga. galvanized steel hog rings spaced 24" o.c.
- H. Fabric: Leave approximately 2" between finish grade and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.
- I. Stretcher Bars: Thread through or clamp to fabric 4" o.c., and secure to posts with metal bands spaced 15" o.c.
- J. Barbed Wire: Pull wire taut and install securely to extension arms and secure to end post or terminal arms in accordance with manufacturer's instructions.
- K. Barbed Tape: Install barbed tape in configurations indicated in accordance with manufacturer's recommendations and securely fasten to fencing to prevent movement or displacement.
- L. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- M. Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.
 - 1. Tie fabric to line posts, with wire ties spaced 12" o.c. Tie fabric to rails and braces, with wire ties spaced 24" o.c. Tie fabric to tension wires, with hog rings spaced 24" o.c.
- N. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Drawings and general provisions of Contract, including General and Supplementary conditions apply to this section.
- B. Refer to Division 2 selection "Earthwork - Underground Utilities" for excavation and backfill required for underground utilities; not work of this section.

1.2 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** Firms regularly engaged in manufacturer of sewage forcemain systems materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Installer's Qualifications:** Firm with at least 3 years of successful installation experience on projects with sewage forcemain piping work similar to that required for project.
- C. **Product Data:** Submit manufacturer's technical product data and installation instructions for sewage forcemain system materials and products.
- D. **Shop Drawings:** Submit shop drawings for sewage forcemain systems, showing piping materials, size, locations, and elevations. Include details of underground structures, connections, thrust blocks, and anchors. Show interface and spatial relationship between piping and proximate structures.
- E. **Record Drawings:** At project closeout, submit record drawings of installed sewage forcemain system piping and products.
- F. **Maintenance Data:** Submit maintenance data and parts lists for sewage forcemain system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 1.
- G. **Environmental Compliance:** Comply with applicable portions of Florida Department of Environmental Regulation, Orange County Public Utilities, and Orange County Engineering.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

- A. **Underground-Type Plastic Line Markers:** Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide brown tape with black printing reading "CAUTION SEWAGE FORCEMAIN BURIED BELOW".
- B. Provide #10 AWG copper conductivity wire over underground non-metallic forcemains. Include termination above ground at equipment or valves.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers

offering plastic line markers which may be incorporated in the work include, but are not limited to, the following:

Allen Systems Inc.
Seton Name Plate Corp.

2.2 PIPE & FITTINGS

- A. Iron Pipe: Pipe shall be ductile iron (DI) with minimum thickness of Class 51 for 3 and 4 inch diameter pipe and Class 50 for larger pipe. Fittings may be ductile iron or gray iron (GI) unless otherwise noted herein or in the Drawings. The materials shall be as follows:
1. Pipe - ANSI A21.51 (AWWA C151)
 2. Fittings - ANSI A21.10 (AWWA C110)
 3. Joints - Mechanical & Push-on, ANSI A21.11 (AWWA C2111)
 4. Joints - Flanges ANSI A21.10 & A21.15 (AWWA C110 & C115) Class 125 and 1/8 inch full faced rubber gaskets.
 5. Restrained joints - Ductile iron mechanical joint retainer glands accepted equal to American Cast Iron Pipe Co.
 6. Flexible joints - Boltless with 15 joint deflection per applicable portions of ANSI A21.10 (AWWA C110) accepted equal to "Flex-Lok" by American Cast Iron Pipe Co.
 7. Bolts & Nuts - Bolts, ANSI B18.21 Nuts, B18.2.1; low carbon steel per ASTM A307, Grade B.
 8. Coatings, Linings & Encasement (DIP): All pipe and fittings shall be bituminous coated inside and out as specified in the ANSI Specifications cited in B-1 except where special painting or lining is called for. Polyethylene encasement shall be per ANSI 21.5 (AWWA C105).
 9. Where protective interior lining is called for, use 20 mil (minimum dry thickness) virgin polyethylene per ASTM D1248 compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during above ground storage, heat bonded to pipe and fittings, accepted equal to "polybond" by American Cast Iron Pipe Company. Polyethylene Encasement, where required, shall be per ANSI A21.5 (AWWA C105).
- B. Polyvinyl Chloride Pipe (PVC) (4 inch to 12 inch): AWWA C900, DR 25, Pressure Class 100, integral bell and spigot with elastomeric gaskets per ASTM D1869 and ASTM E477. PVC pipe shall use cast iron fittings per Paragraph A.
- C. Plug Valves: Semi-steel body, non-lubricated, eccentric type, with resilient faced plugs capable of drip-tight shut-off at the rated pressure applied at either port. Exposed valves shall have flanged connections; buried valves shall have mechanical joint connections. Provide gear actuators for valves 10 inches or larger. Valves and appurtenances shall be Series 100 as manufactured by DeZurik Corp., Sartell, Minn., or accepted equal.
- D. Check Valves: Iron body, bronze-mounted, stainless steel hinge pin, outside spring operated, swing non-slab type, and equipped with removable inspection covers. Units shall be rated for 150 psi minimum working pressure and shall permit full flow area equal to that of the connecting pipe. Valves shall be accepted equal to M & H.
- E. Air Release and Vacuum Valves: Cast iron body, minimum 150 psi working pressure, equipped with vacuum ball to prevent air return, two-inch inlet and 1 inch blow off valve accepted equal to APCO 400/401.

- F. Tapping Sleeves and Valves: Mechanical joint type with flanged outlet per ANSI B16.1, Class 125 accepted equal to M & H Fig. 74-M (Tapping Sleeve) manufactured by Dresser Industries, Inc., Anniston, Alabama. Valves shall be gate valves as specified herein and shall be specially designed for wet tapping and be compatible with connecting sleeve.
- G. Gate Valves: Iron body, bronze-mounted AWWA C500, double disc, non-rising stem type, equipped with 2 inch square cast iron wrench nut.
- H. Valve Boxes: Adjustable cast iron suitable sized to the valve with minimum diameter of 5 inches. Cover shall have the work "SEWER" legibly cast into the face. Boxes shall be suitable for H-20 loading and shall be accepted equal to Clow, M & H or U.S. Foundry.

PART 3 - EXECUTION

3.1 GENERAL

- A. Excavation and backfill including sheeting and bracing, dewatering, bedding and foundation, and furnishing and disposal of materials shall be as specified in Section 02210 of these Standard Specifications, "Earthwork - Underground Utilities" with any additional requirements included herein.
- B. Pipe Laying: Lay all pipe "in the dry" along straight lines and grades between fittings, manholes, or other defined points, unless definite alignments deflections or grade changes are noted in the Drawings. Maintain a 3 foot minimum depth of cover over the top of pipe, unless otherwise noted in the Drawings. Maintain all materials, clean and protect all coatings from damage. Maintain the interior of the pipe, clean and free of dirt and debris. When work is not in progress, plug all open ends. Underground piping shall not be driven to grade by striking it with an unyielding object. Provide bell holes in the bedding to allow uniform load bearing along the pipe barrel.
- C. Subaqueous pipe laying may be permitted with prior acceptance of the Engineer where conditions make it impracticable to lay pipe "in the dry".
- D. Push-on Joints: The pipe bell and spigot shall be thoroughly cleaned immediately prior to inserting the gasket and jointing. Assure that the gasket is properly faced and positioned. Lubricate in accordance with manufacturer's recommendations. Protect pipe against damage from jointing equipment by using timber headers, etc.
- E. Mechanical Joints: Wipe clean the socket and plain end. The plain end, socket, and gasket shall be washed with a soap solution immediately prior jointing. Maintain the joint straight during assembly with the gasket pressed firmly and evenly into the recess. Bolts shall be tightened such that the gland remains reasonably parallel to the flange by alternating from bolt to bolt in cycles. The required bolt size (pipes 4 inch to 24 inch diameter) is 3/4 inch torques to 75-90 ft-lbs.
- F. Flange Joints: Make all flanged joints tight, without applying undue strain upon the joint or other appurtenances. Fit joints such that contact surfaces bear uniformly on the gasket with relatively uniform bolt stresses.
- G. Pipe Cutting: Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat workman like manner without damaging pipe coatings or linings. Cut the pipe with an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw or milling wheel saw. Cut ends and rough edges shall be ground smooth and for push-on joint

- connections, the cut end shall be beveled.
- H. Pipe Restraint: All plugs, caps, tees, and bends, unless otherwise specified, shall be restrained by thrust block reaction backing and/or the use of tie rods, retainer glands and/or restrained joints as shown in the Drawings and Standard Detail Drawings. Thrust blocking shall be placed between solid ground and the fitting to be anchored. Where concrete is to be placed around bolted joints, provide a sheet of 3 mil (minimum) polyethylene between the fitting and the concrete. Where soil bearing is inadequate to provide proper thrust blocking, Contractor shall provide mechanical restraint as directed by the Engineer. Protect tie rods, clamps, or other components of dissimilar metal against corrosion by hand application of a bituminous coating. Backfilling over pipe restraints shall not proceed until inspected by the Engineer.
 - I. Polyethylene Encasement: When polyethylene encasement is specified for ductile iron pipe it shall be installed in accordance with Section 5-4 of ANSI A21.5 (AWWA C105).
 - J. Above Ground Pipe Support: Support exposed systems as necessary to hold the piping and appurtenances in a firm, substantial manner to the required lines and grades indicated in the Drawings, with no undue piping stresses transmitted to equipment. Support all pipe above ground outside of buildings by concrete supports.
 - K. Tapping: Tapping shall be by tapping sleeve and valve installed with a tapping device designed for the pipe material.
 - L. Valves: Carefully inspect all valves, opened wide, and then tightly closed, and all the various nuts and bolts for tightness. Take special care to prevent joint materials, stones, and other substances from becoming lodged in the valve seat. Any valve that does not operate correctly shall be replaced. Install at the locations, to the sizes, and elevations called for in the Drawings.
 - M. Unless otherwise noted in the Drawings, set valve stems vertically above the center-line of the pipe. Where extension stems are required within valve boxes, provide insert stems.
 - N. Valve Boxes: Center all valve boxes over the operating nut of underground valves to permit a valve wrench to be easily fitted to the nut. Set top of boxes to final grade. The valve box shall not transmit surface loads directly to either the pipe or valve. Use excessive care to prevent earth and other materials from entering the boxes. Any valve box that becomes out of alignment or is not to grade, shall be dug out and adjusted. A concrete collar shall be provided as shown in the Standard Detail Drawings.
 - O. Air & Vacuum Valves: Install air and vacuum valves in manhole structures as shown in the Standard Detail Drawings.
 - P. Hydrostatic Testing: This test shall be performed by the Contractor with his labor and equipment in the presence of the Engineer and Orange County Representative. No testing will proceed until all thrust blocks are cured or restraining devices installed. Clean and flush all piping thoroughly prior to testing. During filling of water all air will be carefully permitted to escape through release cocks installed as required.
 - Q. Perform the hydrostatic test at 100 psi for a period of two (2) hours as per Section 4, AWWA C600. The maximum allowable leakage shall not be less than that determined by the following formula:

$$L = \frac{(N) (D) (P)^{0.5}}{100} = \text{allowable leakage in gal. per hr.}$$

7400

L = 0.00270 ND; for 100 psi test for 2 hours

N = Number of joints in the section tested

D = Nominal pipe diameter in inches

P = Average test pressure maintained during the leakage test in psig (gauge)

- R. During the two (2) hour period of the test, the Contractor shall maintain a continuous pressure of 100 psi, by means of a pump taking supply from a container suitable for the measurement of water loss. Should the test fail, the leak will be located and repaired and the test performed again until it meets the above specified limits.

END OF SECTION

SECTION 02920 - SEWAGE LIFT STATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this section.

1.2 DESCRIPTION OF WORK

- A. Extent of systems work is indicated on drawings and schedules, and by requirements of this section.
- B. Refer to section 31 22 10 "Earthwork - Underground Utilities" for excavation and backfill required for sanitary sewage systems; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of pumping system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with sanitary sewage work similar to that required for project.
- C. Codes and Standards:
 - 1. Code Compliance: Comply with applicable portions of Florida Department of Environmental Regulation and Orange County Public Utilities.

1.4 SUBMITTALS

- A. Shop Drawings: Wiring diagrams for all equipment showing full details of factory wiring and all field wiring required to complete installation and pump pit.
- B. Product Data: Manufacturer's detailed literature, including equipment capacity data:
 - 1. Pumps complete with required accessories.
 - 2. Controls and control panels.
 - 3. Valves (all types).
 - 4. Flange gaskets.
 - 5. Corrosion protection materials.
 - 6. Pit access covers.

C. Certificates of Compliance:

1. Certifications: Manufacturer's detailed literature that notes compliance with reference standards (including types, pressure rating, schedule, class and grade.
2. Manufacturer's detailed literature:
 - a. Pipe.
 - b. Pipe fittings.
 - c. Pipe flanges.
3. Record drawings:
 - a. Pipe.
 - b. Pipe fittings.
 - c. Pipe flanges.
4. Maintenance Data:
 - a. Pipe.
 - b. Pipe fittings.
 - c. Pipe flanges.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipes, pipe fittings, plug valves, and check valves shall be per Orange County Utilities Standards and Specifications, Latest Edition.

2.2 PRE-CAST WET WELL SECTIONS

- A. ASTM C478 as modified in Section 31 27 30 of Standard Specifications, for "Sanitary Sewage Systems."

2.3 PUMPS AND MOTORS

- A. Hydromatic, Flygt, or approved equal, 3 phase, 240 volt.

2.4 DISCHARGE ELBOW/ANCHOR BOLTS

- A. Class 125, flanged, per pump manufacturer.

2.5 ACCESS FRAMES AND COVERS

- A. Aluminum, sized to provide access clearance as required by the pump manufacturer, and as required to adequately service and/or remove check valves from the check valve vault. Cover shall have lifting handles, safety latches and locking hasp.

2.6 CONTROL EQUIPMENT

- A. As listed below or approved equal:

1. Enclosure - Weatherproof, NEMA-3R with dead front panel, separate removable inside panel, handle and lock hasp.
2. Main Disconnect - Two manual interlocked circuit breakers.
3. Starters.
4. Alternator - Plug-in type.
5. Bubbler Level Control - Air pump, Mercury tube type switches in Honeywell Vapor stat.
6. High-level Sensor - Normally open, mercury float ball.
7. High Level Alarm - 115 Volt AC light in weatherproof bracket fixture for 100 watt lamp with red enclosing PVC vapor tight globe.
8. Relays.
9. Elapsed Time Meters.
10. HOA Switches.
11. Lightning Arrester, 3 phase.
12. Phase Voltage Monitor Relay - Phase loss, phase reversal and low voltage sensor and relay to alarm system.
13. Run-lights - Red running lights.
14. Emergency Generator Plug - Russell & Stoll JRS 1033F for 0 to 5 HP and JRS 1044F for greater than 5 HP.
15. Pump Disagree Timer.
16. Convenience Outlet - Grounded type 115 Volt, 60 cycle.

2.7 VENT CAP

- A. Vandal-proof, hooded, galvanized iron equal to Josam 26700.

2.8 BACKFLOW PREVENTER

- A. Provide hose bib backflow prevention device conforming with requirements of the local authority.

2.9 CONCRETE

- A. FDOT 345-2 (except no pozzolan), 3, 4, 6, 9, 10, 11, and 12. Class I and Class II shall have minimum compressive strength of 2500 and 3400 psi respectively.

2.10 REINFORCEMENT

- A. FDOT 415.

2.11 CURING

- A. FDOT 932.

2.12 FENCING

- A. Refer to Section 02831 - Chain Link Fencing and Gates.

PART 3 - EXECUTION

3.1 GENERAL

- A. Excavation and backfill including sheeting and bracing, dewatering, bedding and foundation, and furnishing and disposal of materials shall be as specified in Section 31 22 10 of these Standard Specifications, "Earthwork - Underground Utilities," with any additional requirements included herein.

3.2 WET WELLS

- A. Construct wet wells to the same requirements as sanitary sewer manholes with the following additional requirements:
 - 1. Base shall be monolithic with lower ring.
 - 2. Base slab and top slab shall be constructed to the dimensions shown in the Standard Detail Drawings. Wall thickness and inside diameter of the wet well shall be constant over its full depth.
 - 3. Brick construction shall not be acceptable.

3.3 PIPE, VALVES AND FITTINGS

- A. All exposed pipe shall have flanged joints. All buried pipes shall have mechanical joints.

3.4 PUMP INSTALLATION

- A. Install equipment in accordance with approved shop drawings and manufacturer's instructions to operate as intended by the manufacturer. Locate upper guide rail holders exactly as required to seat pumps such that shafts will turn freely without binding or leaking.

3.5 CONTROL PANEL

- A. The control panel shall be factory assembled and tested prior to installation at the pump station. Contractor shall provide for coordination between pump manufacturer and panel manufacturer to assure that the control panel as a whole as well as the individual components comprise a system which is intimately compatible with the pumps. The following equipment shall be included in the panel: Main breakers, pump circuit breakers (2), 20 amp panel circuit breaker, bubbler control, pump, mercury vapor stat switches (2), starters (2), alternator, elapsed time meters (2), run lights (2), HOA switches (2), starters disagree timer, phase voltage monitor relay. All switches, main circuit wiring, breakers and other devices shall be clearly and neatly labeled

inside the control panel. A single line wiring diagram shall be included within the panel with a copy provided for the Engineer's record.

3.6 HIGH LEVEL ALARM

- A. Provide two mercury float ball switches as high level alarm switches to the telemetry system and to the red alarm signal light. Mount red alarm light on top of control panel enclosure.

3.7 ACCESSORY EQUIPMENT

- A. Provide lightning arrester, emergency disconnect switch, emergency generator plug, red alarm light, bubbler piping and convenience outlet as shown in the Standard Detail Drawings.

3.8 POTABLE WATER SUPPLY

- A. Provide 1-inch potable water service with 3/4 inch hose bib and backflow prevention device (B-9) to the station. Exposed pipe shall be galvanized iron.

3.9 GRADING

- A. Grade the site away from the cover slab a 1 inch per foot drop.

3.10 FACTORY PERFORMANCE TESTS

- A. Manufacturer's factory performance tests and certified performance curves shall be provided for capacity power requirement and efficiency at specified minimum operating head, rated head, shut-off head and at as many other points as necessary.

3.11 FIELD TESTING

- A. Field testing shall be provided by Contractor with pump manufacturer's representative present and witnessed by the Engineer to provide a three point pump performance test by measuring amp draw and voltage, discharge pressure and rate of flow. Rate of flow and head must be within 10 percent and 5 percent respectively above the approved curve for acceptance. Results shall be provided to the Orange County Representative prior to final inspection of the system.

3.12 START-UP AND FINAL INSPECTION

- A. Contractor shall schedule with the Orange County Representative and Engineer for start-up and final inspection at the completion of the work.

3.13 PUMP STATION ELECTRICAL POWER AND CONTROL SYSTEM

- A. This section specifies the electrical power and control system requirements for wastewater pump stations. These requirements apply to duplex pump panels. Similar requirements shall apply when more than two pumps are involved except for the quantity of control equipment and panel size shall be increased accordingly. The manufacturer of the control panel shall provide data to indicate that the manufacturer has a minimum of 3 years experience in the building of pump control panels.

A pump station control panel shall be provided for each wastewater pump station. (See approved manufacturer's list in appendix.) The control panel shall respond to liquid level float switches to automatically start and stop pumps as well as sound an alarm upon high or low wet well levels. The control panel shall operate two (2) electrical submersible pumps at the power characteristics stipulated. The control function shall provide for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump shall automatically start to handle this increased flow. As the flow decreases, pumps shall be cut off at elevation as shown on the Plans. Pumps shall alternate positions as lead pump at the end of each cycle. A failure of the alternator shall not disable the pumping system. The alternator shall include a safe, convenient method of manual operation alternation without disturbing any wiring. Should the "pump off" regulator fail, the system shall keep the station in operation and provide a visual indication of the regulator failure.

The control panel shall consist of main circuit breakers and generator breaker with mechanical interlock, an emergency power receptacle, a circuit breaker and magnetic starter for each pump motor, and 15 ampere, 120 volt circuit breakers as required. All pump control operations shall be accomplished by a float type liquid level control system with all control components mounted in one common enclosure. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the "lead" and "lag" pumps after each pumping cycle. A float type liquid level control system shall continuously monitor wet well liquid level and control operation of the low-level cutoff for the pumps and shall operate off a 24 volt circuit.

- B. Panel Construction

The duplex pump panel shall be housed in a NEMA 3R, Type 304, 14 Gauge stainless steel enclosure with 30% extra mounting space for additional equipment. Enclosure shall have provisions for padlocking the door and a dead front inner door unit for mounting controls. All exterior hardware and hinges shall be stainless steel.

There shall be permanently affixed to the interior side of the exterior enclosure door both a nameplate and a 10" x 12" pocket for log sheet storage. The nameplate shall contain the following information, voltage, phase, rated horsepower, speed, date manufactured and pump and control panel manufacturer's name, address and

telephone number, pump data, including impeller data, operating point and head, KW input, and amps at the operating point and at least two other points on the pump curve.

The control panel and enclosure shall be Underwriters Laboratories (UL) 50 type 3R listed.

C. Power Supply and Main Disconnect

Power supply to the control panel shall be either 240 volt, 3 phase, 4 wire or 480 volt, 3 phase, 4 wire. Minimum service shall be 100 AMP. Single phase power shall not be accepted.

Nonfusible safety service main disconnects shall be installed at all stations. In all 240 volt systems, disconnects should be installed between the meter and the panel and on all 480 volt systems disconnect should be installed ahead of the meter. LED power available indicators shall be supplied on all legs.

D. Circuit Breakers

1. Main Breakers - The panel shall have an inter-lock system between the normal power main breaker and the emergency breaker to ensure only one breaker is in the "on" position at a time. Both breakers shall be equal in size. (See approved manufacturers' list in appendix.)
2. Circuit Breakers - All circuit breakers shall be heavy duty molded case breakers. The handle on the circuit breakers shall be operational through the inner door. (See approved manufacturers' list in appendix.)

E. Motor Circuit Protectors

Each pump motor shall be protected by a 3-pole motor circuit protector. (See approved manufacturers' list in appendix.) The Motor Circuit Protector shall be operated by a toggle-type handle and shall have a quick-make, quick-break overcenter switching mechanism that is mechanically trip-free from the handle so that the contacts cannot be held closed against a short circuit and abnormal currents which cause the Motor Circuit Protector to trip. Tripping shall be clearly indicated by the handle automatically assuming a position midway between the normal ON and OFF positions. All latch surfaces shall be ground and polished. All poles shall be so constructed that they open, close, and trip simultaneously. Motor Circuit Protector must be completely enclosed in a high-strength glass polyester molded case. Ampere ratings shall be clearly visible. Contacts shall be of non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes. A manual push-to-trip button shall be provided for manual exercising of the trip mechanism. Each pole of these Motor Circuit Protector's shall provide instantaneous short circuit protection by means of an adjustable magnetic-only element.

F. Motor Starter and Selector Switches

The panel shall contain two motor starters. The motor starter shall be across the line magnetic starter with individual overload protection on each power leg with reset installed through the inner door unit. (See approved manufacturers' list in appendix.) Local Power Company Regulations shall govern.

G. Pump Alternator

An eight pin plug-in solid state alternator (see approved manufacturers' list in appendix) shall be provided to change the pump starting sequence on each pumping cycle. A three position alternator test switch shall be provided to control the alternation operation. Switch positions to include the "Auto" to provide normal automatic sequence, "Off" position to disable alternator, and "test" position with a spring return to allow the alternating of the pump sequence to check alternator operation.

H. Lights and Alarms

1. Indicator Lights - There shall be installed on the face of the inner door unit, heavy duty oil tight indicator lights as shown on the Standard Drawings.
2. High Level Alarm - A vapor proof red light and horn shall be mounted on top of the panel for high level alarm. Also, there shall be an alarm silence pushbutton on the inner door and a silence relay which will silence the horn and automatically reset when these signals are restored to normal. The pushbutton shall be heavy duty oil tight. The red globe shall be the screw-on type.

I. Emergency Power Receptacle

This item shall only be required on stations that do not have a permanent standby generator system. The panel shall have an external mounted generator receptacle of the required size. (See approved manufacturer's list).

J. Additional Requirements

1. Wiring - All power wires shall be THW and THWN 75 Degree C insulated stranded copper conductors and shall be appropriately sized for the given load application. All control circuit wire shall be type THW; Size 14, stranded type. All wiring within the enclosure shall be neatly routed by the use of slotted type wiring duct with snap on type covers. Wiring on the rear of the inner door shall be neatly bundled with nylon ties and include sufficient loop across the hinges to prevent wire damage, with each end of conductor marked (I.D.), Color: Red, 24 volt; white, neutral; black, 120 volts.

2. Terminal Points - Terminal points of all terminal strips shall be permanently identified. All terminal numbers and identifying nomenclature shall correspond to and be shown on electrical diagrams. All wiring shall be permanently shown on electrical schematic diagrams.
3. Engraved Nameplates - All circuit breakers, control switches, indicator pilot lights and other control devices shall be identified with permanently affixed legend plates and lamicoïd-type engraved nameplates where applicable.
4. Surge Protector - A surge protector shall be included and wired to protect motors and control equipment from lightning induced line surges. All surge protectors shall be U.L. approved and installed per respective power company requirements and manufacturers' specifications, surge protectors shall be attached to the main disconnects.
5. Elapsed Time Meters - Elapsed time meters shall be 115 volt not-reset type and shall totalize pump running time in hours and tenths of hours to 99999.9 hours.
6. Convenience Receptacle - On the face of the inner door unit, there shall be installed a 15 AMP 120 volt, duplex convenience receptacle. It shall be provided with it's own single pole, 15 AMP circuit breaker for protection. Ground fault interrupt type shall be required.
7. Control Terminal Blocks - Control terminal blocks shall be of the clamp screw type, rated for 600 volts. Amperage rating shall accommodate the control circuit amperage. An additional 30 space terminal strip shall be installed in the cabinet for future use, with RTU equipment.
8. Control Power Transformer - There shall be a control power transformer with a minimum size of 500VA to provide 120VAC power for: coils for starters, 15A duplex receptacle, indicator pilot lights, alarm horn, alarm light, pump alternator, elapsed time meters etc. The secondary side shall have one leg fused and the other grounded. This control power transformer is required only on 480 volt control panels.

The signal required by the float switches and relays shall be 24VAC. This shall be provided by a 24VAC control power transformer properly sized with a fused secondary.
9. Control Relay - The level control relays shall operate from 24VAC. They shall be enclosed, plug-in 8 pin type with octal-style screw terminal sockets.
10. Electrical Schematic - There shall be permanently affixed to the interior side of the exterior enclosure door an electrical schematic diagram and a copy supplied to County personnel at start-up. The schematic diagram shall include the rated amperage and voltage for all components.

11. Phase Monitor - For all 240 volt stations an eight pin plug-in type phase monitor shall be provided for protection of electrical components due to phase loss. Adequate dummy pin protection shall be provided to prevent accidental interchanging of the eight pin phase monitor with the eight pin alternator. All 480 volt stations shall have surface mount type phase monitors.

K. Testing, Service and Warranty

1. Testing - After fabrication in the control panel manufacturer's plant, an operational test shall be performed to check out the entire panel before delivery. Three phase source voltage to which the panel is intended for shall be used for the testing.
2. Service - The control panel manufacturer shall maintain a service organization in Orange County that is available for service.
3. Warranty - The manufacturer shall furnish a five (5) year warranty against defects in materials and workmanship covering parts and labor on all items supplied under this section.

END OF SECTION

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.

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.

END OF SECTION 260500

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.

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 Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway
- D. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- E. Branch Circuits Concealed Underground: Type THHN-THWN, single conductors in raceway.
- F. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- G. Class 2 Control Circuits: Type THHN-THWN, in raceway

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables underground 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.
- E. 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. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- B. 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.

- C Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.
- D. 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 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 260519

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. 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 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.

3.3 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. Receptacle circuits.
3. Single-phase motor and appliance branch circuits.
4. Three-phase motor and appliance branch circuits.
5. Flexible raceway runs.
6. Armored and metal-clad cable runs.
7. 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.
8. Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

3.4 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. 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.

H. 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.

3.5 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 Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
 2. Substations and Pad-Mounted Equipment: 5 ohms.
 3. 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 260526

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.
10. Or approved equal.

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. Arnco 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.
13. Or approved equal.

- 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.
 4. Or approved equal.
- 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 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.
 - 14. Or approved equal.
- 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.

2.5 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.
 - e. Or approved equal.

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.
 - e. Or approved equal.

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.
 - d. Or approved equal.

2.06 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.
 6. 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. 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.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- J. 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.
- K. 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.

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 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 260533

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.

PART 3 - EXECUTION

3.1 APPLICATION

- A. 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.
- B. 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. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - b. 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. Transformers.
 - c. Disconnect switches.
 - d. Enclosed circuit breakers.
 - e. Motor starters.

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 260553

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 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.

1.7 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. 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. Outdoor Locations: NEMA 250, Type 4x, stainless steel.
 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 262416

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 262713

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. Receptacles with integral surge suppression units.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- C. TVSS: Transient voltage surge suppressor.

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.

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).
 - 5. Or approved equal.

2.2 STRAIGHT BLADE RECEPTACLES

- A. 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.
 - d. Or approved equal.
 - 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.

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. Or approved equal.

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.

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. 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.

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 262726

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 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.

2.5 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.

2.6 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. Outdoor Locations: NEMA 250, Type 4X, stainless steel..
 2. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

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 262816