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TO
TECHNICAL SPECIFICATIONS**



FOR

The Riverfront Promenade Overlook

City of Cocoa, Florida

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SECTION 01100

SUMMARY

PART 1 - GENERAL

1.1 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.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: The work under this project consists of construction of the Cocoa Promenade project in accordance with these contract documents.
 - 1. Project Location: 430 Delannoy St, Cocoa, FL 32922.
 - 2. Owner: City of Cocoa.
- B. Engineer Identification: The Contract Documents were prepared for this Project by Infrastructure Solution Services LLC, 7185 Murrell Rd, Suite 101, Melbourne, FL, 32940.
- C. The Work under this contract includes, but is not limited to, the following:
 - 1. Construction of a reinforced concrete wall with piers and a precast stone cap, including reinforced concrete footing
 - 2. Construction of two (2) reinforced concrete overlooks on a pile foundation, including railing and appurtenances.
 - 3. Construction of landscaping and irrigation improvements
 - 4. Removal and replacement of fencing and utilities.
 - 5. Earthwork including excavation for structures and adjustments of grade.
 - 6. All other work shown, and all other work implied/required to perform the work shown, in the contract drawings and specifications.

1.3 CONTRACT

- A. Project will be constructed under one contract.

1.4 WORK SEQUENCE

- A. Any and all work necessary will be coordinated with City staff for site access and necessary shut downs or temporary operational changes to the existing area.

1.5 CONTRACTORS USE OF PREMISES

- A. General: The Contractor shall limit his use of the premises to the work indicated.
- B. Use of the Site: Confine operations to rights-of-way. Storage of materials or equipment beyond areas on which work is indicated is not permitted.
 - 1. Keep existing driveways and entrances clear and available at all times. Do not use these areas for parking or storage of materials.
- C. Coordinate use of premises under direction of the Owner and Engineer.
- D. Assume full responsibility for the protection and safe-keeping of products under this Contract, stored on the site.
- E. Move any stored products, under Contractor's control, which interfere with operations of the Owner or separate Contractor.
- F. Obtain and pay for the use of additional storage or work areas needed for operations.

1.6 WORK UNDER OTHER CONTRACTS

- A. Separate Contract: Owner may award separate contracts for performance of certain construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
- B. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.7 OWNER OCCUPANCY

- A. Owner will need access to the project site during the entire period of construction. Coordinate and cooperate with Engineer in all construction operations to minimize conflict and to facilitate Owner usage.
- B. Contractor shall at all times conduct his operations so as to insure the least inconvenience to the general public.

1.8 STORAGE OF EQUIPMENT AND MATERIALS

- A. The use of City facilities for the storage of equipment and/or materials shall not be permitted. Contractor shall obtain storage facilities for materials and equipment at his own expense.

1.9 WORK ON PRIVATE PROPERTY

- A. Contractor shall obtain Owner permission before performing work on private property. Permission shall be obtained at least 48 hours in advance of work. If the work is going to be extensive or require restoration, the Contractor shall notify the City in advance and written permission must be obtained through the City before work can be started. The Contractor shall photograph the work area before commencing work on private property and provide a copy to the City.

1.10 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by workmen.

1.11 TEST PITS

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

1.12 CARE AND PROTECTION OF PROPERTY

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

1.13 COOPERATION WITHIN THIS CONTRACT

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

1.14 REQUIRED INSURANCE AND LIABILITY

- A. Should any damage from the Contractor's operations occur, the City will investigate claims and notify the Contractor and the damaged party as to its findings. The Contractor shall be responsible for any damages caused by his operations.

1.15 SAFETY AND OSHA COMPLIANCE

- A. The Contractor shall comply in all respects with all Federal, State, and Local safety, health, and traffic control regulations. Copies of the Federal regulations may be obtained from the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), Washington DC 20210 or their regional offices. Particular attention is drawn to safety requirements for handling chemicals and entering confined spaces.
- B. The Contractor shall comply in all respects with the applicable Workman's Compensation Laws.

1.16 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.
 - 1. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Specifications are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Specifications to determine numbers and names of sections in the Contract Documents.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
- C. Specifications: The Technical Specifications consist of three parts: General, Products and Execution. The General Section contains General Requirements which govern the work.

Products and Execution modify and supplement these by detailed requirements of the work and shall always govern whenever there appears to be a conflict.

- D. Intent: All work called for in the Specifications applicable to this Contract, but not shown on the plans in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the plans or the Specifications, but involved in carrying out their intent or in the complete and proper execution of the work is required and shall be performed by the Contractor as though it were specifically delineated or described.
 - 1. The apparent silence of the specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these specifications shall be made upon that basis. The inclusion of the General Requirements (or work specified elsewhere) in the General part of the specifications is only for the convenience of the Contractor, and shall not be interpreted as a complete list of related Specification Sections.

1.17 PERMITS

- A. It shall be the CONTRACTOR's responsibility to secure all permits required to initiate and complete the Work under this Contract, except permits obtained by the OWNER.
- B. Permits obtained, or to be obtained, by the OWNER include the following:
 - 1. US Army Corps of Engineers Nationwide Permit
 - 2. Determination from St Johns River Water Management District that no permit is required.

PART 2 - PRODUCTS

2.1 SALVAGED MATERIALS

- A. In the absence of special provisions to the Contract, salvaged materials, equipment or supplies that occur are the property of the Owner and shall be cleaned, stored and delivered to the Owner as directed by the Engineer.

2.2 CERTIFIED CHEMICALS

- A. All chemicals used during project construction or furnished for project whether herbicide, pesticide, disinfectant, polymer, reactant, chemical grout or other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residue shall be in strict conformance with instructions.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall, prior to entering any section, prepare a Pre-Construction video and/or digital photographs, in accordance with Section 01380 PRECONSTRUCTION DOCUMENTATION, of each property and surrounding area to determine existing site conditions. Together the video and/or photographs will provide the basis for the level of restoration required and to address claims made against Contractor for damages caused.
- B. The Contractor shall notify all property owners 48 hours prior to working in public Rights-of-Way or easements affecting or adjoining their properties. Notification shall be by hand-delivered flyer (prior Engineer approval required) which shall contain the following information:
 - 1. Project Name
 - 2. Date of Entry
 - 3. Description of Work
 - 4. Name of Contractor's Representative
 - 5. Local Phone Number of Contractor's Representative
- C. The Contractor shall, prior to the removal of any fences, erect temporary fences to secure the owner's property. These temporary fences shall be of 4' high woven wire (2" x 4" grid), on the T line post 10' on centers. These fences shall run along the easement line and will remain in place until the permanent fence is re-erected.

3.2 CONNECTIONS TO EXISTING LINES

- A. Where connecting to existing lines, it shall be done at such a time in such a manner to cause the least amount of interruption to City operations and customer services.

END OF SECTION 01100

SECTION 01140
CONTROL OF WORK

PART 1 - GENERAL

1.1 CONSTRUCTION AREAS

- A. Coordinate use of work site under direction of Engineer and/or Owner.
- B. Assume full responsibility for the protection and safekeeping of materials and products under this Contract, stored on the site.
- C. Move stored products, under Contractor's control, which interfere with operations of the Owner or separate contractor.
- D. Obtain and pay for the use of additional storage of work areas needed for operations.

1.2 PRIVATE LAND

- A. The Contractor shall not enter or occupy private land outside of the Owner's property, public right-of way, or other easements, except by permission of the land owner.

1.3 WORK LOCATIONS

- A. Structures and pipelines shall be located substantially as indicated on the Drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him/her from laying and jointing different or additional items where required.

1.4 OPEN EXCAVATIONS

- A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The Contractor shall, at his/her own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access during construction shall be removed when no longer required. The length or size of excavation will be controlled by the particular surrounding conditions. The Engineer may require special construction procedures such as limiting the length of the open trench, prohibiting stacking excavated material in the street and requiring that the trench shall not remain open overnight.

- B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be well lighted at night.
- C. The Contractor shall adhere to the requirements of the Florida Trench Safety Act, and O.S.H.A. Excavation Safety Standards 29 CFRs 1926.650 Subpart P.

1.5 TEST PITS

- A. Test pits for the purpose of locating all known and unknown underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor at the direction of the Engineer. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer. No separate payment will be made.

1.6 CARE AND PROTECTION OF PROPERTY

- A. The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his/her expense, to a condition similar or equal to that existing before the damage was done, or he/she shall make good the damage in other manner acceptable to the Engineer.
- B. Along the location of this work all fences, walks, bushes, trees, shrubbery, and other physical features shall be protected and restored in a thoroughly workmanlike manner. Fences and other features removed by the Contractor shall be replaced in the location indicated by the Engineer as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be re-graded and seeded.
- C. The protection, removal, and replacement of existing physical features along the line of work shall be a part of the work under the Contract, and all costs in connection therewith shall be included in the unit and/or lump sum prices established under the items in the Schedule of Values.

1.7 PROTECTION/RELOCATION OF EXISTING STRUCTURES AND UTILITIES

- A. The Contractor shall assume full responsibility for the protection of all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, storm drains and electric and telephone cables, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind.

Any damage resulting from the Contractor's operations shall be repaired by him/her at his/her expense.

- B. The Contractor, however, shall bear full responsibility for obtaining all locations of underground structures and utilities (including existing water services, drain lines and sewers). Services to buildings shall be maintained, and all costs or charges resulting from damage thereto shall be paid by the Contractor.
- C. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract and all costs in connection therewith shall be included in the Total Bid Price in the Bid Form.
- D. The Contractor shall be responsible to maintain water, telephone, power, cable TV, sewer, gas and other related utilities throughout construction at no additional cost to the Owner.
- E. The Contractor shall fully cooperate with all private and public utilities during the installation of new facilities, or relocation of existing facilities. The Contractor shall coordinate his work accordingly and shall have no claim except for time extension for delays associated with the proposed utility improvements.

1.8 WATER FOR CONSTRUCTION PURPOSES

- A. The Contractor shall at his/her own cost, provide for the continuous operation of sewers, force mains, drains, and water mains during the progress of the work. The Contractor shall provide temporary services and/or bypasses when necessary to provide continuous utility service.
- B. Contractor shall be responsible for obtaining any water necessary for construction through the City.

1.9 CLEANUP AND DISPOSAL OF EXCESS MATERIAL

- A. During the course of the work, the Contractor shall keep the site of his/her operations in as clean and neat a condition as is possible. He/She shall dispose of all residue resulting from the construction work and, at the conclusion of the work, he/she shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and shall leave the entire site of the work in a neat and orderly condition.
- B. In order to prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and his/her subcontractors shall comply with all applicable Federal, State and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

- C. The Contractor is advised that the disposal of excess excavated material in wetlands, stream corridors, and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor, or Subcontractor, will be brought to the immediate attention of the responsible regulatory agencies. The Contractor shall be responsible for any action ordered by the regulatory agency.

1.10 MAINTENANCE OF ACCESS

- A. Portions of the work are located in developed areas requiring the access for fire and other departments to be provided for and at least one free lane be available for all traffic. Contractor is to arrange operations in these areas to meet these requirements and secure approval or operating procedures from the local traffic authority.

1.11 MAINTENANCE OF TRAFFIC

- A. Open pits, trenches, unpaved streets, debris, or other obstructions due to construction that will prevent the normal flow of traffic during an extended construction stoppage, for any reason, shall be minimized. In the event an extended construction stoppage is found to be necessary, Contractor shall, at his own expense, provide normal traffic flow during extended construction stoppage.
- B. All excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he shall repair the road surface, provide temporary roadways, erect wheel guards or fences, or take other measures for safety satisfactory to the Engineer.
- C. Detours around construction areas will be subject to the approval of the Owner. Where detours are permitted the Contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured the Contractor shall expedite construction operations and periods when traffic is being detoured will be strictly controlled by the Owner.

PART 2 - PRODUCTS

2.1 PROTECTION OF CONSTRUCTION AND EQUIPMENT

- A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions injured shall be reconstructed by the Contractor at his own expense.
- B. All structures shall be protected in a manner approved by the Engineer. Should any of the floors or other parts of the structures become heaved, cracked or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the

Contractor at his own expense and to the satisfaction of the Engineer. If, in the final inspection of the work, any defects, faults or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the guarantee period described in the contract.

- C. The Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the Owner.
- D. The Contractor shall maintain the work during construction and until the project is accepted. This maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces to the end that the road or structures are kept in satisfactory condition at all times. In the case of a Contract for the placing of a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.
- E. All cost of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various pay items and the Contractor will not be paid an additional amount for such work.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01140

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SECTION 01200

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
 - 1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Division 1 Section "Closeout Procedures" for administrative requirements governing project closeout.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - c. Contractor's Construction Schedule.
 - 2. Submit the Schedule of Values to Engineer at earliest possible date but no later than seven (7) days before the date scheduled for submittal of initial Applications for Payment.

- B. Format and Content: Use the bid form and/or specifications table of contents as a guide to establish line items 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 Engineer and Engineer's project number.
 - c. Contractor's name and address.
 - d. Date of submittal.
 2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
 3. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 4. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
 5. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
 6. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
- C. Schedule of Values Form: Use form provided at the end of this Section for Schedule of Values. Contractor may use their own form provided such form is approved by both the Owner and Engineer.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.
1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Progress payments shall be submitted to Engineer by the 5th day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
- C. Payment Application Forms: Use form provided at the end of this Section for Applications for Payment. Contractor may use their own form provided such form is approved by both the Owner and Engineer.

- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.
 - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit three (3) signed and notarized original copies of each Application for Payment to Engineer. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit final or full waivers.
 - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 - 1. Schedule of Values.
 - 2. Contractor's Construction Schedule (preliminary if not final).
 - 3. Submittals Schedule (preliminary if not final).
 - 4. Certificates of insurance and insurance policies.
 - 5. Performance and payment bonds.
- H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
 - 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
 - 1. Evidence of completion of Project closeout requirements.

2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. Evidence that claims have been settled.
5. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
6. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 BID ITEMS

- A. The scope of this section defines the items included in each bid item in the Bid Response Form of these Specifications. Payment will be made based on the specified items included in the description in this section for each bid item.
- B. The Contractor's attention is called to the fact that the quotations for the various items of work are intended to establish a total price for completing the work in its entirety. Should the Contractor feel that the cost for any item of work has not been established by the Bid Schedule or Payment Items, the Contractor shall include the cost for that work in some other applicable bid item, so that the proposal for the project reflects the Contractor's total price for completing the work in its entirety.
- C. All contract prices included in the Bid Form section will be full compensation for all labor, materials, tools, equipment and incidentals necessary to complete the construction as shown on the Drawings and/or as specified in the Contract Documents to be performed under this contract. Payment for all items listed in the Schedule of Values will constitute full compensation for all work shown and/or specified to be performed under this project.
- D. Bid Item No. 1 – Mobilization/Demobilization, Insurance, Bonds
 1. Payment for the mobilization and demobilization shall be limited to twenty-five (25) percent at the first payment application and at least ten (10) percent at the final pay application. The remaining sixty (65) percent shall be divided among the pay applications following the initial pay application.
 2. Price for mobilization, demobilization, insurance and bonds shall not exceed seven (7) percent of the total base bid contract price.
- E. Bid Item No. 2 – Level “A” Subsurface Utility Investigations
 1. Periodic payment will be made for these items based upon percent complete, less retainage.

2. This bid item includes all work, equipment, and materials necessary to perform subsurface utility investigations (Quality Level “A”) in accordance with the Contract Documents. These investigations must be performed in the project area between the existing paver walkway and the sea wall along the length of the project. In addition, the investigations must be performed along the route of any excavations and conduit runs outside of the project area. The investigations shall also record the location and size of any tie-backs from the existing sea wall to an elevation of 1.0 (NAVD88). The contractor is responsible for the costs associated with these investigations. These investigations shall be performed prior to beginning any other work, and the results of the investigations shall be provided to the Owner and the Engineer for review prior to beginning any other work.

F. Bid Item No. 3 – Erosion and Sediment Control

1. Periodic payment will be made for these items based upon percent complete, less retainage.
2. This bid item includes all work, equipment, and materials required for furnishing, constructing, installing, and maintaining erosion and sediment control throughout the duration required for the project. This item shall include all NPDES permitting, erosion and sediment control plans, and associated work.

G. Bid Item No. 4 – Demolition

1. Periodic payment will be made for these items based upon percent complete, less retainage.
2. Demolition shall include all work, equipment, and materials required to demolish the items shown to be demolished or removed in the Contract Documents, plus any incidental demolition required to complete other work shown in the Contract Documents. The cost of any clearing is to be included in this bid item. Disposal of all associated waste materials is also included in this item. The contractor shall note that not all demolition is explicitly shown on the drawings; additional will be required for removal and installation of various utilities and services lines, as noted on the utility and other plans. The contractor shall account for this demolition in his bid.

H. Bid Item No. 5 – Construct Electrical and Lighting

1. Periodic payment will be made for these items based upon percent complete, less retainage.
2. This bid item includes all work, equipment, materials, and permitting required to construct/install conduit, wiring, duct banks, fixtures, earthwork and related items shown in the Contract Documents. This includes all work on land and on the overlooks. These bid items also include all work, equipment, and materials required to install, test and complete all appurtenances detailed in the contract documentation to operate a fully functional system.

- I. Bid Item No. 6 – Reinforced Concrete Walls and Piers
 - 1. Periodic payment will be made for these items based upon percent complete, less retainage.
 - 2. This bid item includes all work, equipment, and materials required to construct reinforced concrete walls and piers with precast stone caps and all other related items shown in the Contract Documents. This work includes all soil excavation, fill/removal, compaction, protection of utilities and seawall & tie-backs, testing, and coating of the structures, and temporary improvements necessary for the work.
- J. Bid Item No. 7 – Reinforced Concrete Overlooks
 - 1. Periodic payment will be made for these items based upon percent complete, less retainage.
 - 2. This bid item includes all work, equipment, and materials required to construct reinforced concrete overlooks, on pile supported foundations, with stainless steel cable-railing and concrete piers, and all other related items shown in the Contract Documents. This work includes all soil excavation, fill/removal, compaction, accommodation and protection of utilities and seawall & tie-backs, testing, coatings, and temporary improvements necessary for the work.
- K. Bid Item No. 8 – Construct Utilities
 - 1. Periodic payment will be made for these items based upon percent complete, less retainage.
 - 2. This bid item includes all work, equipment, and materials, including communication conduit & hand holes, reclaimed water piping, valves, taps, fittings, connections, earthwork, testing, temporary improvements, service line and installations/relocations/replacements, dewatering, and all other work and associated appurtenances required to construct/install the utilities and to connect to existing utilities as shown in the Contract Documents.
- L. Bid Item No. 9 – Landscape Curb
 - 1. Periodic payment will be made for these items based upon percent complete, less retainage.
 - 2. This bid item includes all work, equipment, and materials, including concrete, reinforcements, testing and all associated appurtenances required to construct/install the concrete landscape curb as shown in the Contract Documents.
- M. Bid Item No. 10 – Landscape & Irrigation
 - 1. Periodic payment will be made for these items based upon percent complete, less retainage.
 - 2. This bid item includes all work, equipment, and materials required to furnish and install all landscape and irrigation improvements in accordance with the Contract Documents. This work shall also include any grading, sod, repair and restoration required due to construction activities in accordance with the Contract Documents.
- N. Bid Item No. 11 – Lighted Sign

1. Periodic payment will be made for these items based upon percent complete, less retainage.
 2. This bid items include all work, equipment, and materials, required to furnish and install the lighted sign as shown in the Contract Documents and manufactures specifications.
- O. Bid Item No. 12 – Survey and AutoCAD Format Record Drawings Provided by the Contractor
1. Payment for this item shall be limited to fifty (50) percent of the total amount spread equally over the length of the project. The remaining fifty (50) percent shall be paid following submittal and approval of the final survey and AutoCAD format record drawings.
 2. The minimum price bid for this bid item shall be equal to or greater than one (1) percent of the total contract-based bid price.
 3. This bid item includes all work, equipment, and materials for maintaining and preparing record drawings and survey in accordance with the City of Cocoa Standards and the Contract Documents.
- P. Bid Item No. 13 – Allowance
1. Payment for work related to this item will be made for Owner-approved resolution of unforeseen construction conflicts, and/or minor amendments to the Contract Documents. The Contractor shall not be entitled to an amount of monies for this item unless authorized in writing by the Owner. Payment for this item will be made based upon a negotiated lump sum or based on time and materials. The Contractor shall produce documentation upon request to verify costs. Only fees substantiated and approved by the Owner prior to work shall be paid as part of this bid item in accordance with the requirements of the Contract Documents. Any excess remaining at the end of the project will be recovered by deductive change order.
 2. Payment for authorized contract amendments shall be made in accordance with the provisions of the Contract Documents. Allowance monies remaining at the completion of the project, inclusive of all authorized contract amendments, will be returned to the Owner.
- Q. Bid Item No. 14 – Additive Bid Alternate 1 – Alternate Landscaping
1. Payment for this work will only be made if the City accepts this Additive Bid Alternate 1 and makes it part of the Contract.
 2. The amount included in the Bid Form shall be the additional cost for completing the alternate work only.
 3. Periodic payment will be made for these items based upon percent complete, less retainage.
 4. This bid item includes all work, equipment, and materials, including additional plantings, reduction in sod, additional landscape curb, and ancillary improvements identified and referenced on drawing *C-11 Bid Add Alternate Plan* as shown in the Contract Documents.

- R. Bid Item No. 15 – Deductive Bid Alternate 2 – Use of Precast Overlook Elements
1. Payment for this work will only be made if the City accepts this Deductive Bid Alternate 2 and makes it part of the Contract.
 2. The amount included in the Bid Form shall be the deduction in cost for the alternate work only.
 3. Periodic payment will be made for these items based upon percent complete, less retainage.
 4. This bid item allows the Contractor to propose cost savings to the City for the use of precast concrete elements in the construction of some or all of the overlook structures. This includes all work, equipment, and materials, including delegated design submittal for providing the overlook structures meeting all performance and aesthetic requirements of the Contract Documents using precast concrete elements.

SCHEDULE OF VALUES FORM

Project Name: _____

Pay Application No. _____

[illegible]

SCHEDULE OF VALUES FORM (CONTINUED)

Project Name: _____

Pay Application No. _____

[illegible]

APPLICATION AND CERTIFICATE FOR PAYMENT

Project Name: _____ Original Contract Sum: \$ _____

Owner: _____ Contractor: _____

Application No: _____ Owner's Project No.: _____
Period From: _____ Contractor's Project No.: _____
Period To: _____ Engineer's Project No.: _____

Application is made for payment, as detailed on the following page(s), of: \$ _____

The undersigned Contractor certifies that to the best of his knowledge, information and belief, the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work done on previous applications for payment for which payments have been received from the Owner, and that the current payment shown herein is now due.

CONTRACTOR: _____

By: _____ Date: _____
_____ (print)

COUNTY OF _____ STATE OF _____

Before me on this _____ day of _____, 20____, personally appeared _____, known to me, who being duly sworn, deposes and says that (s)he is the _____ of the Contractor above mentioned; that(s) he executed the above Application for Payment and statement on behalf of said Contractor; and that all of the statements contained therein are true, correct and complete.

(Notary Public)
My Commission Expires _____

OWNER: _____

By: _____ Date: _____ By: _____ Date: _____
_____ (print) _____ (print)

ENGINEER: _____

Amount Certified: \$ _____ By: _____ Date: _____
_____ (print)

Explanation (if different from amount shown): _____

Change Order Summary:

Previously Approved Change Orders			
		<u>Additions</u>	<u>Deductions</u>
Total		\$ _____	\$ _____

Change Orders Approved This Pay Period			
<u>Change Order No.</u>	<u>Date Approved</u>	<u>Additions</u>	<u>Deductions</u>
_____	_____	\$ _____	\$ _____
_____	_____	\$ _____	\$ _____
_____	_____	\$ _____	\$ _____
_____	_____	\$ _____	\$ _____
_____	_____	\$ _____	\$ _____
_____	_____	\$ _____	\$ _____
_____	_____	\$ _____	\$ _____
Total This Pay Period		\$ _____	\$ _____
Net Change (Current plus previous change orders)		\$ _____	\$ _____

Net Change Order		\$ _____
------------------	--	----------

Application is made for payment as shown below:

1. ORIGINAL CONTRACT SUM	\$ _____
2. Net Change by Change Order	\$ _____
3. CONTRACT SUM TO DATE (Line 1 and 2)	\$ _____
4. TOTAL COMPLETED AND STORED TO DATE	\$ _____
5. RETAINAGE:	
a. _____% of Completed Work	\$ _____
b. _____% of Stored Material	\$ _____
c. Total Retainage (Line 5a and 5b)	\$ _____
6. TOTAL EARNED LESS RETAINAGE (Line 4 less Line 5c)	\$ _____
7. LESS PREVIOUS PAYMENTS (Line 6 from prior Certificate)	\$ _____
8. AMOUNT DUE THIS APPLICATION	\$ _____
9. BALANCE TO FINISH, PLUS RETAINAGE (Line 3 less Line 6)	\$ _____

END OF SECTION 01290

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SECTION 01250

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

- A. Engineer will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Engineer are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within ten (10) days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Engineer.
1. Include a statement outlining 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 the Contract Time.
 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include costs of labor and supervision directly attributable to the change.
 5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 6. Comply with requirements in Division 1 Section "Products and Substitutions" if the proposed change requires substitution of one product or system for product or system specified.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Engineer will issue a Change Order for signatures of Owner and Contractor.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Engineer may issue a Construction Change Directive. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the 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 change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01250

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SECTION 01310

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination Drawings.
 - 2. Administrative and supervisory personnel.
 - 3. Project meetings.
 - 4. Requests for Interpretation (RFIs).
- B. Related Sections include the following:
 - 1. Division 1 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required

maintenance, service, and repair of all components, including mechanical and electrical.

- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Preparation of the Schedule of Values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Pre-installation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.
- C. 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 involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within five (5) days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than fifteen (15) days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
- C. Progress Meetings: Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.
 - 1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be

represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

1.6 REQUESTS FOR INTERPRETATION (RFI)

- A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form provided at the end of this Section.
 - 1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
 - 1. Project name.
 - 2. Date.
 - 3. Name of Contractor.
 - 4. Name of Engineer.
 - 5. RFI number, numbered sequentially.
 - 6. Specification Section number and title and related paragraphs, as appropriate.
 - 7. Drawing number and detail references, as appropriate.
 - 8. Field dimensions and conditions, as appropriate.
 - 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 10. Contractor's signature.
 - 11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
- C. Hard-Copy RFIs:
 - 1. Identify each page of attachments with the RFI number and sequential page number.
- D. Software-Generated RFIs: Software-generated form, with substantially the same content as indicated above and shown on the form provided at the end of this Section, may be used by the Contractor. Form shall be approved by Engineer prior to use.
 - 1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- E. Engineer's Action: Engineer will review each RFI, determine action required, and return it. Allow seven (7) working days for Engineer's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Engineer's actions on submittals.
 - f. Incomplete RFIs or RFIs with numerous errors.
2. Engineer's action may include a request for additional information, in which case Engineer's time for response will start again.
3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within ten (10) days of receipt of the RFI response.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

CONTRACTOR REQUEST FOR INFORMATION (RFI) FORM

RFI NO. _____

OWNER:	<u>City of Cocoa</u>	No. Copies _____
ENGINEER:	<u>Infrastructure Solution Services</u>	No. Copies _____
ARCHITECT:	_____	No. Copies _____
CONTRACTOR:	_____	No. Copies _____
OTHER:	_____	No. Copies _____

PROJECT DATA

NAME: _____
LOCATION: _____
OWNER: _____
OTHER: _____

CONTRACT DATA

NUMBER: _____
DATE: _____
DRAWING NO: _____
SPEC SECTION: _____

QUESTION:

BY: _____ DATE: _____

REPLY:

BY: _____ DATE: _____

END OF SECTION 01310

SECTION 01330

SUBMITTALS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

- A. The CONTRACTOR shall submit to the ENGINEER for review such working drawings, shop drawings, test reports and data on materials and equipment (hereinafter in this Section called data), and material samples (hereinafter in this Section called samples) as are required for the proper control of work, including but not limited to those working drawings, shop drawings, data and samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.
- B. The CONTRACTOR shall note that there are specific submittal requirements in other sections of these Specifications.
- C. The CONTRACTOR is to maintain an accurate updated submittal log and shall bring this log to each scheduled progress meeting with the OWNER and the ENGINEER. This log should include the following items:
 - 1. Submittal-Description and File Number assigned.
 - 2. Date to ENGINEER.
 - 3. Date returned to CONTRACTOR (from ENGINEER).
 - 4. Status of Submittal
 - a. Approved
 - b. Approved as Noted
 - c. Revise and Resubmit
 - d. Submit Specific Item
 - e. 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 O&M submittal

1.2 SHOP DRAWINGS

- A. When used in the Contract Documents, the term "shop drawings" shall be considered to mean CONTRACTOR's plans for material and equipment which become an integral part of the Project. These drawings shall be complete and detailed. Shop drawings shall consist of fabrication, erection and setting drawings and schedule drawings, manufacturer's scale

drawings, bills of material, wiring and control diagrams, and inspection and test reports including performance curves and certifications as applicable to the Work.

- B. All details on shop drawings submitted for approval shall show clearly the elevations of the various parts to the main members and lines of the structure and/or equipment, and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the shop drawings before being submitted for approval.
- C. See Shop Drawing Schedule requirements in subparagraph 1.7 CONTRACTOR'S RESPONSIBILITY.

1.3 PRODUCT DATA

- A. Product data as specified in individual sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and installation instructions, availability of colors and patterns, MANUFACTURER'S printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing storage instructions, and printed product warranties, as applicable to the work.

1.4 WORKING DRAWINGS

- A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the CONTRACTOR's plans for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities, ground water control systems, forming and falsework; for underpinning; and for such other work as may be required for construction but does not become an integral part of the Project.
- B. Working drawings shall be signed and sealed by a registered Professional Engineer, currently licensed to practice in the State and shall convey, or be accompanied by, calculations or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use. Prior to commencing such work, working drawings must have been reviewed without specific exceptions by the ENGINEER. Such review will be for general conformance and will not relieve the CONTRACTOR in any way from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the CONTRACTOR; the OWNER and ENGINEER shall have no responsibility therefor.

1.5 SAMPLES

- A. The CONTRACTOR shall furnish, for the approval of the ENGINEER, samples required by the Contract Documents or requested by the ENGINEER. Samples shall be delivered to the ENGINEER as specified or requested and in quantities and sizes as specified. A minimum of two samples of each item shall be submitted unless otherwise specified. The CONTRACTOR shall pre-pay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until approved by the ENGINEER.
- B. Samples specified in individual sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and units of work to be used by the ENGINEER or OWNER for independent inspection and testing, as applicable to the Work.
- C. The CONTRACTOR shall prepare a transmittal letter in triplicate for each shipment of samples. The CONTRACTOR shall enclose a copy of this letter with the shipment and send a copy of this letter to the ENGINEER. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify any Contract requirements.
- D. Approved samples not destroyed in testing shall be sent to the ENGINEER or stored at the site of the work. Materials and equipment incorporated in work shall match the approved samples. Samples which fail testing or are not approved will be returned to the CONTRACTOR at his expense, if so requested at time of submission.

1.6 SUBMITTAL REQUIREMENTS

- A. The CONTRACTOR shall review, approve, and submit, with reasonable promptness and in such sequence as shown on the Shop Drawing Submittal Schedule so as to cause no delay in the Contract Work or in the Work of the OWNER or any separate contractor, all shop drawings, product data, working drawings and samples required by the Contract Documents.
- B. The CONTRACTOR shall submit electronically one digital copy of the submittal in pdf version and four (4) printed copies of all shop drawings for the ENGINEER to review, of which the ENGINEER will retain two (2) sets.
- C. All submittals shall be made directly to the ENGINEER.
- D. Shop drawings, product data, working drawings and samples shall be furnished with the following information:
 - 1. Number and title of the drawing.
 - 2. Date of drawing or revision.

3. Name of project building or facility.
 4. Name of contractor, subcontractor, and manufacturer submitting drawing.
 5. Clear identification of contents, location of the work, and the sheet numbers and specification section where the product is found in the contract drawings.
 6. CONTRACTOR Certification Statement.
 7. Submittal Number.
 8. Contract Drawing Number Reference.
- E. In accordance with subparagraph 1.7 A, each shop drawing, working drawing, sample, and catalog data submitted by the CONTRACTOR shall have affixed to it the following Certification Statement, signed by the CONTRACTOR:
1. "Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers, and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all CONTRACTOR requirements."
- F. All items specified are not necessarily intended to be a manufacturer's standard product. Variations from specified items will be considered on an "or equal" basis. If submittals show variations from Contract requirements because of standard shop practice or for other reasons, the CONTRACTOR shall describe such variations in his letter of transmittal and on the shop drawings along with notification of his intent to seek contract adjustment. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the CONTRACTOR fails to describe such variations he shall not be relieved of the responsibility for executing the work in accordance with the Contract, even though such drawings have been reviewed. Variations submitted but not described may be cause for rejection. Any variations initiated by the CONTRACTOR will not be considered as an addition to the scope of work unless specifically noted and then approved as such in writing by the ENGINEER.
- G. Data on materials and equipment shall include materials and equipment lists giving, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, material, size, finish, and all other pertinent data.
- H. For all mechanical and electrical equipment furnished, the CONTRACTOR shall provide a list including the equipment name, and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained. In addition, a maintenance schedule for each piece of equipment shall be submitted.
- I. All MANUFACTURERS or equipment suppliers who propose to furnish equipment or products under Divisions 11, 13, 14, 15 and 16 shall submit an installation list to the ENGINEER along with the required shop drawings. The installation list shall include all installations where identical equipment has been installed and has been in operation for a period of at least one (1) year.

- J. The CONTRACTOR shall use the color "green" to make his remarks on the Submittals. Only the ENGINEER will utilize the color "red" in marking submittals.
- K. Facsimiles or copies of facsimiles will not be accepted for review.

1.7 CONTRACTOR'S RESPONSIBILITY

- A. It is the duty of the CONTRACTOR to check, and coordinate with the work of all trades, all drawings, data, schedules and samples prepared by or for him before submitting them to the ENGINEER for review. Each and every copy of any drawing or data sheet larger than 11"x17" shall bear CONTRACTOR's stamp showing that they have been so checked and approved. Drawings or data sheets 11"x17" and smaller shall be bound together in an orderly fashion and bear the CONTRACTOR's stamp on the cover sheet. The cover sheet shall fully describe the packaged data and include a list of all sheet numbers within the package. Shop drawings submitted to the ENGINEER without the CONTRACTOR's stamp will be returned to the CONTRACTOR, without review at the ENGINEER's option, for conformance with this requirement.
- B. The CONTRACTOR shall review shop drawings, product data, and samples prior to submission to determine and verify the following:
 - 1. Field measurements.
 - 2. Field construction criteria.
 - 3. Manufacturer's catalog numbers and similar data.
 - 4. Conformance with Specifications.
- C. Deviations from the Specifications or Drawings
 - 1. Shop drawings shall indicate any deviations in the submittal from the requirements of the Contract Documents. If no exceptions are taken to the specifications or drawings, the Contractor (or any Subcontractor, Manufacturer, etc.) shall make a statement as such. If there is no statement included in the submittal, then it is acknowledged that no exceptions are taken.
 - 2. Exceptions to the Specifications and/or Drawings shall be clearly defined in a Deviation List. The Deviation List shall consist of a paragraph by paragraph review of the Specifications indicating acceptance or any proposed deviations, the reason for exception, the exact nature of the exception and the proposed substitution so that an evaluation may be made by the Engineer.
 - 3. Exceptions in the submittal that are not clearly noted as described herein are not valid even if the Engineer has returned the submitted marked as Approved, Approved as Noted, or Submit Specific Item.
- D. At a time decided upon at the preconstruction meeting the CONTRACTOR shall furnish the ENGINEER a Shop Drawing schedule fixing the respective dates for the initial submission of shop and working drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall be provided as a separate entity and indicate those submittals that are critical to the progress schedule. The

CONTRACTOR shall prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work sections of the Specifications, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required), coordination with other submittals, testing, purchasing, fabrication, delivery, and similar sequenced activities. No extension of time will be authorized because of the CONTRACTOR's failure to transmit complete and acceptable submittals sufficiently in advance of the Work.

- E. The CONTRACTOR shall not begin any work affected by a submittal returned as not approved. Before starting this work all revisions must be corrected by the CONTRACTOR. After resubmittal they will be reviewed and returned to him by the ENGINEER. If approved or approved as noted, then the CONTRACTOR may begin this work. Any corrections made to the shop drawings are to be followed without exception.
- F. The CONTRACTOR shall submit to the ENGINEER all shop drawings and data sufficiently in advance of construction requirements to provide no less than twenty-one (21) calendar days for review from the time the ENGINEER receives them. No less than thirty (30) calendar days will be required for major equipment that requires review by more than one (1) engineering discipline.
- G. The CONTRACTOR shall be responsible for and bear all cost of damages which may result from the ordering of any material or from proceeding with any part of work prior to the review and approval by ENGINEER of the necessary shop drawings.
- H. All shop drawings, product data, working drawings and samples submitted by subcontractors for approval shall be sent directly to the CONTRACTOR for checking. The CONTRACTOR shall be responsible for their submission according to the approved shop drawing schedule so as to prevent delays in delivery of materials and project completion.
- I. The CONTRACTOR shall check all subcontractor's shop drawings, product data, working drawings and samples regarding measurements, size of members, materials, and details to satisfy himself that they are in conformance to the Contract Documents. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission to the ENGINEER.
- J. Requests for Information (RFI) shall be submitted on a standard form provided by the ENGINEER. RFIs shall indicate their importance to the timely completion of the project. RFIs will be processed as a shop drawing unless there is an urgent need for immediate response.

1.8 ENGINEER'S REVIEW OF SHOP DRAWINGS, PRODUCT DATA, WORKING DRAWINGS AND SAMPLES

- A. The ENGINEER's review is for general conformance with the design concept and contract drawings. Markings or comments shall not be construed as relieving the CONTRACTOR from compliance with the contract plans and specifications or from departures therefrom. The CONTRACTOR remains responsible for details and accuracy, for coordinating the work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
- B. The review of shop drawings, data, and samples will be general. They shall not be construed:
 - 1. As permitting any departure from the Contract requirements;
 - 2. As relieving the CONTRACTOR of responsibility for any errors, including details, dimensions, and materials;
 - 3. As approving departures from details furnished by the ENGINEER, except as otherwise provided herein.
- C. If the shop drawings, data or samples as submitted describe variations per subparagraph (1.6F), and show a departure from the Contract requirements which ENGINEER finds to be in the interest of the OWNER and to be so minor as not to involve a change in Contract Price or time for performance, the ENGINEER may return the reviewed drawings without noting an exception.
- D. Submittals will be returned to the CONTRACTOR under one of the following:
 - 1. "APPROVED" is assigned when there are no notations or comments on the submittal. When returned under this code the CONTRACTOR may release the equipment and/or material for manufacture.
 - 2. "APPROVED AS NOTED" is assigned when notations or comments have been made on the submittal pointing out minor discrepancies as compared with the Contract Documents. Re-submittal is not necessary prior to release for manufacturing.
 - 3. "REVISE & RESUBMIT." This combination of codes is assigned when the submittal is in noncompliance with the Contract Documents and must be corrected and the entire package resubmitted. This code generally means that the equipment or material cannot be released for manufacture unless the CONTRACTOR takes full responsibility for providing the submitted items in accordance with Contract Documents.
 - 4. "REJECTED" is assigned when the submittal does not meet the intent of the Contract Documents. The CONTRACTOR must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the Contract Documents.
 - 5. "SUBMIT SPECIFIC ITEM" is assigned when a specific item was left out. The CONTRACTOR must turn in a submittal on that item to bring the entire package into conformance. The entire package does not have to be resubmitted.

- E. Re-submittals will be handled in the same manner as first submittals. On resubmittals the CONTRACTOR shall direct specific attention, in writing on the letter of transmittal and on resubmitted shop drawings by use of revision triangles or other similar methods, to revisions other than the corrections requested by the ENGINEER on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the CONTRACTOR. The CONTRACTOR shall make corrections to any work done because of this type revision that is not in accordance to the Contract Documents as may be required by the ENGINEER.
- F. If the CONTRACTOR considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the CONTRACTOR shall give written notice thereof to the ENGINEER at least seven (7) working days prior to release for manufacture.
- G. The ENGINEER will review a submittal a maximum of two (2) times after which cost of review will be borne by the CONTRACTOR. The cost of engineering shall be equal to the ENGINEER's charges to the OWNER under the terms of the ENGINEER's agreement with the OWNER.
- H. When the shop drawings have been completed to the satisfaction of the ENGINEER, the CONTRACTOR shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the ENGINEER.
- I. Partial submittals may not be reviewed. The ENGINEER will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the CONTRACTOR, and will be considered "Rejected" until resubmitted. The ENGINEER may at his option provide a list or mark the submittal directing the CONTRACTOR to the areas that are incomplete.

1.9 PROFESSIONAL ENGINEER (P.E.) CERTIFICATION FORM

- A. If specifically required in other sections of these Specifications, the CONTRACTOR shall submit a P.E. Certification for each item required, in the form attached to this Section, completely filled in and stamped.

1.10 FINAL COMBINED SUBMITTAL OF DIGITAL VERSION OF SHOP DRAWING SUBMITTALS

- A. At the completion of the project, a digital version of all shop drawing submittals and review forms in pdf format shall be compiled and provided to the ENGINEER as an appendix to the Operation and Maintenance Manual. Should no component of the construction necessitate an Operation and Maintenance Manual, the compendium of submittals in digital form shall be submitted as a final shop drawing submittal for review by the ENGINEER.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01330

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SECTION 01380

PRECONSTRUCTION DOCUMENTATION

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

- A. The Contractor shall employ a competent photographer to take pre-construction record digital photographs and/or perform video recording, including providing all labor, materials, equipment and incidentals necessary to obtain photographs and/or video recordings of all areas in which Work is to be performed as specified in the Contract Documents.

1.2 QUALIFICATIONS

- A. All photography shall be done by a competent digital camera operator who is fully experienced and qualified with the specified equipment.
- B. For the video recording, the audio portion should be done by a person qualified and knowledgeable in the specifics of the Contract, who shall speak with clarity and diction so as to be easily understood.

1.3 VIDEO RECORDINGS

- A. Video recording shall be accomplished for all areas that are scheduled for construction. All video recording shall be in full color. Video recording shall include full recording of both sides of all streets on which construction is to be performed.
- B. When property is adjacent to a roadway, the recording shall, when viewed, show the image, 1/4 of the roadway fronting all property and 3/4 of the image shall be of the property. The recording shall be done so as to show the roadway and property in an oblique view (30 degrees).
- C. A complete view, in sufficient detail, of all existing facilities with audio description of the exact location shall be provided.
- D. The Engineering plans shall be used as a reference for stationing in the audio portion of the recording for easy location identifications. If applicable, house numbers shall be mentioned on the audio.

- E. Two complete sets of video recording on DVD shall be delivered to the Engineer for the permanent and exclusive use of the Engineer prior to the start of any construction on the project.
- F. All DVDs shall contain the name of the project, the date and time of the videotaping, the name and address of the photographer and any other identifying information required.

1.4 DIGITAL PROJECT PHOTOGRAPHS

- A. Digital cameras and photographs may be used in lieu of video recording described in Paragraph 1.3 above. Provide photographs of the entire work area prior to any construction for the purpose of recording conditions prior to construction. Photographs should be spaced at approximately 100 foot intervals along improved areas. Photographs taken along unimproved areas of the project shall be spaced at approximately 300 foot intervals. In addition, all special features shall be photographed prior to construction.
- B. The Contractor shall deliver hard copies of photographs and CD-ROM(s) or DVD(s) in conformance with the above requirements to the Engineer. No construction shall start until pre-construction photographs are completed and submitted to the Engineer.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01380

SECTION 01605

PRODUCTS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF REQUIREMENTS

- A. Definitions: "Products" is defined to include purchased items for incorporation into the work, regardless of whether specially purchased for project or taken from Contractor's stock of previously purchased products. "Materials", is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, installed or applied to form units of work. "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, etc.). Definitions in this paragraph are not intended to negate the meaning of other terms used in contract documents, including "specialties," "systems," "structure," finishes," "accessories," "furnishings," "special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.
- B. Substitutions: The requirements for substitutions do not apply to specified Contractor options on products and construction methods. Revisions to contract documents, where requested by Owner, or Engineer, are "changes" not "substitutions." Requested substitutions during bidding period, which have been accepted prior to Contract Date, are included in contract documents and are not subject to requirements for substitutions as specified herein. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute "substitutions" and do not constitute a basis for change orders, except as provided in contract documents are considered requests for "substitutions," and are subject to requirements hereof.

1.3 QUALITY ASSURANCE

- A. Source Limitations: To the greatest extent possible for each unit of work, provide products, materials or equipment of a singular generic kind and from a single source.
- B. Compatibility of Options: Where more than one choice is available as options for Contractor's selection of a product or material, select an option which is compatible with

other products and materials already selected (which may have been from among options for those other products and materials). Total compatibility among options is not assured by limitations within contract documents, but must be provided by Contractor. Compatibility is a basic general requirement of product/material sections.

1.4 PRODUCTS LISTED

- A. Within 30 days after award of Contract, submit to Engineer six (6) copies of complete list of major products which are proposed for installation.
- B. Tabulate products by specification section number and title.
- C. For products specified only by reference standards, list for each such product:
 - 1. Name and address of manufacturer.
 - 2. Trade name.
 - 3. Model or catalogue designation.
 - 4. Manufacturer's data:
 - a. Reference standards.
 - b. Performance test data.

1.5 CONTRACTOR'S OPTIONS

- A. For products specified only by reference standard, select product meeting that standard, by any manufacturer.
- B. For products specified by naming several products or manufacturers, select any one of those products and manufacturers named which complies with Specifications.
- C. For products specified by naming only one or more products or manufacturers and stating "or equal", select one of those named products or manufacturers. After award of the Contract, submit a request as for substitutions, for any product or manufacturer which is not specifically named.
- D. For products specified by naming only one product and manufacturer, there is no option and no substitution will be allowed.

1.6 SUBSTITUTION SUBMITTALS

- A. Requests for Substitutions: Submit three (3) copies, fully identified for product or method being replaced by substitutions, including related specification section and drawing number(s), and fully documented to show compliance with requirements for substitutions. Include product data/drawings, description of methods, samples where applicable, Contractor's detailed comparison of significant qualities between specified item and proposed substitutions, statement of effect on construction time and

coordination with other affected work, cost information or proposal, and Contractor's statement to the effect that proposed substitution will result in overall work equal-to-or better- than work originally indicated.

- B. Within a period of 30 days after award of Contract, Engineer will consider formal requests from the Contractor for substitution of products in place of those specified:
 - 1. After the end of that period, the request will be considered only in case of product unavailability or other conditions beyond the control of the Contract Documents.
- C. Submit a separate request for each substitution. Support each request with:
 - 1. Complete data substantiating compliance of the proposed substitution. Support each request with:
 - a. Product identification, including manufacturer's name and address.
 - b. Manufacturer's literature; identify:
 - 1) Product description.
 - 2) Reference standards.
 - 3) Performance and test data.
 - c. Samples, as applicable.
 - d. Name and address of similar projects on which product has been used, and the date of each installation.
 - 2. Itemized comparison of the proposed substitution with product specified; list significant variations.
 - 3. Data relating to changes in the construction schedule.
 - 4. Any effect of the substitution on separate contracts.
 - 5. List of changes required in other work or products.
 - 6. Accurate cost data comparing proposed substitution with product specified.
 - 7. Designation of required license fees or royalties.
 - 8. Designation of availability of maintenance services and sources of replacement materials.
- D. Substitutions will not be considered for acceptance when:
 - 1. They are indicated or implied on Shop Drawings or product data submittals without a formal request from Contractor.
 - 2. They are requested by anyone other than Contractor.
 - 3. Submitted without data relating to changes in construction schedule.
 - 4. Any effect of substitution on separate contracts is not included.
 - 5. A list of changes required in other work or products is not included.
 - 6. Accurate cost data comparing proposed substitution with product specified is not included.
 - 7. Designation of required license fees or royalties is not included.
 - 8. Designation of availability of maintenance services, sources of replacement materials is not included.
 - 9. Acceptance will require substantial revision of Contract Documents.
- E. Substitute products shall not be ordered or installed without written acceptance of Engineer.

- F. Engineer will determine the acceptability of proposed substitutions. Contractor shall pay all costs associated with Engineer's review.

1.7 CONTRACTOR'S REPRESENTATION

- A. In making formal request for substitution, the Contractor represents that:
 - 1. The proposed product has been investigated and determined that it is equal to or superior in all respects to that specified.
 - 2. The same warranties or bonds shall be provided for substitution as for product specified.
 - 3. The installation of accepted changes shall be incorporated as may be required for the Work to be complete in all respects.
 - 4. Any claims for additional costs caused by substitution are waived.
 - 5. All costs, resulting under separate contracts, which result from the substitution, are the responsibility of the Contractor.
 - 6. Any and all Engineering costs for redesign or revision of the Contract Documents shall be the responsibility of the Contractor.
 - 7. Cost data is complete and includes related costs under his contract, but not:
 - a. Costs under separate contracts.
 - b. Engineer's costs of redesign or revision of Contract Documents.

1.8 ENGINEER DUTIES

- A. Review Contractor's requests for substitutions with reasonable promptness.
- B. Notify Contractor in writing of decision to accept or reject requested substitution.

1.9 PRODUCT DELIVERY-STORAGE-HANDLING

- A. General: Deliver, handle and store products in accordance with manufacturer's recommendations and by methods and means which will prevent damage, deterioration, and loss including theft. Control delivery schedules to minimize long-term storage of products at site and overcrowding of construction spaces. In particular, provide delivery/installation coordination to ensure minimum holding or storage times for products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.

1.10 WARRANTIES (GUARANTEES)

- A. Coincidental Product Warranty: A warranty which is not specifically required by contract documents (other than as specified in this section) but which is available on a product incorporated into the work, by virtue of the fact that manufacturer of product has

published warranty in connection with purchases and uses of product without regard for specific applications except as otherwise limited by terms of warranty.

- B. Refer to individual sections of Division 2 through 16 for the determination of units of work which are required to be specifically or individually warranted, and for the specific requirements and terms of those warranties (or guarantees).
- C. General Limitations: It is recognized that specific warranties are intended primarily to protect Owner against failure of the work to perform as required, and against deficient, defective and faulty materials and workmanship, regardless of sources. Except as otherwise indicated, specific warranties do not cover failures in the work which results from:
 - 1. Unusual and abnormal phenomena of the elements.
 - 2. The Owner's misuse, maltreatment or improper maintenance of the work.
 - 3. Vandalism after time of substantial completion.
 - 4. Insurrection of acts of aggression including war.
- D. Related Damages and Losses: In connection with Contractor's correction of warranted work which has failed, remove and replace other work of project which has been damaged as a result of such failure, or must be removed and replaced to provide access for correction of warranted work.
- E. Reinstatement of Warranty Period: Except as otherwise indicated, when product warranty has failed and has been corrected by replacement or restoration, reinstate warranty by written endorsement for the following time period, starting on date of acceptance of replaced or restored work.
- F. A period of time equal to original warranty period of time.
- G. Replacement Cost, Obligations: Except as otherwise indicated, costs of replacing or restoring failing warranted units or products is Contractor's obligation, without regard for whether Owner has already benefited from use through a portion of anticipated useful service lives.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT COMPLIANCES

- A. General: The compliance requirements, for individual products as indicated in contract documents, are multiple in nature and may include generic, descriptive, proprietary, performance, prescriptive, compliance with standards, compliances with codes, conformance with graphic details and other similar forms and methods of indicating requirements, all of which must be complied with. Also "allowances" and similar provisions of contract documents will have a bearing on selection process.

- B. Procedures for Selecting Products: Contractor's options for selecting products are limited by contract document requirements, and governing regulations, and are not controlled by industry traditions or procedures experienced by Contractor on previous construction project. Required procedures include, but are not necessarily limited to, the following for various indicated methods of specifying:
1. Single Product/Manufacturer Name: Provide product indicated, except advise Engineer before proceeding, where known that named product is not a feasible or acceptable selection.
 2. Two or More Product/Manufacturer Names: Provide one of the named products, at Contractor's option, but excluding products which do not comply with requirements. Do not provide or offer to provide an unnamed product, except where none of named products comply with requirements or are a feasible selection; advise Engineer before proceeding.
 3. "Or Equal": Where named products in specifications text are accompanied by the term "or equal," or other language of similar effect, comply with those contract document provisions concerning "substitutions" for obtaining Engineer's approval (by change order) to provide an unnamed product.
 4. "Approved Equal": The use of this phrase shall mean that in lieu of the product called for in the Specifications, the Contractor may submit to the Engineer another product for consideration. The Engineer must receive a package that details the product for consideration at least two (2) weeks (14 days) prior to the receipt of Bids. Only the Contractor wishing to use another product may submit that product for review. If approval is given, the Engineer will notify the Contractor in writing. Any modifications necessary, including piping, electrical, structural, etc. that may be required, will be the responsibility of the Contractor.
 5. "Named," except as otherwise indicated, is defined to mean manufacturer's name for product, as recorded in published product literature, of latest issue as of date of contract documents. Refer to requests to use products of a later (or earlier) model to Engineer for acceptance before proceeding.
 6. Standards, Codes and Regulations: Where only compliance with an imposed standard, code or regulation is required, selection from among products which comply with requirements including those standards, codes and regulations, is Contractor's option.
 7. Performance Requirements: Provide products which comply with specific performances indicated, and which are recommended by manufacturer (in published product literature or by individual certification) for application indicated. Overall performance of a product is implied where product is specified with only certain specific performance requirements.
 8. Prescriptive Requirements: Provide products which have been produced in accordance with prescriptive requirements, using specified ingredients and components, and complying with specified requirements for mixing, fabricating, curing, finishing, testing and similar operations in manufacturing process.

2.2 SUBSTITUTIONS

- A. Conditions: Contractor's request for substitution will be received and considered when extensive revisions to contract documents are not required and changes are in keeping with general intent of contract documents; when timely, fully documented and properly submitted; and when one or more of the following conditions is satisfied, all as judged by Engineer. Otherwise, request will be returned without action except to record noncompliance with these requirements:
1. Where request is directly related to an "or equal" clause or other language of same effect in contract documents. Where "or approved equal" is not specified, no other material or article may be substituted.
 2. Where required product, material or method cannot be provided within Contract Time, but not as a result of Contractor's failure to pursue the work promptly to coordinate various activities properly.
 3. Where required product, material or method cannot be provided in a manner which is compatible with other materials of the work, or cannot be properly coordinated, therewith, or cannot be warranted as required, or cannot be used without adversely affecting Owner's insurance coverage on completed work, or will encounter other substantial non-compliances which are not possible to otherwise overcome except by making requested substitution, which Contractor thereby certifies to overcome such non-compatibility, non-coordination, nonwarranty, non-insurability or other non-compliance as claimed.
 4. Where required product, material or method cannot receive required approval by a governing authority, and requested substitution can be so approved.
 5. Where substantial advantage is offered Owner, in terms of cost, time, energy conservation or other valuable considerations, after deducting offsetting responsibilities, Owner may be required to bear, including additional compensation to Engineer for redesign and evaluation services, increased cost of other work by Owner or separate contractors, and similar considerations.
- B. Work-Related Submittals: Contractor's submittal of, and Engineer's acceptance of shop drawings, product data or samples which indicated work not complying with requirements of contract documents, does not constitute an acceptable and valid request for, nor approval of, a substitution.

2.3 GENERAL PRODUCT REQUIREMENTS

- A. General: Provide products which comply with requirements, and which are undamaged and unused at time of installation, and which are complete with accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for intended use and effect.
- B. Standard Products: Where available, provide standard products of types which have been produced and used previously and successfully on other projects and in similar applications.

- C. Continued Availability: Where additional amounts of a product, by nature of its application, are likely to be needed by Owner at a later date for maintenance and repair or replacement work, provide a standard, domestically produced product which is likely to be available to Owner at such later date.
- D. Equipment Nameplates: Provide permanent nameplate on each item of service connected or power operated equipment. Indicate manufacturer, product name, model number, serial number, capacity, speed, ratings and similar essential operating data.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01605

SECTION 01770
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Final cleaning.
- B. Related Sections include the following:
 - 1. Division 1 Section "Measurement and Payment" for requirements for Applications for Payment for Substantial and Final Completion.
 - 2. Division 1 Section "Pre-Construction Documentation" for submitting Final Completion construction photographs and negatives.
 - 3. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 4. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 3. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 4. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

5. Complete startup testing of systems.
 6. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 7. Complete final cleaning requirements, including touchup painting.
 8. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 1 Section "Measurement and Payment."
 2. Submit copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three (3) copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing

correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Engineer.
 - d. Name of Contractor.
 - e. Page number.

1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

- c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - f. Remove labels that are not permanent.
 - g. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - h. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - i. Replace parts subject to unusual operating conditions.
 - j. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770

SECTION 01781

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Product Data.
- B. Related Sections include the following:
 - 1. Division 1 Section "Closeout Procedures" for general closeout procedures.
 - 2. Divisions 2 through 16 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit two (2) set(s) of marked-up Record Prints. Engineer will review and provide comments.
 - 2) Submit two (2) sets of surveyor's as-built survey of the improvements
 - 3) Submit one (1) copy of the Record Prints in AutoCAD format.
 - b. Final Submittal:
 - 1) Submit five (5) set(s) of marked-up Record Prints.
 - 2) Submit five (5) copies of the signed & sealed surveyor's asbuilt survey of the improvements.
 - 3) Submit one (1) copy of the Record Prints in AutoCAD format.
- B. Record Product Data: Submit one (1) copy of each Product Data submittal.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints shall be prepared using the construction plans marked “Released for Construction.” The Record Prints shall be submitted electronically in AutoCAD (latest release) format. A copy of the “Released for Construction” plans shall be provided by the engineer in AutoCAD format for the contractor’s use in preparing Record Prints.
- B. Record Drawings shall conform to the requirements of this specification and all requirements of the City of Cocoa Standards.
- C. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Locations and depths of underground utilities.
 - d. Revisions to routing of piping and conduits.
 - e. Revisions to electrical circuitry.
 - f. Actual equipment locations.
 - g. Locations of concealed internal utilities.
 - h. Changes made by Change Order or Construction Change Directive.
 - i. Changes made following Engineer's written orders.
 - j. Details not on the original Contract Drawings.
 - k. Field records for variable and concealed conditions.
 - l. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- D. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Engineer.
 - e. Name of Contractor.

2.2 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders and Record Drawings where applicable.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours.

END OF SECTION 01781

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SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Demolition includes the complete wrecking of structures and the removal and disposal of piping, valves, fittings, mechanical and electrical equipment and appurtenances, concrete, steel, and all other miscellaneous debris and demolished materials, as shown on the drawings, specified herein, and required for a complete project.

1.2 JOB CONDITIONS

- A. Condition of Structures:

- 1. The OWNER assumes no responsibility for the actual condition of structures and items to be demolished. The CONTRACTOR shall field verify the conditions to be encountered in the work to be performed.

- B. Salvage:

- 1. OWNER has first right of refusal for all items of salvageable value. Items to be salvaged by the OWNER may include, but are not limited to, piping, valves, fittings, flow meter, and electrical components. The OWNER will identify items to be salvaged before the CONTRACTOR begins demolition. The CONTRACTOR shall coordinate with the OWNER and remove items, which are identified by the OWNER to be salvaged, as the work progresses. Salvaged items shall be transported to a location on site as directed by the ENGINEER. All items not salvaged and delivered to OWNER shall be removed off site as specified hereinafter.

- C. Explosives:

- 1. The use of explosives will not be permitted.

- D. Traffic:

- 1. Conduct demolition operations and the removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
 - 2. Construct any temporary facilities necessary to maintain vehicular and pedestrian traffic at all times.

E. Protections:

1. Ensure the safe passage of persons around the area of demolition. Conduct operations to prevent injury or damage to adjacent buildings, structures, utilities, other facilities, and persons.

F. Damages:

1. Promptly repair damage to all structures, facilities, equipment, piping, and miscellaneous items, which is due to demolition operations, at no cost to the OWNER.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The CONTRACTOR shall provide all materials and equipment in suitable and adequate quantity as required to accomplish the work shown, as specified, and as required to complete the project.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Requirement to Locate Underground Structures and Utilities:

In addition to contacting Sunshine811 and other legal responsibility for locating utilities as part of the work, the Contractor shall perform a Quality A Subsurface Utility Engineering Investigation as defined by FDOT. As part of this work, the Contractor shall identify and locate subsurface tie-backs from the existing sea wall to an elevation of 1.0 (NAVD88). The results of this work shall be submitted to the Engineer and City for record purposes prior to beginning any construction or demolition.

B. Pollution Controls:

1. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level.
2. Comply with governing regulations pertaining to environmental protection.
3. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations, as directed by the Engineer. Return adjacent areas to condition existing prior to the start of the work.

4. Coordinate demolition work with OWNER so that existing plant operations are not impacted.

3.2 UTILITIES

- A. The CONTRACTOR shall be responsible for rerouting, unhooking, capping or bulkheading, and removing and abandoning all utilities as shown on the Drawings, specified herein or as necessary to complete the work. Coordinate the disconnection of electrical service with the proper authorities. Maintain in service and protect from damage all existing utilities to remain. All piping to be abandoned in-place shall be removed to a minimum dimension of two feet below the existing ground surface. Abandoned piping shall have a mechanical plug or cap permanently installed and encased with 6 inches of concrete all around the pipe and for distance of 12 inches back from the plug or cap. Water and gas lines shall be permanently capped as approved by the OWNER or appropriate utility.

3.3 DISPOSAL OF DEMOLISHED MATERIALS

A. General:

1. Remove from the site and properly dispose of all debris, rubbish, and other materials resulting from demolition operations in accordance with all applicable federal, state, and local laws, codes, and ordinances.
2. Burning of materials removed from demolished structures will not be permitted on the site.

B. Removal:

1. Transport materials removed from demolished structures and dispose of off the site.

END OF SECTION 02050

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SECTION 02100
SITE PREPARATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This Section covers clearing, grubbing and stripping along the construction sites, complete as specified herein.
- B. The CONTRACTOR shall clear and grub all of the area within the limits of construction or as required. The area to be cleared shall be reviewed by the ENGINEER prior to the beginning of any clearing.
- C. All trees noted to be retained shall be protected from damage during construction.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Division 02 Section "Earthwork" for excavation, backfilling, filling, compaction and structure and road base preparation.
- C. Division 02 Section "Sedimentation and Erosion Control" for temporary erosion and sedimentation control measures.
- D. Division 02 Section "Trench Excavation, Backfill, and Compaction" for excavating and backfilling buried mechanical utilities and buried utility structures.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLEARING

- A. The surface of the ground, for the area to be cleared and grubbed, shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on, or protruding through, the surface of the ground. However, those trees which are designated by the ENGINEER shall be preserved as

hereinafter specified. Clearing operations shall be conducted so as to prevent damage to existing structures and installations, and to those under construction, and so as to provide for the safety of employees and others. Clearing for structures shall consist of topsoil and vegetation removal.

3.2 GRUBBING

- A. Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade. All depressions excavated below the original ground surface for, or by the removal of, such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

3.3 STRIPPING

- A. In areas so designated, topsoil shall be stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. Any topsoil remaining after all work is in place shall be disposed of by the CONTRACTOR.

3.4 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

- A. Dispose of all material and debris from the clearing, grubbing, and stripping operation off site in accordance with all federal, state, county, and city laws, codes and ordinances. Burying of debris on site will not be allowed. The cost of disposal (including hauling) of the cleared, grubbed, and stripped material and debris shall be considered a subsidiary obligation of the CONTRACTOR, the cost of which shall be included in the Contract prices.

3.5 PRESERVATION OF TREES

- A. Those trees which are designated by the ENGINEER for preservation shall be carefully protected from damage. Erect such barricades, guards, and enclosures as may be considered necessary by him for the protection of the trees during all construction operations.

3.6 EXCAVATED MATERIALS UNSUITABLE FOR CONVENTIONAL DISPOSAL

- A. It will be the CONTRACTOR'S responsibility to properly dispose of materials unsuitable for conventional disposal.

END OF SECTION 02100

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SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
 - 2. Subbase course for concrete pavements.
 - 3. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Division 02 Section "Site Preparation" for site clearing, grubbing, stripping and stockpiling topsoil, protecting trees to remain, and removal of above- and below-grade improvements and utilities.
- C. Division 02 Section "Sedimentation and Erosion Control" for temporary erosion and sedimentation control measures.
- D. Division 02 Section "Trench Excavation, Backfill, and Compaction" for excavating and backfilling buried mechanical utilities and buried utility structures.

1.3 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
 - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Layer placed between the subbase course and asphalt paving.
- C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

- E. Ditch/Swale Grading: Consists of the excavation and satisfactory disposal of all materials from the limits of ditch/swale as shown on the plans.
- F. Excavation: Removal of material encountered above subgrade elevations of all types of materials encountered in areas as designated on the construction plans or specified in the technical specifications; and the placement of the excavation material, wherever practicable, in embankments.
 - 1. Additional Excavation: Excavation below subgrade elevations as directed by ENGINEER. Except in areas identified in the drawings for over excavation or in areas required for subgrade compaction by other sections of the specifications, additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Bulk Excavation: Excavations more than 10 feet in width and pits more than 30 feet in either length or width.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by ENGINEER. Unauthorized excavation, as well as remedial work directed by ENGINEER, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- J. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

- A. Test Reports: In addition to test reports required under field quality control, submit the following:
 - 1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources.
 - 2. One optimum moisture-maximum Modified Proctor Density Curve for each soil material.
 - 3. Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

1.5 QUALITY ASSURANCE

- A. Testing and Inspection Service: City shall employ at its expense, and coordinated by the Contractor, a qualified independent geotechnical engineering testing agency, under the direction of a Professional Engineer, licensed in the State of Florida, to classify, perform soil tests, and provide inspection services for quality control during earthwork operations. All proposed fill soils will require the testing agency to verify that soils comply with specified requirements and to perform required field and laboratory testing. Contractor shall replace materials removed for testing purposes. Should any work or materials fail to meet the requirements set forth in the plans and specifications, Contractor shall pay for re-testing of same.
- B. Testing Laboratory Qualifications: To qualify for acceptance, the geotechnical testing laboratory must demonstrate to the Engineers' satisfaction, based on evaluation of laboratory-submitted criteria, 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. Existing Utilities: Do not interrupt existing utilities unless permitted in writing by ENGINEER and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner or Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's and Engineer's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- C. 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. Contractor shall bear all costs of repairing damaged utilities to the satisfaction of utility owner.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

- B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 1.5 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Backfill and Fill: Satisfactory soil materials.
- E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- F. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- G. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 02 Section "Site Preparation."
- C. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- D. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- E. Tree Protection is specified in the Division 02 Section "Site Preparation".

3.2 EXPLOSIVES

- A. Explosives: The use of explosives is not permitted.

3.3 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
- C. The Contractor shall prevent the accumulation of water in excavated areas, and shall remove by pumping or other means any water which accumulates in the excavation. The Contractor shall prevent the accumulation of water in both structural and trench excavations and shall remove by well point system or by other means water which accumulates. The Contractor shall provide, install and operate a suitable and satisfactory dewatering system. The Contractor shall include the cost of this pumping equipment and work in the lump sum price bid for the work.
- D. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collection or runoff areas. Do not use trench excavations as temporary drainage ditches.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials. Waste unsatisfactory material as specified.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs on grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
- B. Cut: Where required, the site shall be excavated to the grades shown. Excavated material that is suitable shall be used in the fill sections of the site.
- C. Fill: In order to ensure proper bond and prevent slipping between the original ground and fill, the surface of the original ground shall be scarified to a depth of at least three

inches. Each layer of fill material shall be compacted until the required density is achieved.

3.5 STABILITY OF EXCAVATIONS

- A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.
- B. All excavation work shall conform to OSHA Publication "Excavations 2226," 1990 revision, and OSHA Excavation; Final Rule 29, CFR, Part 1926, October 31, 1989, or other applicable excavation safety standards. The Contractor will provide written assurance of compliance with the law and with the laws of Florida Chapter 90-96. The Contractor's method of providing protective support to prevent cave-ins shall be submitted with the bid and conform to OSHA requirements. Slope excavations, shoring, and trench box usage in the field must be based on tabulated data and designed by the Contractor.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Refer to Section 02221.

3.8 APPROVAL OF SUBGRADE

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer.

3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation by placing compacted backfill of satisfactory material as indicated for fill material placement in the location of excavation.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials to be used as fill. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover short-term storage piles to prevent windblown dust. For stockpiles with portions to remain longer than four weeks, provide a temporary vegetative cover by hydroseeding within two weeks of final soil placement of any areas remaining static. Cover remaining areas.
- B. Stockpile soil materials away from edge of excavations.
- C. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for record documents.
 - 3. Removing concrete formwork.
 - 4. Removing trash and debris.
 - 5. Removing temporary shoring and bracing, and sheeting.
 - 6. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice. No backfill material shall be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, backfill operations shall not be resumed until the moisture content and density of the fill are as previously specified.

3.12 UTILITY TRENCH BACKFILL

- A. Backfill trenches to indicated grades, and elevations. Refer to Section 02221.

3.13 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.

3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF BACKFILLS AND FILLS

- A. Structure footprints including all building pads, tankage, parking areas and roadway areas are to be proof rolled and compacted with traffic sized non-vibratory equipment.
- B. Water should be added at the start of compaction efforts if the soils are dry, and excess water should be allowed time to percolate through existing soils.
- C. Compaction shall include a minimum of 8 passes in structure areas with each pass overlapping the previous pass by a minimum of 2' with the rolling extended to the greater of 10' beyond the structure area or the remaining fill height to subgrade.
- D. Place backfill and fill materials in layers not more than 12 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.
- E. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- F. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D1557:
 - 1. Under structures, building slabs, roadways, and 6" thick walkways, scarify and recompact top 24 inches of existing subgrade and each layer of backfill or fill material at 95 percent.

2. Under tankage, scarify and recompact top 36 inches of existing subgrade and each layer of backfill or fill material at 98 percent.
3. Under 4" thick walkways, scarify and recompact top 12 inches below subgrade and compact each layer of backfill or fill material at 95 percent.
4. Under lawn areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.
5. The top 12 inches of soil beneath structural slabs-on-grade and beneath footings should be compacted to a minimum of 98 percent Modified Proctor Density.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 2. Walks: Plus or minus 1 inch.
 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building/Tankage Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 FIELD QUALITY CONTROL

- A. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- B. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by ENGINEER.
- C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 1. Tankage and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one (1) test for every 2000 sq. ft. or less of building slab, but in no case fewer than three tests.

2. Foundation Wall Backfill: At each compacted backfill layer, at least one (1) test for each 100 feet or less of wall length, but no fewer than two (2) tests.
 3. Trench Backfill: For each 150 feet or less of trench length, but no fewer than two tests per length. A field density test shall be performed at the following locations in the trench backfill:
 - a. Bottom lift
 - b. Center of pipe
 - c. 12" over pipe
 - d. Every second (12") lift to subgrade elevation.
- D. When field in-place density 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.
- E. If, in the opinion of the Engineer, based on testing service reports and inspection, when subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.
- F. Perform additional spot testing as directed by the ENGINEER as incidental to the required testing. Spot testing shall not exceed in number ten percent of the otherwise required testing except that spot test which fail the specification shall not count towards this limit.

3.18 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 1. Scarify or remove and replace soil material to depth as directed by ENGINEER; reshape and recompact at optimum moisture content to the required density.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.
- D. Perform excavation within drip-line of large trees to remain by hand, and protect the root system from damage or dryout in the manner prescribed in Division 02 specification sections.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Legally dispose of surplus soils and rock off of Owner's property.
- B. Remove waste material, including trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 02200

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SECTION 02221

TRENCH EXCAVATION, BACKFILL, AND COMPACTION

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION OF WORK

- A. Excavation, shoring, dewatering, pipe bedding, trench backfill, compaction, grading and cleanup of all pipeline trenching for the project.
- B. All work must be done in accordance with these specifications and the safety requirements of the State and OSHA standards.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Division 02 Section "Earthwork" for excavation, backfilling, filling, compaction and structure and road base preparation.
- C. Division 02 Section "Site Preparation" for site stripping, grubbing, stripping and stockpiling topsoil, protecting trees to remain, and removal of above- and below-grade improvements and utilities.
- D. Division 02 Section "Sedimentation and Erosion Control" for temporary erosion and sedimentation control measures.

1.3 JOB CONDITIONS

- A. Accept site in condition existing during Contract time frame.
- B. Groundwater/surface water found during construction are conditions of the Contract and responsibility of CONTRACTOR.

PART 2 - PRODUCTS

2.1 PIPE BEDDING AND BACKFILL

- A. Determination of source of materials for bedding and backfill shall be responsibility of CONTRACTOR, but use of such materials shall be subject to approval of ENGINEER.
- B. Pipe bedding shall be angular material.

2.2 SAND BACKFILL

- A. Where specified on plans, use sand or fine aggregate with source of material subject to approval of the ENGINEER.

2.3 CRADLING ROCK

- A. Use crushed rock or stone with 70-100% passing 1" sieve and no more than 50% passing 3/4" sieve. Crushed oyster shells are acceptable.

2.4 CONTROLLED DENSITY FILL

- A. Use high slump mixture of Portland cement, fly ash and fine aggregate in accordance with Section 121 of the latest edition of the FDOT Standard Specifications for Road and Bridge Construction for excavatable or non-excavatable fill, as required.
- B. Provide mixture with minimum 28-day compressive strength of 70 psi (excavatable) or 125 psi (non-excavatable) with no measurable shrinkage or surface settlement.

2.5 SHEETING, SHORING AND BRACING

- A. Use sound timber or structural steel.
- B. Use shapes and sizes as required.
- C. Designed by a licensed Professional Engineer for the project area for live and dead loads and groundwater conditions

PART 3 - EXECUTION

3.1 GENERAL

- A. Dewatering

1. Prevent surface water from flowing into excavation.
2. Provide equipment for handling water encountered as required. Obtain approval of proposed method of dewatering.
3. No sanitary sewer shall be used for disposal of trench water.
4. Soil erosion and sediment control and stormwater pollution prevention plan devices shall be installed and maintained throughout dewatering operation.

B. Protection of Existing Utilities

1. Notify all utilities of location and schedule of work.
2. Locations and elevations of utilities shown on plans are to be considered approximate only. Notify utility and ENGINEER of conflicts between existing and proposed facilities.
3. Repair, relay or replace existing utilities damaged, destroyed or disrupted during work. Unless specified otherwise, replacement will be at the CONTRACTOR's expense.

C. Sheet piling, Shoring and Bracing

1. Provide as necessary, to hold walls of excavation, prevent damage to adjacent structures, and to protect workmen and property.
2. Leave sheet piling and shoring in place where removal might cause damage to work or as otherwise indicated on drawings.
3. When moveable trench shield is used below spring line of pipe, it shall be lifted prior to any forward movement to avoid pipe displacement.

D. Changes in Grade

1. Minor adjustments to grades may be made from plan grades to suit unforeseen construction conflicts or conditions with approval from ENGINEER.
2. No additional compensation will be made for such minor changes.

3.2 EXCAVATION AND TRENCHING

A. General

1. Method of excavation at CONTRACTOR's option.
2. The CONTRACTOR will use caution when excavating under tree roots and under and around structures and utilities. Excavate by hand when necessary.
3. Stockpile and replace topsoil equal to pre-existing depth for surface restoration in grassed or agricultural areas where specified or shown on plans.

B. Trench Characteristics

1. Depth: As indicated for pipe installation to lines and grades required with proper allowance for thickness of pipe and type of bedding specified or indicated. Where depth is not indicated, place pipe at such depth to provided required minimum cover and slope from connection points and provide minimum clearances at all utility crossings.
2. Width

- a. Keep width of trench as narrow as possible and yet provide adequate room for backfilling and jointing.
 - b. Maximum trench width of 30-inch or pipe O.D. plus 18 inches where soil conditions permit.
3. Provide bell holes for each pipe joint where pipe bears on undisturbed earth.
4. Trench bottom shall be free of large stones and other foreign material.

3.3 ORGANIC OR UNSTABLE MATERIALS

- A. Stop work and notify ENGINEER.
- B. Perform remedial work as directed.
- C. If material is judged unsuitable and removal is authorized, remove and replace with trench stabilizing material as directed by the ENGINEER.

3.4 ROCK EXCAVATION

- A. Excavate any rock to maintain minimum 6-inch clearance around pipe.
- B. Dispose of rock material not suitable for backfill as directed by the ENGINEER.
- C. Use of explosives not permitted without prior written authorization from the OWNER and ENGINEER.
- D. Provide Special Hazard Insurance covering liability for blasting operations.

3.5 BEDDING

- A. Place after bottom of trench has been excavated to proper depth and grade.
- B. Place, compact and shape bedding material to conform to barrel of pipe to ensure continuous firm bedding for full length of pipe. Bedding soils should be compacted to a minimum soil density of 95% of the Modified Proctor test (ASTM D1557).
- C. Provide bedding, as described below, unless indicated otherwise on Plans or in Special Conditions.
 1. Ductile Iron Pipe: ANSI/AWWA C600 Type 2 and above according to bury depth as noted in the Ductile Iron Pipe Design Manual 2.04 or latest revision.
 2. Flexible Pipe Soil Class III Uni-bell "Handbook of PVC Pipe" Tables 10.9 and 10.10
 3. See standard plan details.

3.6 TRENCH BACKFILL

- A. Use excavated material backfill unless otherwise specified or directed.
- B. Use suitable backfill for all trenches within 5 feet of buildings and beneath walks, parking areas, paved streets or existing exposed utilities.
- C. Initial Backfill
 1. Place after pipe has been bedded and checked for alignment, grade and internal obstructions.
 2. Carry out in an orderly fashion after authorization to cover pipe has been given.
 3. Allow no more than 300 feet of trench to be open at one time.
 4. Do not backfill until concrete or mortar has sufficiently cured.
 5. Record location of connections and appurtenances before backfilling.
 6. Place by hand and hand tamp under, around and over pipe joints and fittings, to not less than 12 inches above top of pipe, in approximately 4-inch layers.
 7. Backfill simultaneously on both sides of pipe to prevent displacement.
 8. Place cushion of 4 feet above pipe envelope before using heavy compacting equipment.
- D. Subsequent Backfill
 1. Place backfill into trench at an angle so that impact on installed pipe is minimized.
 2. Compaction of all backfill material shall be performed in a manner that shall not crack, crush, and/or cause the installed pipe to be moved from the established grade and/or alignment.
 3. Area under pavement and walks or within buildings shall be mechanically compacted to the top of the subgrade in 6-inch lifts to a minimum of 95 percent Modified Proctor Density.
 4. Area under tankage shall be mechanically compacted to the top of the subgrade in 6-inch lifts to a minimum of 98 percent Modified Proctor Density
 5. Areas not subject to vehicular traffic shall be backfilled and compacted in layers not more than 12 inches in depth to a minimum soil density of 92% of the Modified Proctor test (ASTM D1557).
 6. Compaction method at discretion of the CONTRACTOR with the following exceptions:
 - a. If in the ENGINEER's opinion compaction method presents potential damage to pipe, it will not be allowed.
 - b. Compaction of any backfill material by flooding or jetting will require prior written authorization of the ENGINEER.
 7. Mound excavated materials no greater than 6 inches in open areas only.
 8. Fill upper portion of trench with topsoil as specified hereinbefore.
 9. No trench shall be open overnight.
- E. Controlled Density Fill
 1. Use where shown on plans.
 2. Provide suitable forms to limit volume of controlled density fill material.

3. Protect exposed utility lines during placement.
4. Place material in accordance with suppliers' written recommendations unless directed otherwise by the ENGINEER.

3.7 FORCE MAIN, RECLAIMED WATER FORCE MAIN, POTABLE WATER MAIN, AND GRAVITY SEWER MARKING TAPE

- A. All polyvinyl chloride (PVC) and ductile iron (DI) pipelines 4-inches and greater shall have identification marking tape.
- B. A polyethylene double-safe detectable marking tape shall be installed continuously in the backfill along the entire length of all gravity sewer, sewage force mains, potable water, reclaimed water or any other yard piping for identification and detection purposes.
- C. All ductile iron pipelines marking tape shall be non-detectable type, but shall have all of the design features as specified herein. As directed by the OWNER, buried ductile iron pipe for unforeseen conflicts shall be encased in a colored tubular polywrap conforming to 100% polyethylene material in accordance with ASTM D1248-84 Type 1, Class C, grade E-1, tensile strength 1200 psi, elongation 300%.
- D. The tape shall be as manufactured by Thor Enterprises or equal. The polyethylene tape shall meet the requirements of ASTM D 1248, Type I Class A, Grade E-1 for polyethylene plastics molding and extrusion materials. The tape shall have a minimum tensile strength of 1750 psi, a minimum elongation of 250 percent, not less than 50 gauge solid aluminum core and a nominal thickness of 5 mils. The tape shall be composed of 2 mil clear film reverse - printed laminated to aluminum, foil-laminated to 2 mil clear film and reverse-printed. Minimum total thickness 4 mils.
- E. The tape for sewage force mains and gravity sewer pipes shall have a fade-resistant green color throughout conforming to the American Public Works Association and Utility Location Coordination Council Color coding. The continuous warning message shall be repeated every 16 to 36 inches in lettering no less than 2 inches high.
- F. Marking Tape Message:
 1. The message for PVC or DI sewage force mains shall be printed on one side in black letters (typical for all lettering) and shall read "CAUTION: BURIED SEWER FORCE MAIN BELOW".
 2. The message for PVC or DI gravity sanitary sewer pipe including service connections installed in areas of earthen cover only, shall be fade-resistant green color and shall read "CAUTION: BURIED GRAVITY SANITARY SEWER LINE BELOW".
 3. The message for PVC or DI potable water pipe including service connections shall be fade-resistant blue color and shall read "CAUTION: BURIED POTABLE WATER LINE BELOW".

- G. Minimum marking tape widths shall be as follows:

Pipe Inside Diameter, Inches	Minimum Tape Width, Inches	No. of Tape strips
4 through 12	4	1
14-20	4	2

- H. The CONTRACTOR shall submit typical samples of the printed marking tape to the ENGINEER for approval prior to installation (minimum length to show repeat of message).
- I. The marking tape shall be placed in the trench backfill directly above and centered over the pipeline. The marking tape shall be installed between 12 and 18 inches above the top of the pipe. The CONTRACTOR shall exercise care to prevent damage to the polyethylene tape when placing the remaining backfill.
- J. Where the pipeline passes through in a manhole, vault or other underground structure, the polyethylene marking tape shall be placed on top of that portion of the pipeline, located inside the structure and shall be secured to the pipeline with adhesive tape.
- K. Openings for air valves and similar appurtenances shall be provided by making an X-shaped cut in the polyethylene and temporarily folding back the film. After the polyethylene is installed over the appurtenance, the slack shall be taped securely to appurtenance and the cut in the polyethylene shall be repaired with adhesive tape.

3.8 EXCESS MATERIAL

- A. Dispose of waste excess excavated material as directed by the ENGINEER.

3.9 TESTING

- A. Payment of failed tests will be the responsibility of the CONTRACTOR.
- B. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
1. Trench Backfill: For each 150 feet or less of trench length, but no fewer than two tests per length. A field density test shall be performed at the following locations in the trench backfill:
 - a. Bottom lift
 - b. Center of pipe
 - c. 12" over pipe

- d. Every second (12") lift to subgrade elevation.
- C. When field in-place density 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.
- D. If, in the opinion of the Engineer, based on testing service reports and inspection, when subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.
- E. Perform additional spot testing as directed by the ENGINEER as incidental to the required testing. Spot testing shall not exceed in number ten percent of the otherwise required testing except that spot test which fail the specification shall not count towards this limit.

END OF SECTION 02221

SECTION 02241 – DEWATERING – ALTERNATE COFFERDAM

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. Related Requirements:
 - 1. Section 01322 "Photographic Documentation" for recording preexisting conditions and dewatering system progress.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review condition of site to be dewatered including coordination with temporary erosion-control measures and temporary controls and protections.
 - 3. Review geotechnical report.
 - 4. Review proposed site clearing and excavations.
 - 5. Review existing utilities and subsurface conditions.
 - 6. Review observation and monitoring of dewatering system.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional engineer.
 - 1. Include plans, elevations, sections, and details.
 - 2. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
 - 3. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
 - 4. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, land surveyor and professional engineer.
- B. Field quality-control reports.
- C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.
- D. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

1.7 FIELD CONDITIONS

- A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.
 - 2. The geotechnical report is included elsewhere in Project Manual.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 - 1. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.
 - 2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
 - 3. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 5. Remove dewatering system when no longer required for construction.

- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 - 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 01500 "Temporary Facilities and Controls," and Section 02230 "Site Clearing," during dewatering operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Space well points or wells at intervals required to provide sufficient dewatering.
 - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Place dewatering system into operation to lower water to specified levels before excavating below surface-water level.
- C. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- D. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

- A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- B. Operate system to lower and control surface and ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
 - 2. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
- C. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. MEET ALL REGULATORY PERMITTING CONDIITONS OVER OR ADJACENT TO OPEN WATER BODIES.
- D. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

- A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.
 - 1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
 - 2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
 - 3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.
- B. Survey-Work Benchmarks: Resurvey benchmarks regularly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.
- C. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.
- D. Prepare reports of observations.

3.5 PROTECTION

- A. Protect and maintain dewatering system during dewatering operations.
- B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 02241

SECTION 02261 - EXCAVATION SUPPORT AND PROTECTION – ALTERNATE COFFERDAM

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 temporary excavation support and protection systems for an ALTERNATE COFFERDAM utilized over open waters as part of Precast Concrete Construction.
- B. Related Requirements:
 - 1. Section 01322 "Photographic Documentation" for recording preexisting conditions and excavation support and protection system progress.
 - 2. Section 02241 "Dewatering – Alternate Cofferdam" for dewatering excavations.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review geotechnical report.
 - 2. Review existing utilities and subsurface conditions.
 - 3. Review coordination for interruption, shutoff, capping, and continuation of utility services.
 - 4. Review proposed excavations.
 - 5. Review proposed equipment.
 - 6. Review monitoring of excavation support and protection system.
 - 7. Review coordination with waterproofing.
 - 8. Review abandonment or removal of excavation support and protection system.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, performance properties, and dimensions of individual components and profiles, and calculations for excavation support and protection system.
- B. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.
 - 1. Include plans, elevations, sections, and details.

2. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.
3. Indicate type and location of waterproofing.
4. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor and professional engineer.
- B. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.
- D. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.6 FIELD CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 1. Notify Engineer and Owner no fewer than two days in advance of proposed interruption of utility.
 2. Do not proceed with interruption of utility without Engineers' and Owner's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
 1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection according to the performance requirements.
 2. The geotechnical report is included elsewhere in Project Manual.
- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide, design, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.
 - 1. Contractor Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 4. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

2.2 MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
- C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.
 - 1. Corners: Roll-formed corner shape with continuous interlock.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
 - 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

- C. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

3.2 SOLDIER PILES AND LAGGING – IF REQUIRED BY DELEGATED ENGINEER

- A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.3 SHEET PILING – IF REQUIRED BY DELEGATED ENGINEER

- A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.
- B. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

3.4 TIEBACKS – IF REQUIRED BY DELEGATED ENGINEER

- A. Drill, install, grout, and tension tiebacks.
- B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
 - 1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.
- C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.5 BRACING – IF REQUIRED BY DELEGATED ENGINEER

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
 - 1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
 - 2. Install internal bracing if required to prevent spreading or distortion of braced frames.
 - 3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 FIELD QUALITY CONTROL

- A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.
- B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.
- C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.7 REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
 - 1. Remove excavation support and protection systems IN IT'S ENTIRETY. Retain paragraph below if excavation support and protection system will be left in place.

END OF SECTION 02261

SECTION 02270

SEDIMENTATION AND EROSION CONTROL

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals necessary to perform all installation, maintenance, removal, and area cleanup related to sedimentation control work as shown on the Drawings and as specified herein or as required to prevent the transport of silt or sediment outside the limits of construction. The work shall include, but not necessarily be limited to, installation of temporary access ways and staging areas, silt fences, temporary seeding, turbidity barriers, sediment removal and disposal, device maintenance, removal of temporary devices, temporary mulching, and final cleanup.
- B. The CONTRACTOR shall prepare a Sedimentation and Erosion Control Plan. This plan shall be used as a minimum in developing the Pollution Prevention Plan for the NPDES permit application (notification) to be filed by the CONTRACTOR.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Division 02 Section "Site Preparation" for site stripping, grubbing, stripping and stockpiling topsoil, protecting trees to remain, and removal of above- and below-grade improvements and utilities.
- C. Division 02 Section "Earthwork" for excavation, backfilling, filling, compaction and structure and road base preparation.
- D. Division 02 Section "Trench Excavation, Backfill, and Compaction" for excavating and backfilling buried mechanical utilities and buried utility structures.

1.3 SUBMITTALS

- A. Within 14 days after receipt of notice to proceed, the CONTRACTOR shall submit to the ENGINEER for approval, technical product literature for all commercial products to be used for sedimentation and erosion control.

1.4 QUALITY ASSURANCE

- A. The CONTRACTOR shall be responsible for the timely installation and maintenance of all sedimentation control devices necessary to prevent the movement of sediment from the construction site to off-site areas, via surface runoff or underground drainage systems. Measures in addition to those shown on the Drawings necessary to prevent the movement of sediment outside the limits of construction shall be installed, maintained, removed, and cleaned up at the expense of the CONTRACTOR. No additional charges to the OWNER will be considered.
- B. Sedimentation and erosion control measures shall conform to the Best Management Practices outlined in the Drawings and in the Florida Development Manual.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Silt Fence
 1. Silt fence shall include all components as indicated in the drawings.
 2. All lumber used in the silt fencing shall be pressure/preservative treated.
 3. Unless indicated otherwise, prefabricated silt fences with hay bales are permitted as long as they meet or exceed FDOT specifications.
- B. Turbidity barriers meeting FDOT Type I and Type II requirements shall be provided where required by Part 3. Turbidity barrier may be floating or staked, based on the conditions at the location for installation. Turbidity barrier shall be capable of functioning properly for flow conditions up to a 5 year/24 hour storm event. Turbidity barriers shall be constructed of PVC or polypropylene material, all portions which will be exposed to direct sunlight shall be ultraviolet resistant. All metal components shall be corrosion resistant. Woven materials may be acceptable for installations where high flow conditions may exist during storm events. Turbidity barriers shall be "Mark I", "Mark II", or "PC-2" as manufactured by American Boom & Barrier Corporation, Cape Canaveral, FL or equal.
- C. Straw mulch shall be utilized on all newly graded areas to protect areas against washouts and erosion. Straw mulch shall be comprised of threshed straw of oats, wheat, barley, rye, or hay that is free from noxious weeds, mold or other objectionable material. The straw mulch shall contain at least 50 percent by weight of material to be 10-in or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.
- D. Latex acrylic copolymer, such as Soil Sealant with coalescing agent as manufactured by Soil Stabilization Co., Merced, CA or approved equivalent shall be used as straw mulch tackifier.

- E. An asphalt tackifier may be used in place of a latex acrylic copolymer with prior written approval from the ENGINEER.
- F. Baled Hay or Straw: This work shall consist of construction of baled hay or straw dams to protect against downstream accumulations of silt. The baled hay or straw dams shall be constructed in accordance with the details in the FDOT Roadway and Traffic Design Standards. All baled hay or straw utilized shall comply with the provisions of FDOT Specification Section 9811-3.1 for dry mulch.

PART 3 - EXECUTION

3.1 LOCATION OF SEDIMENT/EROSION CONTROL AND TURBIDITY BARRIERS

- A. At a minimum, sediment/erosion control devices shall be installed at all locations shown on the plans and specified herein.
- B. Sediment/erosion control devices shall be installed at 500 feet intervals along all swales and ditches constructed and around all installed drainage structures prior to placement of sod.
- C. Sediment/erosion control shall be installed along all limits of construction.
- D. Sediment control or turbidity barriers shall be installed along the upstream side of all littoral zones within stormwater ponds. Sediment control or turbidity barriers shall be installed along the open water side of all littoral zones in borrow areas in which excavation is being conducted.
- E. Turbidity barriers shall be installed in all waters of the U.S. and the stormwater drainage ditch. Clearing of vegetation 20 feet upstream and downstream of the turbidity barriers is required.
- F. CONTRACTOR shall provide additional sediment/erosion control and turbidity barriers as needed to control the transport of silt and sediments outside of the limits of construction.
- G. Sediment/erosion control shall be installed around the base of all soil stockpile areas. All non-working faces of soil stockpiles, which will be in place longer than one month shall be seeded in accordance with the temporary seed requirements in Division 02 Section "Grass Seeding and Sod."
- H. Sediment/erosion control devices shall be installed along the perimeter of all staging areas.
- I. Sediment/erosion control for all construction activities which take place within an existing Jurisdictional Wetland (SJRWMD and FDEP), which will only be partially

impacted by construction shall have double sediment/erosion control barriers. The separation between the double barriers shall be at least 5 feet, but no greater than 10 feet.

- J. All disturbed areas, greater than one (1) acre, in which construction activities have stopped and are not anticipated to resume for a period of three months or longer shall be temporarily seeded, within five days of stoppage of construction, in accordance with the temporary seeding requirements in Division 02 Section "Grass Seeding and Sod."
- K. All disturbed areas, greater than one (1) acre, in which construction activities have been stopped and are not anticipated to resume for a period of 21 days, but not longer than three months shall be temporarily mulched, within five days of stoppage of construction in accordance with Paragraph 3.4.

3.2 INSTALLATION

A. Silt Fence Installation

- 1. Silt fences shall be positioned facing the drainage flow and as necessary to prevent movement of sediment produced by construction activities outside of the limits of construction or as approved.
- 2. All silt fence is to be installed prior to commencement of any construction activities uphill of silt fence location.
- 3. Dig trench approximately 6-in wide and 8-in deep along proposed fence lines.
- 4. Drive metal-stakes, 8 feet on center (maximum) at back edge of trenches. Stakes shall be driven 2 feet (minimum) into ground.
- 5. Hang 4 by 4 woven wire mesh on posts, setting bottom of wire in bottom of trench. Secure wire to posts with self-fastening tabs.
- 6. Hang filter fabric on wire carrying to bottom of trench with about 4-in of fabric laid across bottom of trench. Stretch fabric fairly taut along fence length and secure with tie wires 12-in O.C. both ways.
- 7. Backfill trench with excavated material and tamp.
- 8. Install FDOT approved, pre-fabricated, silt fence according to MANUFACTURER's instructions.

B. Hay bale Barrier

- 1. Bales shall be either wire-bound or string-tied with the bindings oriented around the sides rather than over and under the bales.
- 2. Bales shall be placed lengthwise in parallel rows with the ends of adjacent bales tightly abutting one another and rows staggered.
- 3. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. After bales are staked and chinked, the excavated soil shall be backfilled against the barrier. Backfilled material shall conform to the ground level on the downhill side and shall be built up to 2 inches against the uphill side.

4. Each bale shall be securely anchored by at least two stakes or rebars driven through the bale. The first stake shall be driven toward the previously laid bale to force the bales together. Stakes shall be driven deep enough into the ground to securely anchor the bales. The gaps between each bale shall be chinked (filled by wedging) with straw to prevent water from escaping between the bales
5. Where placed in concert with the required silt fencing, a second row of silt fencing paralleling the first at five foot spacing may be substituted for the rows of hay bales provided performance is not compromised.

C. Turbidity Barriers

1. Turbidity barriers should extend the entire depth of the water.
2. Turbidity barriers should not be placed perpendicular to flow. Barriers should be installed at an angle to the flow. Angle should be determined on the amount of flow in the waterway and the MANUFACTURER's recommendation.
3. Turbidity barrier should be 10 to 20 percent longer than the straight line measurement.
4. Joints between panels should be kept to a minimum.
5. Barrier should extend to the top of bank. All ends should be secured firmly to the shoreline.
6. Where significant flow is anticipated, a heavy woven pervious filter fabric may be substituted.

D. Erosion Control and Excelsior Matting

1. Erosion control and excelsior matting blankets shall be installed as shown on the drawings and as approved in accordance with MANUFACTURER's instructions. The area to be covered shall be properly prepared before the blanket is applied. When the blanket is unrolled, the netting shall be on top and the fibers in contact with the soil over the entire area. The blankets shall be applied in the direction of water flow, and stapled. Blankets shall be placed a minimum of three rows (of 4-ft) wide (total approx. 12-ft width) and stapled together in accordance with MANUFACTURER's instructions. Side overlaps shall be 6-in minimum. The staples shall be made of wire, .091-in in diameter or greater, "U" shaped with legs 10-in in length and a 1-1/2 -in crown. The staples shall be driven vertically into the ground, spaced approximately 2 linear feet apart, on each side, and one row in the center alternately spaced between each side. Upper and lower ends of the matting shall be buried to a depth of 4-in in a trench. The bottom of the fold shall be 4-in below the ground surface. Staple on both sides of fold. Where the matting must be cut or more than one roll length is required, turn down upper end of downstream roll into a trench to a depth of 4-in. Overlap lower end of upstream roll 4-in past edge of downstream roll and staple.
2. To ensure full contact with soil surface, roll matting with a roller weighing 100 pounds per foot of width perpendicular to flow direction after placing matting, stapling and seeding. Thoroughly inspect installation after completion. Correct any areas where matting does not present a smooth surface in full contact with the soil below.

3.3 MAINTENANCE AND INSPECTIONS

A. Inspections

1. CONTRACTOR shall make a visual inspection of all sedimentation and erosion control devices (including turbidity barriers) once per week and promptly after every rainstorm. If such inspection reveals that additional measures are needed to prevent movement of sediment to areas outside the limits of construction, CONTRACTOR shall promptly install additional devices as needed. Sediment controls in need of maintenance shall be repaired promptly.
2. CONTRACTOR shall keep a log of all inspections indicating the following:
 - a. Date and time of inspection
 - b. Inspector
 - c. Amount of rainfall since last inspection
 - d. Erosion and sediment control devices inspected
 - e. Condition of sediment and erosion control devices
 - f. Repairs needed
 - g. Date repair is completed

B. Device Maintenance

1. Silt Fences
 - a. Remove accumulated sediment once it builds up to one-half of the height of the fabric.
 - b. Replace damaged fabric, or patch with a 2-ft minimum overlap.
 - c. Make other repairs as necessary to ensure that the fence is filtering all runoff directed to the fence.
2. Hay bale Barriers
 - a. Remove accumulated sediment once it builds up to one-half of the height of the hay bales.
 - b. Replace damaged hay bales.
 - c. Make other repairs as necessary to ensure that the hay bales are filtering all runoff directed to the barrier.
3. Turbidity Barriers
 - a. Turbidity barriers shall be inspected on a daily basis.
 - b. Replace damaged fabric, or patch with a 2 foot minimum overlap.
 - c. Make other repairs as necessary to ensure barriers are effectively maintaining turbidity levels outside of the barrier.

3.4 TEMPORARY MULCHING

- A. Apply temporary mulch to areas where rough grading has been completed but final grading is not anticipated to begin within 21 days of the completion of rough grading. If construction activities are not planned to resume for three months or longer, the temporary seeding requirements shall be followed.

- B. Straw mulch shall be applied at rate of 2,000 lbs/acre and tackified with latex acrylic copolymer at a rate of 1 gal/1000 ft² diluted in a ratio of 30 parts water to 1-part latex acrylic copolymer mix.
- C. After temporary mulching, traffic should be kept to a minimum, except for designated temporary access roads.

3.5 REMOVAL AND FINAL CLEANUP

- A. Once the site has been fully stabilized against erosion, remove sediment control devices and all accumulated silt. Dispose of silt and waste materials in proper manner. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated on the Drawings or specified herein.

END OF SECTION 02270

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SECTION 02457 - PRESTRESSED CONCRETE PILES

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 solid, precast prestressed concrete piles.

1.3 UNIT PRICES

- A. The Contract Sum: Base the Contract Sum on number and dimensions of piles indicated from tip to cutoff, **plus not less than 10 feet of additional overlength** for cutting piles after total depth verification using Dynamic Pile Testing Methods, for all piles.
- B. Work of this Section is affected as follows:
 - 1. Additional payment for pile lengths in excess of that indicated, and credit for pile lengths less than that indicated, will be calculated at unit prices stated in the Contract, based on net addition or deduction to total pile length as determined by Architect measured to nearest 12 inches.
 - a. Additional payment for splices required to extend pile lengths in excess of that indicated will be calculated at unit prices stated in the Contract.
 - 2. Additional payment for number of piles in excess of that indicated, and credit for number of piles less than that indicated, will be calculated at unit prices stated in the Contract.
 - 3. Unit prices include labor, materials, tools, equipment, and incidentals for furnishing, driving, cutting off, capping, and disposing of cutoffs.
 - 4. Test piles that become part of permanent foundation system will be considered as an integral part of the Work.
 - 5. No payment will be made for rejected piles, including piles driven out of tolerance, defective piles, or piles damaged during handling or driving.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Piles shall withstand transportation, erection, and driving stresses and design loads within limits indicated and under conditions existing at Project site.
 - 1. Design Loads: As indicated on the Drawings.

- B. Delegated Design: Design piles, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For concrete piles. Prepared by or under the supervision of a qualified professional engineer detailing fabrication and lifting devices necessary for handling and driving piles.
 - 1. Indicate pile dimensions, cross sections, locations, and sizes. Show details of pile splices and shoes.
 - 2. Indicate types of reinforcement, including prestressing strand, and detail fabricating, bending, and placing.
 - 3. Indicate layout and dimensions, and identify each pile. Indicate welded connections by AWS standard symbols. Detail cast-in hardware.
 - 4. Indicate transportation, storage, and lifting points.
 - 5. Include arrangement of static pile reaction frame, test and anchor piles, equipment, and instrumentation. Submit structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Delegated-Design Submittal: For concrete piles indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer, manufacturer, professional engineer and testing agency.
- B. Welding certificates.
- C. Design Mixes: For each concrete mix.
- D. Material Certificates: For steel reinforcements, prestressing strand and concrete admixtures, from manufacturer.
- E. Material Test Reports: For concrete materials.
- F. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion.
- G. Static Pile Test Reports: None Required. All piles will utilize dynamic pile testing to establish final driven depth.
- H. Pile-Driving Records: Submit within three days of driving each pile.
- I. Field quality-control reports.

- J. Preconstruction Photographs: Photographs or video of existing conditions of adjacent construction. Submit before the Work begins.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer complying with the following:
 - 1. Engineering Responsibility: Assumes engineering responsibility to comply with requirements in "Performance Requirements" Article by engaging a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data for piles.
 - 2. PCI Plant Certification Program: Participates in PCI's Plant Certification Program and is designated a PCI-Certified Plant for the applicable product group and category, or better.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
 - 1. Installer's responsibility includes engaging a qualified professional engineer to prepare pile-driving records.
- C. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- D. Design Practices: Comply with ACI 318 and the recommendations in PCI Committee Report: "Recommended Practice for Design, Manufacture and Installation of Prestressed Concrete Piling."
- E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for piles, comply with applicable requirements in PCI MNL-116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."
- F. Comply with requirements in ACI 301, "Specifications for Structural Concrete."
- G. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel"
 - 2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."
- H. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent cracking, distorting, warping, or other physical damage, and so markings are visible.
- B. Lift and support piles only at designated lifting or supporting points as shown on Shop Drawings.

1.9 PROJECT CONDITIONS

- A. Protect structures, underground utilities, and other construction from damage caused by pile driving.
- B. Site Information: A geotechnical report has been prepared for this Project and is included elsewhere in the Project Manual for information only.
- C. Preconstruction Photographs: Inventory and record the condition of adjacent structures, underground utilities, and other construction. Provide photographs or video of conditions that might be misconstrued as damage caused by pile driving. Comply with Division 1 Section 01322 "Photographic Documentation."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, submit qualifications of the Precast Pile Products as part of or prior to shop drawing submittals. provide products by one of the following:

2.2 MOLD MATERIALS

- A. Molds: Provide molds of metal, plastic, wood, or another material that is nonreactive with concrete and will produce required finish surfaces.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M.
- C. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M, as follows:
 - 1. Steel Reinforcement: ASTM A 615/A 615M, Grade 60 or ASTM A 706/A 706M, deformed.
- D. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain.

2.4 PRESTRESSING TENDONS

- A. Prestressing Strand: ASTM A 416/A 416M, Grade 250 or 270; uncoated, seven-wire, low-relaxation strand.

2.5 CONCRETE MATERIALS

- A. General: Limit water-soluble chloride ions in concrete to the maximum percentage by mass of cementitious material permitted by ACI 318, but not more than 0.06 percent.
- B. Portland Cement: ASTM C 150, Type II, of same type, brand, and source.
 - 1. Fly Ash: ASTM C 618, Class C or F.
 - 2. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL-116, ASTM C 33, with coarse aggregates complying with Class 4S. Provide aggregates from single source.
 - 1. Nominal Maximum Size of Aggregate: 3/4 inch.
- D. Water: Potable, free of deleterious material that may affect color stability, setting, or strength of concrete, and complying with chemical limits of PCI MNL-116.
- E. Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures.
 - 1. Air-Entraining Admixture: ASTM C 260.
 - 2. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 3. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 4. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 5. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
 - 6. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 7. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 8. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 PILE ACCESSORIES

- A. Pile Shoes: 1-inch-thick, minimum, carbon-steel plate fabricated to match shape of pile tip.

2.7 CONCRETE MIXES

- A. Prepare design mixes for each type of concrete required.
 - 1. Limit use of fly ash and silica fume to not exceed, in total, 25 percent of portland cement by weight.
- B. Design mixes may be prepared by a qualified independent testing agency or by qualified personnel at precast manufacturing plant at precast manufacturer's option.
- C. Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 7000 psi.

2. Maximum Water-Cementitious Material Ratio: 0.40.
- D. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content of 2.5 to 4.5 percent.

2.8 FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete placement, temperature changes, and for pretensioning and detensioning operations. Maintain molds to provide completed piles of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL-116 and PCI MNL-135.
1. Unless molds are stripped before detensioning, design molds so stresses are not induced in piles due to deformation of concrete under prestress or movement during detensioning.
 2. Chamfer edges and corners of square piles.
- B. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.
1. Accurately position, support, and secure reinforcement against displacement by molds, construction, or concrete placement. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.
 2. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- C. Prestress tendons for piles by either pretensioning or post-tensioning methods. Comply with PCI MNL-116.
- D. Pile Shoes: Accurately position and secure pile shoes at pile tips so as to not affect pile alignment during driving. Weld pile shoes to longitudinal reinforcements.
- E. Mix concrete according to PCI MNL-116 and requirements in this Section. After initial concrete batching, no additional water may be added.
- F. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in piles. Comply with requirements in PCI MNL-116 for measuring, mixing, transporting, and placing concrete.
1. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL-116.
 2. Comply with ACI 306.1 procedures for cold-weather concrete placement.
 3. Comply with ACI 305R recommendations for hot-weather concrete placement.
- G. Identify pickup points of piles with permanent markings corresponding with markings indicated on Shop Drawings. Imprint casting date on each pile.

- H. Cure concrete according to requirements in PCI MNL-116 by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.
- I. Delay detensioning piles until concrete has attained at least 70 percent of its compressive strength as established by test cylinders cured under the same conditions as concrete.
 - 1. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 - 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
- J. Where ends of strands will not be enclosed or covered, cut flush and cover with a high-strength mortar bonded to unit with an epoxy-resin bonding agent.
- K. Fabricate precast prestressed concrete piles straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL-116 and PCI MNL-135 product tolerances.
- L. Finish: Fabricate concrete piles with normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.
- M. Finish unformed surfaces by trowel unless otherwise indicated. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.
- N. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch intervals; label the distance from pile tip at 60-inch intervals. Maintain markings on piles until driven.

2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to evaluate pile manufacturer's quality-control and testing methods.
 - 1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.
- B. Testing: Test and inspect piles according to PCI MNL-116.
- C. Strength of piles will be considered deficient if units fail to comply with requirements.
- D. Testing: If there is evidence that strength of piles may be deficient or may not comply with PCI MNL-116 requirements, Owner will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.
 - 1. A minimum of three representative cores shall be taken from piles of suspect strength, from locations directed by Architect.

2. Cores shall be tested, following immersion in water, in a wet condition per ACI 301 if piles will be wet under service conditions.
 3. Cores shall be tested in an air-dry condition per ACI 301 if piles will be dry under service conditions.
 4. Strength of concrete for each series of three cores shall be considered satisfactory if average compressive strength is at least 85 percent of the 28-day design compressive strength and no core compressive strength is less than 75 percent of the 28-day design compressive strength.
 5. Test results shall be reported in writing on same day that tests are performed, with copies to Architect, Contractor, and pile manufacturer. Test reports shall include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete manufacturer.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of pile represented by core tests; design compressive strength; type of break; compressive strength at break, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and piles comply with requirements, solidly fill core holes with patching mortar and finish to match adjacent pile surfaces.
- F. Piles will be considered defective if they do not pass tests and inspections.

PART 3 - EXECUTION

3.1 DRIVING EQUIPMENT

- A. Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.
1. Use pile hammer capable of adjustment to deliver reduced impact to maintain tensile stress within 70 percent of yield strength of pile reinforcement.
- B. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.
- C. Leads: Use fixed, semifixed, or hanging-type pile-driver leads that will hold full length of pile firmly in position and in axial alignment with hammer.

3.2 STATIC PILE TESTS

- A. General: Static pile tests will not be required due to the number of piles to be installed. Dynamic Pile Testing will be used to verify driving criteria and pile lengths and to confirm

allowable load of all piles. Additional pile length is to be provided to allow up to an additional 10' of driving for each pile produced.

- B. Equip each driven pile with two telltale rods, according to ASTM D 1143, for measuring deformation during driving.

3.3 DRIVING PILES

- A. General: Continuously drive piles to elevations or penetration resistance indicated or verified by dynamic pile testing. Establish and maintain axial alignment of leads and piles before and during driving.
- B. Predrilling: Provide only if allowed by the Geotechnical Report recommendations.
- C. Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance.
- D. Pile Splices: No pile splices are anticipated. Damaged piles which would normally require a splice shall be withdrawn and field directions for redriving will be furnished.
- E. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:
 - 1. Location: 4 inches from location indicated after initial driving, and 6 inches after pile driving is completed.
 - 2. Plumb: Maintain 1 inch in 4 feet from vertical, or a maximum of 4 inches, measured when pile is aboveground in leads.
 - 3. Batter Angle: Maximum 1 inch in 4 feet from required angle, measured when pile is aboveground in leads.
- F. Withdraw damaged or defective piles and piles that exceed driving tolerances and install new piles within driving tolerances.
 - 1. Fill holes left by withdrawn piles using cohesionless soil material such as gravel, broken stone, and gravel-sand mixtures. Place and compact in lifts not exceeding 72 inches.
 - 2. Fill holes left by withdrawn piles as directed by Engineer.
- G. Abandon and cut off rejected piles as directed by Engineer. Leave rejected piles in place and install new piles in locations as directed by Engineer.
- H. Cutting Off: Cut off tops of driven piles square with pile axis and at elevations indicated.
- I. Buildups: Construct buildups to elevations indicated of cast-in-place reinforced concrete with compressive strength not less than 6000 psi at 28 days.
- J. Pile-Driving Records: Maintain accurate driving records for each pile, compiled and attested to by a qualified professional engineer. Include the following data:
 - 1. Project name and number.
 - 2. Name of Contractor.
 - 3. Type of pile and date of casting.

4. Pile location in pile group and designation of pile group.
5. Sequence of driving in pile group.
6. Pile dimensions.
7. Ground elevation.
8. Elevation of tips after driving.
9. Final tip and cutoff elevations of piles after driving pile group.
10. Records of redriving.
11. Elevation of splices.
12. Type, make, model, and rated energy of hammer.
13. Weight and stroke of hammer.
14. Type of pile-driving cap used.
15. Cushion material and thickness.
16. Actual stroke and blow rate of hammer.
17. Pile-driving start and finish times, and total driving time.
18. Time, pile-tip elevation, and reason for interruptions.
19. Number of blows for every 12 inches of penetration, and number of blows per 1 inch for the last 6 inches of driving.
20. Pile deviations from location and plumb.
21. Preboring, jetting, or special procedures used.
22. Unusual occurrences during pile driving.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 1. Pile foundations.
- B. Testing Agency: Owner will engage a qualified independent testing agency to perform tests and inspections.
- C. Tests and Inspections:
 1. Dynamic Pile Testing: High-strain dynamic monitoring shall be performed and reported according to ASTM D 4945 during initial driving and during restriking on all piles.

3.5 DISPOSAL

- A. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner's property.

END OF SECTION 02457

SECTION 02764 - PAVEMENT JOINT SEALANTS

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. Cold-applied, fuel-resistant joint sealants.
 - 2. Joint-sealant backer materials.
 - 3. Primers.

- B. Related Requirements:

- 1. Section 07920 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Insert location.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

- C. Paving-Joint-Sealant Schedule: Include the following information:

- 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.

- B. Product Certificates: For each type of joint sealant and accessory.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.

1.7 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.2 COLD-APPLIED, FUEL-RESISTANT JOINT SEALANTS

- A. Fuel-Resistant, Single-Component, Pourable, Modified-Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.
 - 1. **Products:** Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. **BASF Building Systems**; Sonomeric 1.
- B. Fuel-Resistant, Multicomponent, Pourable, Modified-Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade P, Class 12-1/2 or 25, for Use T.
 - 1. **Products:** Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. **Meadows, W.R.,Inc**; Sealtight Gardox.

- b. [Pecora Corporation](#); Urexpan NR-300.

2.3 JOINT-SEALANT BACKER MATERIALS

- A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.
- B. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

2.4 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

- B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.
- C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of joint-sealant backings.
 - 2. Do not stretch, twist, puncture, or tear joint-sealant backings.
 - 3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
 - 1. Place joint sealants so they fully contact joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
 - 1. Remove excess joint sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

- A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.
- B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.5 PAVING-JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Fuel-resistant joints within concrete paving.
 - 1. Joint Location:

- a. Expansion and isolation joints in concrete paving.
 - b. Contraction joints in concrete paving.
 - c. Other joints as indicated.
2. Joint Sealant: Fuel-resistant, single-component, pourable, modified-urethane, elastomeric joint sealant.
3. Joint-Sealant Color: as selected by the Engineer from the range of colors produced.

END OF SECTION 02764

SECTION 02768 - DECORATIVE CEMENT CONCRETE PAVEMENT

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 stamped concrete paving. Stamped concrete shall be colorless.
- B. Related Sections:
 - 1. Section 02751 "Cement Concrete Pavement" for cast-in-place concrete paving with other finishes, curbs and gutters, stamped detectable warnings, pavement markings, and wheel stops.
 - 2. Section 02764 "Pavement Joint Sealants" for joint sealants in expansion and contraction joints within decorative concrete paving and in joints between decorative concrete paving and asphalt paving or adjacent construction.
 - 3. Section 03300 "Cast-in-Place Concrete" for general building applications of concrete.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color, pattern, or texture selection.
- C. Samples for Verification: For each type of exposed color, pattern, or texture indicated.
- D. Other Action Submittals:
 - 1. Design Mixtures: For each decorative concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer, ready-mix concrete manufacturer and testing agency.
- B. Material Certificates: For the following, from manufacturer:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.
 - 5. Curing compounds.
 - 6. Applied finish materials.
 - 7. Bonding agent or epoxy adhesive.
 - 8. Joint fillers.
- C. Material Test Reports: For each of the following:
 - 1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.
- B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- D. Source Limitations: Obtain decorative concrete paving products and each type or class of cementitious material of the same brand from same manufacturer's plant, and obtain each aggregate from single source.
- E. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.
- F. ACI Publications: Comply with ACI 301 unless otherwise indicated.

- G. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockups of full-thickness sections of decorative concrete paving to demonstrate typical joints; surface color, pattern, and texture; curing; and standard of workmanship.
 2. Build mockups of decorative concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.
 4. Remove mockup at the completion of the project.
- H. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to decorative concrete paving, including but not limited to, the following:
 - a. Concrete mixture design.
 - b. Quality control of concrete materials and decorative concrete paving construction practices.
 2. Require representatives of each entity directly concerned with decorative concrete paving to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Decorative concrete paving Installer.
 - e. Manufacturer's representative of decorative concrete paving system.

1.7 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
1. Use flexible or uniformly curved forms for curves of a radius of 100 feet or less. Do not use notched and bent forms.
- B. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.

- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- C. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, gray portland cement Type II.
 - a. Fly Ash: ASTM C 618, Class C or F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Aggregate Size: 3/4 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: Potable and complying with ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 3. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.

2.4 STAMPING DEVICES

- A. Stamp Mats: Semirigid polyurethane mats with projecting textured and ridged underside capable of imprinting texture and joint patterns on plastic concrete.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advanced Surfaces Inc.
 - b. Bomanite Corporation.
 - c. Bon Tool Co.
 - d. Brickform.
 - e. Butterfield Color.
 - f. Creative Urethane Concepts, Inc.
 - g. Matcrete Precision Stamped Concrete Tools.
 - h. Proline Concrete Tools, Inc.
 - i. Scofield, L. M. Company.
 - j. Southern Color N.A., Inc.
 - k. Stampcrete International Ltd.
 - l. Superior Decorative by Dayton Superior.
 - m. SuperStone, Inc.
 - n. SureCrete Design Products.
- B. Stamp Tools: Open-grid, aluminum or rigid-plastic stamp tool capable of imprinting joint patterns on plastic concrete.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Matcrete Precision Stamped Concrete Tools.
 - b. Scofield, L. M. Company.
 - c. SuperStone, Inc.
- C. Rollers: Manually controlled, water-filled aluminum rollers with projecting ridges on drum capable of imprinting texture and joint patterns on plastic concrete.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bon Tool Co.
 - b. Brickform.

2.5 STAIN MATERIALS

- A. Stamped concrete shall be colorless with no stain.

2.6 LIQUID RELEASE

- A. Liquid release agents shall be used to facilitate the release of mats for stamping concrete.
 - 1. **Products:** Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. [Americrete, Inc.](#); A-1800 Release
 - b. [Bomanite Corporation](#); Liquid Release
 - c. [Bon Tool Co.](#); Release Agent
 - d. [Brickform](#); Liquid Release.
 - e. [Scofield, L. M. Company](#); Lithotex
 - f. [SuperStone, Inc.](#); Bubble Gum Liquid Release.

2.7 RELATED MATERIALS

- A. Epoxy Bonding Adhesive: ASTM C 881/C 881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- B. Polyethylene Film: ASTM D 4397, 1 mil thick, clear.

2.8 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
 - 3. Slump Limit: 5 inches, plus or minus 1 inch.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 3-1/2 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing and retarding admixture in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials:

1. Fly Ash or Pozzolan: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.
3. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

- B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.
- B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase 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.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

- E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement joint devices.
- H. Screed paving surface with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- K. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true

planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

3.8 STAMPING

- A. Mat Stamping: After floating and while concrete is plastic, apply mat-stamped finish.
 - 1. Liquid Release Agent: Uniformly distribute onto concrete at the manufacturer's recommended rate.
 - 2. After application of release agent, accurately align and place stamp mats in sequence.
 - 3. Uniformly load mats and press into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp mats. Hand stamp edges and surfaces unable to be imprinted by stamp mats.
 - 4. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.
- B. Tool Stamping: After floating and while concrete is plastic, apply tool-stamped finish.
 - 1. Cover surface with polyethylene film, stretch taut to remove wrinkles, lap sides and ends 3 inches, and secure to edge forms. Lightly broom surface to remove air bubbles.
 - 2. Accurately align and place stamp tools in sequence and tamp into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp tools. Hand stamp edges and surfaces unable to be imprinted by stamp tools.
 - 3. Carefully remove polyethylene film immediately after tool stamping.
- C. Roller Stamping: After floating and while concrete is plastic, apply roller-stamped finish.
 - 1. Cover surface with polyethylene film, stretch taut to remove wrinkles, lap sides and ends 3 inches, and secure to edge forms. Lightly broom surface to remove air bubbles.
 - 2. Accurately align roller and perform rolling operation to produce required imprint pattern and depth of imprint on concrete surface. Hand stamp surfaces inaccessible to roller.
 - 3. Carefully remove polyethylene film immediately after roller stamping.

3.9 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

3.10 STAINING

- A. Stamped concrete shall be colorless and not stained.

3.11 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 - 1. Elevation: 3/4 inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-foot-long, unlevelled straightedge not to exceed 1/2 inch.
 - 4. Lateral Alignment and Spacing of Dowels: 1 inch.
 - 5. Vertical Alignment of Dowels: 1/4 inch.
 - 6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
 - 7. Joint Spacing: 3 inches.
 - 8. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 9. Joint Width: Plus 1/8 inch, no minus.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
 - 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 - 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Decorative concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

3.13 REPAIRS AND PROTECTION

- A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Engineer.
- B. Detailing: Grind concrete "squeeze" left from tool placement. Color ground areas with slurry of color hardener mixed with water and bonding agent. Remove excess release agent with high-velocity blower.
- C. Protect decorative concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain decorative concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

3.14 DECORATIVE CONCRETE PAVING SCHEDULE

- A. Patterned Decorative Concrete Paving:
 - 1. Locations: Install on concrete overlooks and access walkway to overlooks in accordance with the plans
 - 2. Coloring Method:

- a. Color: Colorless
- 3. Field Patterning Method: Stamped
 - a. Texture and Pattern: New Brick Herringbone pattern (4" x 8").
 - b. Release Agent: Liquid
- 4. Border and Accent Strip Patterning Method:
 - a. Texture and Pattern: smooth finish

END OF SECTION 02768

SECTION 03300 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Suspended slabs over Coastal Waters.
 - 5. Concrete toppings.
 - 6. Site walls and Ornamental Piers.
- B. Related Sections:
 - 1. Section 02300 "Earthwork" for drainage fill under slabs-on-grade.
 - 2. Section 02751 "Cement Concrete Pavement" for concrete pavement and walks.
 - 3. Section 02768 "Decorative Cement Concrete Pavement" for decorative concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site. These amounts have to be made part of the truck bill with rotations and time after adding water.

- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Engineer.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer and testing agency.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Floor and slab treatments.
 - 6. Bonding agents.
 - 7. Adhesives.
 - 8. Vapor retarders.
 - 9. Semirigid joint filler.
 - 10. Joint-filler strips.
 - 11. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Field quality-control reports.
- F. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. **Installer Qualifications:** A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. **Testing Agency Qualifications:** An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. **Source Limitations:** Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- E. **Welding Qualifications:** Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- F. **ACI Publications:** Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- G. **Concrete Testing Service:** Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- H. **Mockups:** Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.
 - 1. Build panel approximately 40 sq. ft. for slab-on-grade and 40 sq. ft. for formed surface in the location indicated or, if not indicated, as directed by engineer.
 - 2. Mockups will not be made part of the final work and shall be removed offsite when no longer needed.
- I. **Preinstallation Conference:** Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - e. Special concrete finish subcontractor.
2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, anchor rod and anchorage device installation tolerances, steel reinforcement installation, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 or ASTM A 706/A 706M, deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length. **Provide epoxy-coated reinforcing on all suspended slabs over surface waters.**
- C. Stainless-Steel Reinforcing Bars: ASTM A 955/A 955M, Grade 60, [Type 304] [Type 316L], deformed.
- D. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- E. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, as-drawn, plain-steel wire, with less than 2 percent damaged coating in each 12-inch wire length. **Provide epoxy-coated wire on all suspended slabs over surface waters.**
- F. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type II, gray. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F or C.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 3/4-inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 FLOOR AND SLAB TREATMENTS

2.7 CURING MATERIALS

- A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- B. Water: Potable.

2.8 RELATED MATERIALS

- A. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.9 REPAIR MATERIALS

- A. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Ground Granulated Blast-Furnace Slag: 50 percent.
 - 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 - 5. Silica Fume: 10 percent.
 - 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 - 7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

- D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.11 CONCRETE MIXTURES

- A. Footings and Foundation Walls: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 3. Slump Limit: 4 inches or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
- B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3000 psi at 28 days.
 2. Slump Limit: 4 inches, plus or minus 1 inch.
 3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
 4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- C. Suspended Slabs over Coastal Waters: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Slump Limit: 4 inches, plus or minus 1 inch.
 3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
 4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- D. Concrete Toppings: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Slump Limit: 4 inches, plus or minus 1 inch.
 3. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
 4. Air Content: Do not allow air content of trowel-finished toppings to exceed 3 percent.
- E. Site Walls and Piers: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.50.

3. Slump Limit: 4 inches or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.

- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete. Use V-style joints where formed surfaces abut similar formed surfaces, seal with sealant.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of suspended slabs, walls, piers, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.3 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07920 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.

- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view and to receive a rubbed finish.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
 - 1. Apply scratch finish to surfaces to receive concrete floor toppings.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view.
 - 2. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.9 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.10 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3.11 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least [**one**] [**six**] month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one-part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01-inch-wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Headed bolts and studs.
 3. Verification of use of required design mixture.
 4. Concrete placement, including conveying and depositing.
 5. Curing procedures and maintenance of curing temperature.
 6. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 100-cu. yd. or fraction thereof of each concrete mixture placed each day.

- a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three-consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
10. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness within 24 hours of finishing.

END OF SECTION 03300

SECTION 03410 - PLANT-PRECAST STRUCTURAL CONCRETE

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. Precast structural concrete.

- B. Related Requirements:

- 1. Section 03300 "Cast-in-Place Concrete" for concrete topping and placing connection anchors in concrete.

1.3 DEFINITIONS

- A. Design Reference Sample: Sample of approved precast structural concrete color, finish, and texture, preapproved by Engineer.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Design Mixtures: For each precast concrete mixture. Include compressive strength and, if required, water-absorption tests.

- C. Shop Drawings:

- 1. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.
 - 2. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.
 - 3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
 - 4. Indicate separate face and backup mixture locations and thicknesses.
 - 5. Indicate type, size, and length of welded connections by AWS standard symbols.

6. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
 7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 8. Include and locate openings larger than 10 inches. Where additional structural support is required, include header design.
 9. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
 10. Indicate relationship of precast structural concrete units to adjacent materials.
 11. Indicate locations, dimensions, and details of thin-brick units, including corner units and special shapes, and joint treatment.
 12. Indicate locations, dimensions, and details of stone facings, anchors, and joint widths.
 13. Indicate estimated camber for precast floor slabs with concrete toppings.
 14. Indicate shim sizes and grouting sequence.
 15. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
- D. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Show precast structural concrete unit types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from precast structural concrete.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator and testing agency.
- B. Welding certificates.
- C. Material Certificates: For the following:
1. Cementitious materials.
 2. Reinforcing materials and prestressing tendons.
 3. Admixtures.
 4. Bearing pads.
 5. Insulation.
 6. Structural-steel shapes and hollow structural sections.
- D. Material Test Reports: For aggregates, by a qualified testing agency.
- E. Preconstruction test reports.
- F. Source quality-control reports.
- G. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 1. Designated as a PCI-certified plant as follows:
 - a. Group C, Category C3 - Prestressed Straight Strand Structural Members.
 - 2. Fabricator is located within 500 miles of Project site.
- B. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance, to erect Category S1 - Simple Structural Systems.
- C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- D. Quality-Control Standard: For manufacturing procedures, testing requirements, and quality-control recommendations for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."
- E. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."
- F. Mockups: No mockups of prestressed precast concrete structural components are required, however the Engineer and Owner reserve the right to inspect and approve all components in their location of fabrication prior to shipment.

1.8 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.
- B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
 - 1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
 - 2. Place adequate dunnage of even thickness between each unit.
 - 3. Place stored units so identification marks are clearly visible, and units can be inspected.

- C. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- D. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fabricators: All fabricators shall meet the requirements of paragraph 1.7 above.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01400 "Quality Requirements," to design precast structural concrete units.
- B. Design Standards: Comply with ACI 318 and with design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.
- C. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated within limits and under conditions indicated.
- D. Structural Performance: Provide precast structural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Dead Loads: self-weight
 - 2. Concrete Topping Load: self-weight
 - 3. Live Loads: 200 psf
 - 4. Roof Loads: none
 - 5. Snow Loads: none
 - 6. Seismic Loads: none
 - 7. Wind Loads: wind loads do not govern.
 - 8. Precast concrete Overlooks suspended over coastal waters: wave uplift 300 psf

2.3 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - 1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

2.4 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 or ASTM A 706/A 706M, deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.
- C. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain, flat sheet, Type 1 bendable coating.
- D. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.5 PRESTRESSING TENDONS

- A. Pretensioning Strand: ASTM A 416/A 416M, Grade 250 or Grade 270, uncoated, seven-wire or ASTM A 886/A 886M, Grade 270, indented, seven-wire, low-relaxation strand.

2.6 CONCRETE MATERIALS

- A. Regional Materials: Precast structural concrete shall be manufactured from aggregates and cement that have been extracted or recovered, as well as manufactured, within 500 miles of Project site.
- B. Portland Cement: ASTM C 150/C 150M, Type II, gray, unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.
- C. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Metakaolin: ASTM C 618, Class N.
 - 3. Silica Fume: ASTM C 1240, with optional chemical and physical requirement.
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- D. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33/C 33M, with coarse aggregates complying with Class 4S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
 - 1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
 - a. Gradation: Uniformly graded.
 - 2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate to match approved finish sample.

- E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.
- F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
 - 1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
 - 5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 7. Plasticizing Admixture: ASTM C 1017/C 1017M, Type I.
 - 8. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
 - 9. Corrosion-Inhibiting Admixture: ASTM C 1582/C 1582M.

2.7 STAINLESS-STEEL CONNECTION MATERIALS

- A. Stainless-Steel Plate: ASTM A 666, Type 304, Type 316, or Type 201.
- B. Stainless-Steel Bolts and Studs: ASTM F 593, Alloy Group 1 or 2, hex-head bolts and studs; ASTM F 594, Alloy Group 1 or 2 stainless-steel nuts; and flat, stainless-steel washers.
 - 1. Lubricate threaded parts of stainless-steel bolts with an antiseize thread lubricant during assembly.
- C. Stainless-Steel-Headed Studs: ASTM A 276, Alloy 304 or 316, with minimum mechanical properties of PCI MNL 116.

2.8 BEARING PADS

- A. Provide one of the following bearing pads for precast structural concrete units as recommended by precast fabricator for application:
 - 1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D 2240; minimum tensile strength 2250 psi, ASTM D 412.
 - 2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D 2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
 - 3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; 80 to 100 Shore, Type A durometer hardness,

ASTM D 2240; complying with AASHTO's "AASHTO LRFD Bridge Design Specifications," Division II, Section 18.10.2; or with MIL-C-882E.

4. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless- or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.9 ACCESSORIES

- A. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install structural precast concrete units.

2.10 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1-part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.
- B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.
- C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.11 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 1. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
 2. Limit use of fly ash to 20 percent replacement of portland cement by weight and ground granulated blast-furnace slag to 20 percent of portland cement by weight; metakaolin and silica fume to 10 percent of portland cement by weight.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 116 when tested according to ASTM C 1218/C 1218M.
- D. Normal-Weight Concrete Mixtures: Proportion face mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Water Absorption: For structural precast concrete with an Architectural finish, limit water absorption to 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
- H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.12 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
- B. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
1. Form joints are not permitted on faces of structural precast concrete with an Architectural finish that is exposed to view in the finished work.
 2. Edge and Corner Treatment: Uniformly chamfered.

2.13 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.
- D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Engineer's approval.

- E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 3. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.
1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete unit.
 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
 3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
 5. Protect strand ends and anchorages with a minimum of 1-inch-thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.
- H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- I. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
- J. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
1. Place backup concrete mixture to ensure bond with face-mixture concrete.

- K. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.
 - 1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.
- L. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.
- M. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.
- N. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- O. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Engineer's approval.

2.14 FABRICATION TOLERANCES

- A. Fabricate precast structural concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product dimension tolerances as well as position tolerances for cast-in items.

2.15 COMMERCIAL ARCHITECTURAL FINISHES

- A. Manufacture member faces free of joint marks, grain, and other obvious defects with corners, including false joints, uniform and straight. Finish exposed-face surfaces of precast concrete units to match approved design reference sample and as follows:
 - 1. As-Cast-Surface Finish: Provide surfaces to match approved sample or mockup for acceptable surface, air voids, sand streaks, and honeycomb.

2.16 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to evaluate precast structural concrete fabricator's quality-control and testing methods.
 - 1. Allow testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.

- B. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements and ASTM C 1610/C 1610M, ASTM C 1611/C 1611M, ASTM C 1621/C 1621M, and ASTM C 1712/C 1712M.
1. Test and inspect self-consolidating concrete according to PCI TR-6.
- C. Strength of precast structural concrete units is considered deficient if units fail to comply with ACI 318 requirements for concrete strength.
- D. If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, employ a qualified testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.
1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Engineer.
 2. Test cores in an air-dry condition or, if units are wet under service conditions, test cores after immersion in water in a wet condition.
 3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
 4. Report test results in writing on same day that tests are performed, with copies to Engineer, Contractor, and precast concrete fabricator. Test reports include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Engineer's approval. Engineer reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Do not install precast concrete units until supporting, cast-in-place concrete has attained minimum allowable design compressive strength and until supporting steel or other structure is structurally ready to receive loads from precast concrete units.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.
- B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.
 - 1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - 4. For hollow-core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.
- C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
- D. Field cutting of precast units is not permitted without approval of Engineer.
- E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.
- F. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.

2. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil-thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780/A 780M.
 3. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
 4. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.
- G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
 2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:
 - a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - c. Twist-off Tension Control Bolt: ASTM F 1852.
 - d. Direct-Tension Control Bolt: ASTM F 1852.
 3. For slip-critical connections, use method and inspection procedure approved by Engineer and coordinated with inspection agency.
- H. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.
1. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces.
 2. Fill joints completely without seepage to other surfaces.
 3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
 4. Place grout end cap or dam in voids at ends of hollow-core slabs.
 5. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
 6. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

- A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.
- B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Engineer.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Erection of precast structural concrete members.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.
- D. Testing agency will report test results promptly and in writing to Contractor and Engineer.
- E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.
- G. Prepare test and inspection reports.

3.5 REPAIRS

- A. Repair precast structural concrete units if permitted by Engineer.
 - 1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Engineer.

3.6 CLEANING

- A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03410

SECTION 04720 - CAST STONE MASONRY

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. Cast stone trim including the following:
 - a. Wall caps.
 - b. Pier caps
- B. Related Sections:
 - 1. None.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. RESERVED
- C. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
 - 1. Include building elevations showing layout of units and locations of joints and anchors.
- D. Samples for Initial Selection: For colored mortar.
- E. Samples for Verification:
 - 1. For each color and texture of cast stone required, 10 inches (250 mm) square in size.
 - 2. For colored mortar. Make Samples using same sand and mortar ingredients to be used on Project.
- F. Full-Size Samples: For each shape of cast stone unit required.
 - 1. Make available for Architect's review at Project site.
 - 2. Make Samples from materials to be used for units used on Project.
 - 3. Approved Samples may be installed in the Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer:

1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364.

1. Provide test reports based on testing within previous two years.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Mockups: Furnish cast stone for installation in mockups specified in Section 042000 "Unit Masonry."

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone to avoid delaying the Work.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.7 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 CAST STONE MATERIALS

- A. General: Comply with ASTM C 1364 and the following:
- B. Portland Cement: ASTM C 150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast stone color indicated.
- C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast stone textures and colors.
- D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast stone textures and colors.
- E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
- F. Admixtures: Use only admixtures specified or approved in writing by Architect.
 - 1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
 - 2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
 - 3. Air-Entraining Admixture: ASTM C 260. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
 - 4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.
- G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60 (Grade 420). Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches (38 mm) of cast stone material.
 - 1. Epoxy Coating: ASTM A 775/A 775M.
 - 2. Galvanized Coating: ASTM A 767/A 767M.
- H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304

2.2 CAST STONE UNITS

- A. Manufacturers shall be Certified Producer Members by the Cast Stone Institute®.
- B. Regional Materials: Cast stone units shall be manufactured within 500 miles (800 km) of Project site from aggregates that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.
- C. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.
 - 1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
- D. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
 - 1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
 - 2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
 - 3. Provide drips on projecting elements unless otherwise indicated.
- E. Fabrication Tolerances:
 - 1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch (3 mm).
 - 2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater, but in no case by more than 1/4 inch (6 mm).
 - 3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch (3 mm), whichever is greater.
 - 4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch (3 mm) on formed surfaces of units and 3/8 inch (10 mm) on unformed surfaces.
- F. Cure units as follows:
 - 1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F (38 deg C) for 12 hours or 70 deg F (21 deg C) for 16 hours.
 - 2. Keep units damp and continue curing to comply with one of the following:
 - a. No fewer than five days at mean daily temperature of 70 deg F (21 deg C) or above.
 - b. No fewer than six days at mean daily temperature of 60 deg F (16 deg C) or above.
 - c. No fewer than seven days at mean daily temperature of 50 deg F (10 deg C) or above.
 - d. No fewer than eight days at mean daily temperature of 45 deg F (7 deg C) or above.
- G. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
- H. Colors and Textures: As selected by City from manufacturer's full range.

- I. Color and Texture: Provide units with fine-grained texture and buff color resembling Indiana limestone.
- J. Color and Texture: Provide units with fine texture and red-brown color resembling brownstone on adjacent buildings.

2.3 MORTAR MATERIALS

- A. Provide mortar materials that comply with Section 042000 "Unit Masonry."
- B. Regional Materials: Aggregate for mortar, shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- C. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- D. Hydrated Lime: ASTM C 207, Type S.
- E. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- G. Mortar Cement: ASTM C 1329.
 - 1. **Products:** Subject to compliance with requirements, provide the following, or equal:
 - a. **Lafarge North America Inc.**; Magnolia Superbond Mortar Cement.
- H. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. **Products:** Subject to compliance with requirements, provide the following, or equal:
 - a. **Davis Colors; True Tone Mortar Colors.**
 - b. **Lanxess Corporation**; Bayferrox Iron Oxide Pigments.
 - c. **Solomon Colors, Inc.**; SGS Mortar Colors.
- I. Colored Cement Product: Packaged blend made from mortar cement and mortar pigments, all complying with specified requirements and containing no other ingredients.
 - 1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 - 2. Pigments shall not exceed 10 percent of portland cement by weight.

3. Pigments shall not exceed 5 percent of [masonry cement] [or] [mortar cement] by weight.

J. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

K. Water: Potable.

2.4 ACCESSORIES

- A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.
- B. Dowels: 1/2-inch- (12-mm-) diameter, round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.
- C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.
 1. Manufacturers: Subject to compliance with requirements, provide the following, or equal:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.5 MORTAR MIXES

- A. RESERVED
- B. Do not use admixtures including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.

2. Use mortar cement mortar unless otherwise indicated.
 - C. Comply with ASTM C 270, Proportion Specification.
 1. For setting mortar, use Type N.
 2. For pointing mortar, use Type N.
 - D. Pigmented Mortar: Use colored cement product
 1. Pigments shall not exceed 10 percent of portland cement by weight.
 2. Pigments shall not exceed 5 percent of mortar cement by weight.
 3. Mix to match Architect's sample.
 4. Application: Use pigmented mortar for exposed mortar joints.
 - E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 1. Mix to match Architect's sample.
 2. Application: Use colored aggregate mortar for exposed mortar joints.
- 2.6 SOURCE QUALITY CONTROL
- A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C 1364.
 1. Include one test for resistance to freezing and thawing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

- A. Install cast stone units to comply with requirements in Section 042000 "Unit Masonry."
- B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
 2. Coordinate installation of cast stone with installation of flashing specified in other Sections.
- C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.
- D. Set units in full bed of mortar with full head joints unless otherwise indicated.
1. Set units with joints **1/4 to 3/8 inch (6 to 10 mm)** wide unless otherwise indicated.
 2. Build anchors and ties into mortar joints as units are set.
 3. Fill dowel holes and anchor slots with mortar.
 4. Fill collar joints solid as units are set.
 5. Build concealed flashing into mortar joints as units are set.
 6. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
 7. Keep joints at shelf angles open to receive sealant.
- E. Rake out joints for pointing with mortar to depths of not less than **3/4 inch (19 mm)**. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.
- F. Point mortar joints by placing and compacting mortar in layers not greater than **3/8 inch (10 mm)**. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
- G. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- H. Provide sealant joints at copings and other horizontal surfaces, at expansion, control, and pressure-relieving joints, and at locations indicated.
1. Keep joints free of mortar and other rigid materials.
 2. Build in compressible foam-plastic joint fillers where indicated.
 3. Form joint of width indicated, but not less than **3/8 inch (10 mm)**.
 4. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
 5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.3 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

- A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.

2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.
- B. Keep cavities open where unfilled space is indicated between back of cast stone units and backup wall; do not fill cavities with mortar or grout.
- C. Fill anchor holes with sealant.
 1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.
- D. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.
- E. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.
 1. Form open joint of width indicated, but not less than **3/8 inch (10 mm)**
- F. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
- G. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.4 INSTALLATION TOLERANCES

- A. Variation from Plumb: Do not exceed **1/8 inch in 10 feet (3 mm in 3 m)**, **1/4 inch in 20 feet (6 mm in 6 m)**, or **1/2 inch (12 mm)** maximum.
- B. Variation from Level: Do not exceed **1/8 inch in 10 feet (3 mm in 3 m)**, **1/4 inch in 20 feet (6 mm in 6 m)**, or **1/2 inch (12 mm)** maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than **1/8 inch in 36 inches (3 mm in 900 mm)** or one-fourth of nominal joint width, whichever is less.
- D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than **1/16 inch (1.5 mm)**, except where variation is due to warpage of units within tolerances specified.

3.5 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.
- B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

- C. In-Progress Cleaning: Clean cast stone as work progresses.
 - 1. Remove mortar fins and smears before tooling joints.
 - 2. Remove excess sealant immediately, including spills, smears, and spatter.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
 - 3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
 - 5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04720

SECTION 07115 - BITUMINOUS DAMPPROOFING

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. Cold-applied, cut-back-asphalt dampproofing.
 - 2. Cold-applied, emulsified-asphalt dampproofing.
- B. Related Requirements:
 - 1. None

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.2: For dampproofing, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit IEQ 4: For dampproofing, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer.
- B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.2 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Manufacturers: Subject to compliance with requirements, provide material from the following manufacturers or equal:
 - 1. APOC, Inc.; a division of Gardner-Gibson.
 - 2. BASF Construction Chemicals - Building Systems; Sonneborn Brand Products.
 - 3. Brewer Company (The).
 - 4. ChemMasters, Inc.
 - 5. Euclid Chemical Company (The); an RPM company.
 - 6. Henry Company.
 - 7. Karnak Corporation.
 - 8. Koppers Inc.
 - 9. Malarkey Roofing Products.
 - 10. Meadows, W. R., Inc.
- B. Brush and Spray Coats: ASTM D 4479, Type I, fibered

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.
- B. Cut-Back-Asphalt Primer: ASTM D 41.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.
- C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
 - 1. Extend dampproofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.

3.4 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Unexposed Concrete Wall & Foundations: Apply two brush or spray coats at not less than 1.25 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat.

3.5 CLEANING

- A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07115

SECTION 07920 - JOINT SEALANTS

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. Urethane joint sealants.
- B. Related Sections:
 - 1. Section 02764 "Pavement Joint Sealants" for sealing joints in pavements, walkways, and curbing.

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Engineer.
 - 2. Conduct field tests for each application indicated below:
 - a. Each kind of sealant and joint substrate indicated.
 - 3. Notify Engineer seven days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 - 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with

requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and testing agency.
- B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.
- C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- E. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- G. Field-Adhesion Test Reports: For each sealant application tested.
- H. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
 - 2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
- D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
- E. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Low-Emitting Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- E. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- F. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.2 URETHANE JOINT SEALANTS

- A. Immersible, Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses T and I.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems; Sonolastic NP1.
 - b. Sika Corporation, Construction Products Division; Sikaflex - 1a.
 - c. Tremco Incorporated; Vulkem 116.

2.3 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - 3. Remove laitance and form-release agents from concrete.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of

product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion[].
1. Joint Locations:
 - a. Joints in pedestrian plazas.
 - b. Other joints as indicated.
 2. Urethane Joint Sealant: Immersible, single component, nonsag, traffic grade.
 3. Joint Sealant: .
 4. Joint-Sealant Color: As selected from manufacturer's full range of colors.

END OF SECTION 07920

SECTION 09960 - HIGH-PERFORMANCE COATINGS

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 surface preparation and application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Concrete surfaces.
 - b. Clay masonry.
 - c. Concrete masonry units (CMU).
- B. Related Requirements:
 - 1. None

1.3 DEFINITIONS

- A. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- B. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.
- B. LEED Submittals:
 - 1. Product Data for Credit EQ 4.2: For interior coatings, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit EQ 4: For interior coatings, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Samples for Initial Selection: For each type of topcoat product indicated.

- D. Samples for Verification: For each type of coating system and in each color and gloss of topcoat indicated.
1. Submit Samples on rigid backing, 8 inches square.
 2. Step coats on Samples to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- E. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
 3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Coatings: 5 percent, but not less than 1 gallon of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each coating system specified in Part 3.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following, or equal:
 - 1. Tex-Cote, Inc.
- B. Products: Subject to compliance with requirements, provide product listed in other Part 2 articles for the paint category indicated.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a coating system, provide products recommended in writing by manufacturers of topcoat for use in coating system and on substrate indicated.
 - 3. Provide products of same manufacturer for each coat in a coating system.
- C. Colors: The concrete wall shall be coated with two distinct colors, a primary color and an accent color, selected by the Owner during the submittal review process.

2.3 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
- B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi at 6 to 12 inches.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions.
 - 1. Clean surfaces with pressurized water. Use pressure range of 100 to 600 psi at 6 to 12 inches.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Concrete & Precast Stone Substrates:
 1. Water-based, high build, advanced epoxy-acrylate resin system, sand finish
 - a. XL70® “W” Bridge Cote®

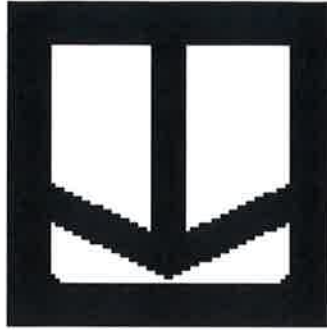
END OF SECTION 09960



Cocoa Promenade Project

City of Cocoa, Florida

APPENDIX A – SUBSURFACE INVESTIGATION REPORT



UNIVERSAL ENGINEERING SCIENCES

SUBSURFACE EXPLORATION

Concrete Docks, Promenade for Riverfront Park
Cocoa, Brevard County, Florida
Universal Project No. 0330.1900108.0000

October 16, 2019

PREPARED FOR:

City of Cocoa, Public Works
155 N. Wilson Avenue
Cocoa, Florida 32922

PREPARED BY:

Universal Engineering Sciences, Inc.
820 Brevard Avenue
Rockledge, Florida 32955
(321) 638-0808

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 • Panama City • Pensacola • Fort Pierce • Tampa • West Palm Beach • Atlanta, GA • Tifton, GA



UNIVERSAL ENGINEERING SCIENCES

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- Atlanta
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- Palm Coast
- Panama City
- Pensacola
- Rockledge
- Sarasota
- Tampa
- West Palm Beach

October 16, 2019

City of Cocoa, Public Works
155 N. Wilson Avenue
Cocoa, Florida 32922

Attention: Mr. Frank Mirabito

Reference: Subsurface Exploration
Concrete Docks, Promenade for Riverfront Park
Cocoa, Brevard County, Florida
Universal Project No. 0330.1900108.0000

Dear Mr. Mirabito:

Universal Engineering Sciences, Inc. (Universal) has completed a subsurface exploration at the above referenced site in Cocoa, Brevard County, Florida. Our exploration was authorized by Ms. Rebecca Bowman of the City of Cocoa under Purchase Order #75065 and was conducted as outlined in Universal's Proposal No. 0330.0719.00022. This exploration was performed in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed 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 our descriptions of the subsurface conditions encountered engineering recommendations concerning foundation design parameters for the proposed concrete dock structures.

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.

Sincerely yours,

UNIVERSAL ENGINEERING SCIENCES, INC.

Certificate of Authorization No. 549

Brad Faucett, M.S. P.E.
Regional Engineer
Florida Registration No. 33123

1 – Addressee (by e-mail)

UES DOCS# 1717152



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Key to Boring Logs Appendix A
Boring Logs Appendix A

EXHIBITS

GBA Document..... Exhibit 1

1.0 INTRODUCTION

Universal Engineering Sciences, Inc. (Universal) has completed a subsurface exploration for the proposed concrete docks at Riverfront Park in Cocoa, Brevard County, Florida. Our exploration was authorized by Ms. Rebecca Bowman of the City of Cocoa under Purchase Order #75065 and was conducted as outlined in Universal's Proposal No. 0330.0719.00022. This exploration was performed in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

2.0 PROJECT DESCRIPTION

Universal understands from review of partial site plans and other information, provided by Infrastructure Solution Services (ISS), the project civil engineers, that the proposed project includes the construction of two concrete docks to be constructed in the general area of the boring locations shown on the attached Figure 1 along/over the river frontage at Riverfront Park in Cocoa, Florida.

We understand that the proposed docks will consist primarily of concrete, supported upon a system of concrete piling. We understand that the proposed piling will be either 12 or 14 inches square pre-stressed concrete with an allowable compressive pile load of 17 tons for the seaward piles and 25 tons for the landward piles.

In addition, a short retaining wall (i.e. knee wall), approximately 18 inches high, will be constructed on the landward portion of each dock.

If any of the above information is incorrect or changes prior to construction, please contact Universal immediately so that we may revise the recommendations contained in this report, as necessary. In order to verify that our recommendations are properly interpreted and implemented, Universal should be allowed to review the final design and specifications prior to the start of construction.

3.0 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 hinder the proposed development;
- to provide geotechnical engineering recommendations for site preparation procedures and foundation design parameters.

4.0 SITE DESCRIPTION

The subject site is located on the east side of Riverfront Park, south of Harrison Street, in Cocoa, Florida. There are currently two wooden gazebos at the riverfront, which are to be replaced with the two proposed concrete docks. At the time of drilling, the site was relatively level with a vegetative cover of mostly grass.

4.1 SOIL SURVEY

The majority of the site soils within Lee Wenner Park are mapped as Urban Land (Ur) according to the Brevard County Soil Survey (BCSS) issued 1974. Urban Land (Ur) is described as areas that are 60 to more than 75 percent covered with streets, buildings, large parking lots, shopping centers, industrial parks, airports, and related facilities.

4.2 TOPOGRAPHY

According to information obtained from the United States Geologic Survey (USGS) Cocoa, Florida quadrangle map, dated 1949, photorevised 1970, ground surface elevation across the general site area is approximately +0 to +5 feet National Geodetic Vertical Datum (NGVD).

5.0 SCOPE OF SERVICES

The services conducted by Universal during our subsurface exploration program are as follows:

- Drill two (2) Standard Penetration Test (SPT) borings adjacent to the existing seawall at the proposed dock locations to a depth of 60 feet below the existing land surface (bls).
- Secure samples of representative soils encountered in the soil borings for review, laboratory analysis and classification by a Geotechnical Engineer.
- Measure the existing site groundwater levels and provide an estimate of the typical wet season groundwater levels at the boring locations.
- Conduct soil gradation tests on selected soil samples obtained in the field to determine their engineering properties.
- Assess the existing soil conditions with respect to the proposed construction.
- Prepare a report which documents the results of our subsurface exploration and analysis with geotechnical engineering recommendations.

6.0 LIMITATIONS

This report has been prepared in order to aid the client/engineer in the design of the proposed concrete docks to be constructed at the east side of Riverfront Park in Cocoa, Florida. The scope is limited to the specific project and locations described herein. Our description of the project's design parameters represents our understanding of the significant aspects relevant to soil and foundation characteristics. In the event that any changes in the design or location of the structures as outlined in this report are planned, we should be informed so the changes can be reviewed and the conclusions of this report modified, if required, and approved in writing by Universal.

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. Please note that this report does not reflect the full vertical and horizontal extent of soft silt bottom soils encountered at this project and, therefore, this report should not be used for estimating such items as cut and fill quantities.

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, Universal does not recommend relying on our boring information to negate presence of anomalous materials or 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 such anomalous conditions or estimate such quantities. Therefore, Universal 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 Universal 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 Universal to locate or identify such concerns. Universal 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.

For a further description of the scope and limitations of this report please review the document attached within Exhibit 1 "Important Information About Your Geotechnical Engineering Report" prepared by GBA/The Geoprofessional Business Association.

7.0 FIELD METHODOLOGIES

The two (2) SPT borings, designated B1 through B2 on the attached Figure No. 1, were performed in general accordance with the procedures of ASTM D 1586 (Standard Method for Penetration Test and Split-Barrel Sampling of Soils). The SPT drilling technique involves driving a standard split-barrel sampler into the soil by a 140 pound hammer, free falling 30 inches. The number of blows required to drive the sampler 1 foot, after an initial seating of 6 inches, is designated the penetration resistance, or N-value, an index to soil strength and consistency. The soil samples recovered from the split-barrel sampler were visually inspected and classified in general accordance with the guidelines of ASTM D 2487 (Standard Classification of Soils for Engineering Purposes [Unified Soil Classification System]).

The SPT soil borings were performed with an ATV mounted drilling rig. Universal located the test borings in the field using a hand held GPS receiver. No survey control was provided on-site, and our boring locations should be considered only as accurate as implied by the methods of measurement used. The approximate boring locations are shown on the attached Figure No. 1.

8.0 LABORATORY METHODOLOGIES

8.1 PARTICLE SIZE ANALYSIS

We completed #200 sieve particle size analyses on six (6) representative soil samples. These samples were tested according to the procedures listed ASTM D 1140 (Standard Test Method for Amount of Material in Soils Finer than the No. 200 Sieve). In part, ASTM D 1140 requires a thorough mixing the sample with water and flushing it through a No. 200 sieve until all of the particles smaller than the sieve size leave the sample. The percentage of the material finer than the No. 200 sieve helps determine the textural nature of the soil sample and aids in evaluating its engineering characteristics. The percentage of materials passing the #200 sieve is shown on the attached boring logs.

9.0 SOIL STRATIGRAPHY

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 stabilized groundwater levels are shown on the boring logs included in Appendix A. The Key to Boring Logs, Soil Classification Chart is also included in Appendix A. 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 the following Table I. For more detailed soil profiles, please refer to the attached boring logs.

TABLE I
GENERALIZED SOIL PROFILE

Depth Encountered (feet, bls)	Approximate Thickness (feet)	Soil Description
Surface	6 to 8	Fill soils consisting of fine sands with varying quantities of silt, clay lumps, plastic pieces, gravel and traces of roots [SP-SM]; loose to medium dense. At boring location B2, a large quantity of gravel was encountered from a depth of 2 to 6 feet bls.
6 to 8	36 to 44	Highly interlayered strata consisting of fine sands with varying quantities of silt, clay, broken shell [SP, SP-SM, SP-SC, SM, and SC]; loose to medium dense. At boring location B1, occasional cemented rock layers were encountered at a depth of 14 feet bls.
42 to 52	8+ to 18+	Fine sands with silt [SP-SM] with occasional cemented rock layers; medium dense.

NOTE: [] denotes Unified Soil Classification system designation.
+ indicates strata encountered at boring termination, total thickness undetermined.

10.0 GROUNDWATER CONDITIONS

10.1 EXISTING GROUNDWATER CONDITIONS

We measured the water level in the boreholes on September 30, 2018 after the groundwater was allowed to stabilize. The groundwater level is shown on the attached boring logs. The groundwater level depth was measured at 4.3 feet bls at boring location B1 and 5.9 at boring location B2. 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.

11.0 LABORATORY RESULTS

11.1 PARTICLE SIZE ANALYSIS

The soil samples submitted for analysis were classified as fine sands with silt [SP-SM], silty fine sands [SM], and clayey fine sands [SC]. The percentage of soil sizes passing the #200 sieve size are shown on the boring logs at the approximate depth sampled.

12.0 PROPOSED CONCRETE DOCKS

12.1 ANALYSIS

We understand that the construction of the two (2) docks will consist primarily of concrete framing, supported upon a system of concrete piling. We understand that pile capacities on the order of approximately 17 and 25 tons in compression will be desired for an efficient foundation system.

The following recommendations are made based upon our understanding of the proposed construction, our experience with similar projects and our familiarity of the subsurface conditions at the project site. If the structural loadings or grading plans change from those discussed previously, we request the opportunity to review and possibly amend our recommendations with respect to those changes.

12.2 RECOMMENDATIONS – DRIVEN PRE-STRESSED CONCRETE PILES

In order to provide adequate protection against scour and achieve the desired compressional capacities, we recommend that the proposed 12 and 14 inch square pre-stressed concrete piles be installed to a tip elevation of -20 feet NGVD, roughly 13 to 17 feet below “mudline” levels. This would translate to the piling bypassing the loose surficial strata and deriving support from the underlying dense sand & shell layers.

Assuming that the piling is installed according to our recommendations, we estimate that maximum total vertical settlements of the docks will be less than 1 inch and maximum differential settlements will be less than ½ inch. Almost all of the expected settlement will take place as soon as the full dead weight of the structures is in place.

Assuming that the pile installation techniques recommended in this report are followed, we estimate that individual pre-stressed concrete piles will exhibit the approximate capacities as listed in the following Table II:

TABLE II
ESTIMATED PRESTRESSED 12" x 12" & 14" x 14" CONCRETE PILE CAPACITIES

Pile Size (Inches)	Allowable Compressional Capacity (tons)	Allowable Tensional Capacity (tons)
12 x 12	44	6
14x 14	58	7

* The pile capacities listed above have been estimated using the procedures developed by Meyerhof (1976). Based on the recommended procedures listed in "Standard Guidelines for the Design and Installation of Pile Foundations" by ASCE, the above listed allowable capacities are based on a factor of safety (FS) of 2.0 for compression. Tensional Capacity is based upon a factor of safety (FS) of approximately 3.0.

Piles have lower capacities in groups. Spacing them at least 3 pile diameters apart, center to center, can significantly minimize the group effect. A reduction for group effect will depend upon the number of piles in a group and their respective positions. For preliminary design purposes, a 100 percent efficiency of the single pile allowable load has been assumed; however, if pile spacings less than 3 pile diameters are used, then a lower efficiency factor will become necessary. In addition, installing piles at a spacing of less than 3 pile diameters could cause significant increases in driving stresses and is not recommended for this project.

Specific requirements for driven piles are detailed in the Florida Building Code under Sections 1808 and 1809. These requirements cover group strength, installation methods, reinforcement cover, etc.

Driven piles are highly dependent on quality of workmanship and other factors. For these reasons, we strongly recommend that all pile installations be monitored by a Universal representative. This is necessary in order to determine if piles are being installed properly by the contractor, provide an accurate record of the installation, and provide an opportunity to correct anomalous or unforeseen conditions during the pile placement work.

A wave equation analysis using the data from contractor's hammer type, hammer cushion material, stroke setting, pile cushioning material, etc should be performed to help predict pile stresses versus driving resistance, prior to the start of test pile/production pile installations.

We recommend that two (2) piles be tested (prior to production pile operations) by instrumentation with a Pile Driving Analyzer (PDA) in accordance with FDOT Specification 455, during driving (including re-strikes at least 2 days later) operations to help confirm the design pile depth and capacity. The test piles should be installed with the same men, methods, and equipment that the production piles will be placed.

The geotechnical engineer and structural engineer should review the results of the PDA testing prior to the final order of specific piles or lengths. The review is to assess whether installation techniques must be modified, pile lengths changed, etc.

As an additional safety factor, we recommend that production piles be at least 5 feet longer than necessary to reach the minimum embedment elevation of -20 feet NGVD.

The piling contractor should be aware that difficult driving conditions may occasionally occur at some locations and depths due to obstacles at the mudline or sporadic pockets of dense sand & shell and/or cemented rock layers.

12.3 LATERAL PILE CAPACITIES

The lateral capacity of a piling system is highly dependent upon the compressive loadings and the configuration of the piles within the cap system. Once the final configuration of the foundation system has been chosen, a lateral analysis using ALLPILE7 software package can be performed. However, at this point we believe that the pile lateral loadings of at least 3 tons per pile can be maintained with minimal lateral deflection (i.e. less than 1 inch).

13.0 PROPOSED KNEE WALL

Based upon the results of the soil borings, the existing fill and native soils within the proposed short retaining (knee) wall areas have a generally medium dense consistency. This has helped to provide a soil mat capable of dissipating the building loads over any remaining loose strata at depth.

Provided our suggested site preparation procedures are followed, we recommend designing conventional, shallow spread footing foundations for a maximum allowable soil-contact pressure of 2,000 pounds per square foot (psf). Even though computed soil-contact pressures may not warrant it, strip and square footings should have minimum widths of at least 18 and 24 inches, respectively to prevent "shear punch" deformations. The base of all footings should be at least 18 inches below finished grade elevation.

The only remaining concern would be the densification of any soil pockets that are disturbed during construction activities. This could be accomplished by re-compacting such pockets with small to mid-sized vibratory plates or rollers to a density of at least 95% of the modified Proctor test (ASTM D-1557) to a depth of at least 12 inches below bottom of footing levels.

Assuming any loosened pockets are densified and the footings are designed according to our recommendations, we estimate maximum total vertical settlements of the proposed wall will be less than 1 inch and maximum differential settlements will be less than ½ inch. Almost all of the expected settlement will take place as soon as the soil fill and structural loads have been applied to the densified existing sandy soils.

Backfill behind/in front of the proposed knee wall should consist of sandy soils with less than 10% fines content [SP, SP-SM, or SP-SC], also compacted to at least 95% of the modified Proctor test (ASTM D-1557).

Assuming that the retaining walls will be smooth concrete, we recommend using the parameters listed in the following Table III for the in-situ sands and/or on-site and imported free draining fine sand backfill soil for the retaining wall design.

TABLE III
LATERAL EARTH PRESSURE DESIGN PARAMETERS (Level Backfill) *

Design Parameter	Recommended Value
At-rest Earth Pressure Coefficient, K_o	0.5
Active Earth Pressure Coefficient, K_a	0.3
Passive Earth Pressure Coefficient, K_p	3.0
Wet Unit Soil Weight (pounds per cubic foot - pcf)	112
Submerged Unit Weight of Soil (pcf)	65
Coefficient of Friction (sliding)	0.3
Angle of Internal Friction, Φ	30

* For sloping backfill, uniform surcharge or transient loads, the table values must be adjusted.

Please note that the Table III values do not include a factor of safety and therefore, the designer should incorporate an appropriate factor of safety (note that uplift and lateral hydrostatic pressures could be exerted on the structure during the time the groundwater level behind the walls is at peak levels from natural or man-induced causes. These forces should also be included in the proposed design).

14.0 EXCAVATIONS

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 (29 CFR Par 1926) dated October 31, 1989. 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.

15.0 SPECIAL CONSIDERATIONS

Vibrations produced during pile driving & compaction operations at the site may be significantly noticeable within 100 feet and may cause settlement distress of adjacent structures if not properly regulated. Therefore, provisions should be made to monitor these vibrations by Universal so that any necessary modifications in the pile driving operations can be made in the field before potential damages occur. In addition, the conditions of the existing adjacent structures should be ascertained and documented prior to pile driving operations. Slight cosmetic damage (e.g. hairline cracks in stucco, plaster, or masonry) may occur in conjunction with compaction operations.

16.0 CLOSURE

The soil and groundwater conditions encountered during our subsurface exploration of the property and the results of the laboratory analysis identified no problems that will significantly hinder development of the proposed project, as we currently understand it, using conventional construction practices. Standard methods of pile installation and vibratory compaction should be applicable to this portion of the proposed project.

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.

We recommend the owner retain the Universal Rockledge office to provide inspection services during the site preparation procedures for confirmation of the adequacy of the pile driving operations. Field tests and observations include verification of pile installation procedures and testing of compacted fill & native soils.

* * * * *



FIGURES

SUBSURFACE EXPLORATION		BORING LOCATION PLAN	
Drawn By:	Wistenly Alphonse	Checked By:	Brad Faucett, P.E.
Project No:	0330.1900108.0000	Date:	October 14, 2019
Scale:		Date:	October 14, 2019
PROMENADE FOR RIVERFRONT PARK COCOA, FLORIDA			
1" = 20' Approx			



* Figure is based upon an aerial

Approximate Boring Locations



APPENDIX A



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.: 0330.19000108.0000

REPORT NO.:

APPENDIX: A

PROJECT: Promenade for Riverfront Park

BORING DESIGNATION: B1

SHEET: 1 of 2

Cocoa, Florida

SECTION: TOWNSHIP: SOUTH

RANGE: EAST

CLIENT: City of Cocoa

G.S. ELEVATION (ft):

DATE STARTED: 9/26/19

LOCATION: SEE BORING LOCATION PLAN

WATER TABLE (ft): 4.3

DATE FINISHED: 9/26/19

REMARKS:

DATE OF READING: 9/30/2019

DRILLED BY: OG, MC

EST. W.S.W.T. (ft):

TYPE OF SAMPLING:

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N-VALUE	W.T.	SYMBOL	WELL DIAGRAM	DESCRIPTION	-200 (%)	MC (%)	K (IN./ HR.)	ORG. CONT. (%)
0							fine SAND with silt and clay lumps, plastic pieces and trace of gravel (fill), brown, [SP-SM]	9.2	14.2		
		7-8-11	19				fine SAND with silt, broken shell and clay lumps (fill), brown, [SP-SM]				
		7-5-4	9								
5		3-5-2	7					10.5	21.2		
		6-6-7	13				fine SAND with clay and broken shell, gray, [SP-SC]				
		5-4-4	8								
10		2-2-3	5								
							fine SAND with broken shell, grey, [SP]				
15		5-6-7	13				fine SAND with silt, broken shell and occasional cemented rock layers, gray, [SP-SM]				
20		5-7-7	14				fine SAND with broken shell, grey, [SP]				
							fine SAND with silt and broken shell, gray, [SP-SM]				
25		11-14-18	32								
30		8-10-13	23				silty fine SAND with broken shell, gray, [SM]				

STANDLOG



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.: 0330.19000108.0000

REPORT NO.:

APPENDIX: A

PROJECT: Promenade for Riverfront Park
Cocoa, FloridaBORING DESIGNATION: B1
SECTION: TOWNSHIP: SOUTHSHEET: 2 of 2
RANGE: EAST

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N-VALUE	W.T.	SYMBOL	WELL DIAGRAM	DESCRIPTION	-200 (%)	MC (%)	K (IN./ HR.)	ORG. CONT. (%)
35		4-3-2	5					19.8	38.2		
40		3-3-3	6								
45		3-2-4	6				fine SAND with silt, broken shell and occasional cemented rock layers, gray, [SP-SM]				
50		5-5-6	11								
55		5-8-8	16								
60		7-10-11	21				BORING TERMINATED AT 60'				

STANDLOG



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.: 0330.19000108.0000

REPORT NO.:

APPENDIX: A

PROJECT: Promenade for Riverfront Park

BORING DESIGNATION: B2

SHEET: 1 of 2

Cocoa, Florida

SECTION: TOWNSHIP: SOUTH

RANGE: EAST

CLIENT: City of Cocoa

G.S. ELEVATION (ft):

DATE STARTED: 9/26/19

LOCATION: SEE BORING LOCATION PLAN

WATER TABLE (ft): 6.9

DATE FINISHED: 9/26/19

REMARKS:

DATE OF READING: 9/30/2019

DRILLED BY: OG, MC

EST. W.S.W.T. (ft):

TYPE OF SAMPLING:

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N-VALUE	W.T.	SYMBOL	WELL DIAGRAM	DESCRIPTION	-200 (%)	MC (%)	K (IN./ HR.)	ORG. CONT. (%)
0							fine SAND with silt, traces of roots and clay lumps (top soil), dark brown, [SP-SM]				
							fine SAND with silt, clay lumps and trace of broken shell (fill), brown, [SP-SM]	9.4	18.3		
							fine SAND with broken shell and heavy gravel (fill), grey, [SP]				
5		3-4-4	8								
		3-7-6	13				fine SAND with broken shell, grey, [SP]				
10		4-3-3	6								
15		1-4-8	12				fine SAND with clay and broken shell, gray, [SP-SC]				
20		4-5-6	11								
25		8-13-8	21								
							fine SAND with silt, gray, [SP-SM]				
30		12-15-14	29					13.4	24.9		

STANDLOG



UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.: 0330.19000108.0000

REPORT NO.:

APPENDIX: A

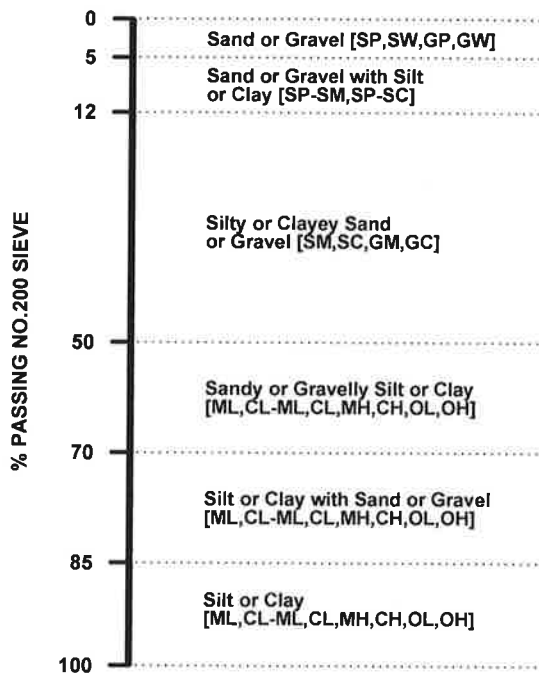
PROJECT: Promenade for Riverfront Park
Cocoa, FloridaBORING DESIGNATION: B2
SECTION: TOWNSHIP: SOUTHSHEET: 2 of 2
RANGE: EAST

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N-VALUE	W.T.	SYMBOL	WELL DIAGRAM	DESCRIPTION	-200 (%)	MC (%)	K (IN./ HR.)	ORG. CONT. (%)
35		7-11-7	18								
40		2-6-9	15								
45		2-2-3	5				clayey fine SAND, grey, [SC]				
50		4-4-6	10					13.6	21.4		
55		6-7-8	15				fine SAND with silt and occasional cemented rock layers, gray, [SP-SM]				
60		4-4-4	8				BORING TERMINATED AT 60'				

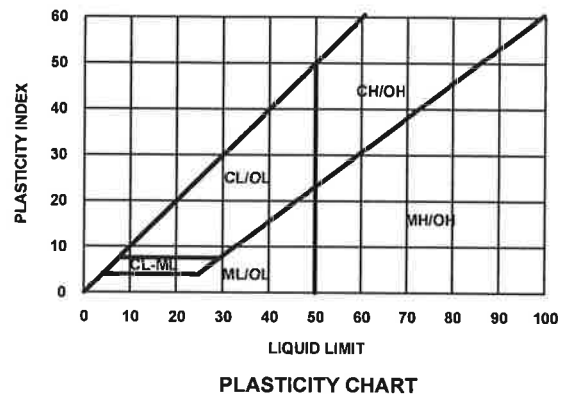
STANDLOG

KEY TO BORING LOGS

SOIL CLASSIFICATION CHART*



**UNIVERSAL
ENGINEERING
SCIENCES, INC.**



GROUP NAME AND SYMBOL

COARSE GRAINED SOILS

	WELL-GRADED SANDS [SW]		WELL-GRADED GRAVELS [GW]
	POORLY-GRADED SANDS [SP]		POORLY-GRADED GRAVELS [GP]
	POORLY-GRADED SANDS WITH SILT [SP-SM]		POORLY-GRADED GRAVELS WITH SILT [GP-GM]
	POORLY-GRADED SANDS WITH CLAY [SP-SC]		POORLY-GRADED GRAVELS WITH CLAY [GP-GC]
	SILTY SANDS [SM]		SILTY GRAVELS [GM]
	CLAYEY SANDS [SC]		CLAYEY GRAVELS [GC]
	SILTY CLAYEY SANDS [SC-SM]		

FINE GRAINED SOILS

	INORGANIC SILTS SLIGHT PLASTICITY [ML]
	INORGANIC SILTY CLAY LOW PLASTICITY [CL-ML]
	INORGANIC CLAYS LOW TO MEDIUM PLASTICITY [CL]
	INORGANIC SILTS HIGH PLASTICITY [MH]
	INORGANIC CLAYS HIGH PLASTICITY [CH]

HIGHLY ORGANIC SOILS

	ORGANIC SILTS/CLAYS LOW PLASTICITY [OL]**
	ORGANIC SILTS/CLAYS MEDIUM TO HIGH PLASTICITY [OH]**
	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS [PT]**

RELATIVE DENSITY

(SAND AND GRAVEL)

VERY LOOSE - 0 to 4 Blows/ft.
LOOSE - 5 to 10 Blows/ft.
MEDIUM DENSE - 11 to 30 Blows/ft.
DENSE - 31 to 50 Blows/ft.
VERY DENSE - more than 50 Blows/ft.

CONSISTENCY

(SILT AND CLAY)

VERY SOFT - 0 to 2 Blows/ft.
SOFT - 3 to 4 Blows/ft.
FIRM - 5 to 8 Blows/ft.
STIFF - 9 to 16 Blows/ft.
VERY STIFF - 17 to 30 Blows/ft.
HARD - more than 30 Blows/ft.

IN ACCORDANCE WITH ASTM D 2487 - UNIFIED SOIL

* CLASSIFICATION SYSTEM.

** LOCALLY MAY BE KNOWN AS MUCK.

NOTES:
8" - DENOTES DYNAMIC CONE PENETROMETER (DCP) VALUE
R - DENOTES REFUSAL TO PENETRATION
P - DENOTES PENETRATION WITH ONLY WEIGHT OF DRIVE HAMMER
N/E - DENOTES GROUNDWATER TABLE NOT ENCOUNTERED

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

APPENDIX A.1



EXHIBIT 1

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.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in 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.

Geotechnical-Engineering 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 given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives 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 this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- 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. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it.* A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only from the design drawings and specifications*. Remind constructors that they may

perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include 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.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering 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 subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old*.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration*. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists*.



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Cocoa Promenade Project

City of Cocoa, Florida

APPENDIX B – City of Cocoa Utilities Technical Provisions and Standard Details

The City of Cocoa Utilities Technical Provisions and Standard Details



The City of Cocoa Utilities

TECHNICAL PROVISIONS AND STANDARD DETAILS MANUAL



John A. Walsh, P.E.
Utilities Director

Manual Committee
Utilities Engineering Division
Utilities Water Field Operations Division
Utilities Wastewater Division

Effective June 1, 2017

(Refer to Page IX for "Technical Provision Revisions")



Utilities Department
351 Shearer Boulevard | Cocoa, FL 32922
Phone: (321) 433-8700 | Fax: (321) 433-8708

June 1, 2017

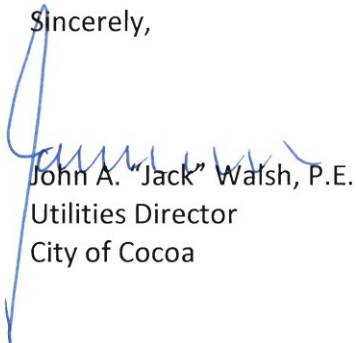
Subject: City of Cocoa Technical Provisions

To Whom It May Concern:

Enclosed is the current revision of Cocoa's Technical Provisions. Construction of all potable water, reclaimed water, and sanitary sewer facilities shall conform to these Technical Provisions to be accepted for transfer of ownership and maintenance by the City of Cocoa. The City of Cocoa proudly supports and requires buying USA domestic materials whenever possible.

Please note this document is date sensitive and will be updated on a regular basis. For the most recent version, please contact the Engineering Division at 321-433-8797 or online at www.cocoafl.org/. The document is located under the Department Tab then Utilities. If you see areas in this document that should be updated, please email your comments to the Engineering Supervisor George Toler at gtoler@cocoafl.org.

Sincerely,



John A. "Jack" Walsh, P.E.
Utilities Director
City of Cocoa

1. WATER – POTABLE AND RECLAIMED

June 1, 2017

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TECHNICAL PROVISION REVISIONS

DATE	SPECIFICATION #	DRAWING	APPROVED MATERIAL	COMMENTS
10/17/13	2. Wastewater Appendices A & B			Changed page numbers from 39 to 117
10/17/13	2. Wastewater Appendices A & B			Updated Table of Contents page numbers
11/6/13			Tapping Sleeves	Added "Bolt Bracket" to Line 6
11/6/13			Tapping Sleeves	Added "TPS" Triple Tap Tapping Sleeve
11/6/13	Section 2.2.2.1			Added paragraph for Boot Connectors
11/6/13		3" & LARGER METER WITH BACKFLOW PREVENTER		Modified Drawing
11/6/13		DOUBLE LINE STOP DETAIL		Modified Drawing
11/6/13		LINE STOP DETAIL		Modified Drawing
11/6/13		TAPPING SADDLE AND VALVE		Modified Drawing
11/6/13		TYPICAL MANHOLE		Modified Drawing
11/6/13		TYPICAL MANHOLE WITH OUTSIDE DROP		Modified Drawing
11/6/13		FORCE MAIN CONNECTION TO MANHOLE		Modified Drawing
12/17/13			McWane Ductile Iron	Added McWane Ductile Iron to approved materials
11/7/14		TYPICAL REQUIRED SEPARATION		Modified Drawing
12/15/14				Replaced City of Cocoa Logo and Letterhead in the City of Cocoa Utilities TP&SD Manual
4/25/17		MASTER METER ASSEMBLY PLAN		Added New Original Drawing
4/25/17		MASTER METER ASSEMBLY METER		Added New Original Drawing
4/25/17		MASTER METER ASSEMBLY DOUBLE CHECK BYPASS		Added New Original Drawing

1. WATER – POTABLE AND RECLAIMED

1. WATER – POTABLE AND RECLAIMED

June 1, 2017

1.1 SCOPE OF WORK

1.1.1 GENERAL

All potable water and reclaimed water mains and appurtenances must be installed in accordance with the City of Cocoa Utilities Department's Technical Provisions and Standard Details, the City of Cocoa Utilities Department Utilities Handbook and the approved plans, for the Construction of the Water Distribution System and the Water Reclamation System.

Contractor requirements include:

- Furnishing all labor, materials, tools and equipment necessary or incidental to the construction.
- Obtaining and paying for all permits, inspections, and other official fees in connection with the work.
- Arranging a pre-construction conference with the Engineering Inspection Division. **All fees must be paid prior to pre-construction meeting.** It is required that the pre-construction meeting be held prior to ordering materials.
- Scheduling materials inspection (24 hours notice), open ditch inspection, pressure/leakage test, and final inspection.
- Provide all documents per the project requirement letter, including but not limited to As Built Drawings, Bills of Sale, Easements, etc.

Any deviation from these requirements must be approved in writing by the Utilities Director or his designee prior to commencement of construction.

Fees charged by the City are set by City Council by resolution and are listed on the appendix "Water Service Rates and Charges" made a part of the Utilities Handbook. Fees are subject to change without notice. The most current fees will be charged.

The Utilities Department and Engineering Division are located at 351 Shearer Blvd., Cocoa, Florida, 32922. The Dispatch telephone number is (321) 433-8718; facsimile number is (321) 433-8708.

1. WATER – POTABLE AND RECLAIMED

June 1, 2017

1.1.2 DEFINITIONS

The term "**approved equal**" is used to mean a part or item that has been approved in writing by the Technical Provision and Standard Details Advisory Committee or the Utilities Director. A written request must be made in order to have an item accepted as an approved equal. Written specifications on the part or item must be furnished with the request.

Approved Tapping/Linestop Contractor - A Contractor who has been approved by the Engineering Division to perform taps or linestops within the Cocoa Water System. Some contractors are only allowed to perform .75" – 2.00" taps for themselves on their on Projects, they may not perform taps for anybody else.

Backflow Preventer Assembly - A Backflow assembly is an approved, testable assembly composed of two independently acting, approved check valves, including tightly closing resilient seated shutoff valves attached at each end of the assembly and fitted with properly located resilient seated test cocks.

Bonafide Tapping Contractor - Means the Contractor is in the business of doing taps or line stops.

Canal - A trench, the bottom of which is normally covered by water, with the upper edges of its two sides normally above water.

City - Means the City of Cocoa.

Collection Mains – Wastewater gravity mains.

Competent Person - A person who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Distribution Main – Any water twelve inches (12") and smaller.

Domestic - Means made or manufactured in the USA.

Drainage Ditch or Irrigation Ditch - A man-made trench which is dug for the purpose of draining water from the land or for transporting water for use on the land and which is not built for navigational purposes.

Force Main – Wastewater main under pressure.

Manual - City of Cocoa Utilities Technical Specification and Standard Details Manual

Normal Working Day - Monday through Friday, excluding CITY holidays.

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Normal Working Hours - Hours are between the hours of 8:00 a.m. to 5:00 p.m. of a NORMAL WORKING DAY.

Passivated – Treated or coated metal to reduce the chemical reactivity of its surface.

Stainless Steel - A steel alloy with a minimum of 10.5% to 11% chromium.

Substantial Completion - The point when the construction project has been finished to the point that the City of Cocoa can use the project for the purpose it was intended.

Swale - A man-made trench which:

- A. Has a top width-to-depth ratio of the cross-section equal to or greater than 6:1, or side slopes equal to or greater than three feet horizontal to one foot vertical;
- B. Contains contiguous areas of standing or flowing water only following a rainfall event;
- C. Is planted with or has stabilized vegetation suitable for soil stabilization, stormwater treatment, and nutrient uptake;
- D. Is designed to take into account the soil erodibility, soil percolation, slope, slope length, and drainage area so as to prevent erosion and reduce pollutant concentration of any discharge.

Technical Provision and Standard Details Committee - Committee whose members shall consist of the manager, or their designee, of the following UTILITIES divisions: Engineering, Inspections, WFO, Wastewater. The committee evaluates and proposes revisions for the design standards, specifications, drawings, products and procedures for the TPSD.

Transmission Main – Any water main sixteen inch (16”) and larger. Fourteen inch (14”) pipelines are not acceptable.

Utilities - Utilities Department of the City of Cocoa, Cocoa, Florida, and/or its designated representative(s).

Whenever a specification from a specific source is cited, the most current revision of that specification will be used. **The word "shall" is mandatory, and the word "may" is permissive.**

Unless otherwise specified, "**City**" means City of Cocoa; "**Utilities Department**" means City of Cocoa Utilities Department; "**Engineering Division**" means City of Cocoa Utilities Department, Engineering Division, "**Inspections**" means City of Cocoa Engineering Inspections Division.

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1.1.3 ABBREVIATIONS

American Association of State Highway and Transportation Officials - AASHTO
Asbestos Cement - AC
Association of PVC Pipe Manufacturers - Uni-Bell
American National Standards Institute - ANSI
American Society of Civil Engineers - ASCE
American Society of Mechanical Engineers - ASME
American Society for Testing and Materials - ASTM
American Water Works Association - AWWA
American Water Works Association Tapered Thread - CC
American Society of Sanitary Engineers - ASSE
Automatic Transfer Switch - ATS
City of Cocoa - CoC
Copper Clad Steel - CCS
Copper Development Association - CDA
Dimension Ratio - DR
Double Check Detector Assemblies - DCDA
Dry Film Thickness - DFT
Ductile Iron Pipe Research Association - DIPRA
Ductile Iron Pipe - DIP
Engineer of Record - EOR
Florida Administrative Code - FAC
Florida Department of Environmental Protection - FDEP
Florida Department of Transportation - FDOT
Florida East Coast Rail Road - FECRR
Foundation for Cross-Connection Control and Hydraulic Research - FCCCHR
Flange - FI
Factory Mutual - FM
Horizontal Directional Drilling - HDD
Jack and Bore - J&B
Maintenance of Traffic - MOT
Manual On Uniform Traffic Control Devices - MUTCD
National Association of Corrosion Engineers - NACE
National Fire Protection Association - NFPA
National Sanitation Foundation - NSF
National Standard Thread - NST
Non-rising stem - NRS
Original Equipment Manufacturer - OEM
Outside Screw and Yoke - OS&Y
National Pollution Discharge Elimination System - NPDES

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Polyvinylchloride - PVC
Portable Changeable Message Signs - PCMS
Precautionary Boil Water Notice - PBWN
Project Manager - PM
Pounds per Square Inch - PSI
Raised Pavement Marker - RPM
Reduced Pressure Zone Assembly - RPZ
Reinforced Concrete Pipe - RCP
Stainless Steel - SS
Technical Provision and Standard Details - TPSD
Traffic Control Plan - TCP
Underwriters Laboratories - UL
Unified Numbering System - UNS
Utilities Department - UD
Variable Frequency Drive - VFD

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1.2 MATERIAL SPECIFICATIONS

1.2.1 PIPE

1.2.1.1 Polyvinyl Chloride Pressure Pipe, 4"-12"

Polyvinyl chloride pressure pipe (sizes 4" through 12") will be cast iron pipe equivalent outside diameter Class 235 (DR 18) conforming to the American Water Works Association's (AWWA) specification C900 and will be blue or white in color. Pipe will be in standard 20-foot lengths. All joints will be of the elastomeric-gasket type with thickened, integral solid-wall bell or coupling with the same DR as the barrel. All PVC pipe and couplings will bear the UL label and NSF approval for potable water.

1.2.1.2 Fusible Polyvinyl Chloride Pipe, 4" thru 12"

Polyvinyl chloride pressure pipe (size 4" through 12") will be cast iron pipe equivalent outside diameter and a pressure rating of 235 p.s.i. (DR 18) conforming to AWWA specification C900 and will be blue or white in color. Fusible PVC pipe shall be supplied by Underground Solutions, Inc. It shall be installed in accordance with the suppliers' specifications. All PVC pipe will bear the UL label and NSF approval for potable water.

1.2.1.3 Ductile Iron Pipe

Ductile iron pipe will be cement-lined pressure Class 350 for 12-inch diameter and smaller and Class 250 for 14-inch and larger conforming to AWWA specification C151. Water main and storm drain crossing conflicts will be properly designed by the project engineer and approved by the Utilities Department prior to installation. Water mains that are less than 10 feet apart from building foundations or other permanent objects will be ductile iron pipe. In no case will water mains be located less than 5 feet from foundations. The above distances will be doubled for water mains larger than 8" in diameter. Polyethylene sleeve conforming to AWWA specification C105 will be provided for all installations. The polyethylene sleeve will be sealed with tape, and shall be blue for water mains.

1.2.1.4 High Density Polyethylene (HDPE) Pipe

HDPE pipe is generally not accepted in the City of Cocoa water system, except as a carrier pipe for a pressurized utility main.

1.2.1.5 Reclaimed Water

PVC pipe installed in reclaimed water systems will be Class 235 (DR 18) conforming to AWWA specification C900 and will be purple in color. Ductile iron pipe installed

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in the reclaimed water system will be pressure Class 350 for 12" and smaller and pressure Class 250 for 14" and larger, provided 3 feet of cover can be maintained. Where cover is less than 3 feet, pressure Class 350 is required. Polyethylene sleeve conforming to AWWA specification C105 will be provided for all installations. The polyethylene sleeve will be sealed with tape, and shall be purple for reclaimed water mains.

1.2.2 VALVES, VALVE BOXES AND VALVE EXTENSIONS

1.2.2.1 Resilient Seat Gate Valves, 4" - 36"

Resilient seat gate valves will have mechanical joint ends as manufactured by American Flow Control; AVK; M&H; U.S. Pipe; Clow; Mueller or an approved equal. The resilient seat gate valves must conform to AWWA specification C509 or C515 and be manufactured in the U.S.A. Resilient seats will be of natural or synthetic rubber and be fully encapsulated to gate. Valves will have 18-8 Type 304 Stainless Steel bolts and nuts. The interior and exterior of the valve body will be fusion bonded epoxy coated in accordance with AWWA specification C550 in order to provide a corrosion-resistant seat. The coating must be applied in a manner to withstand the action of line fluids and operation of the sealing gate under long-term service. Valve seats must seal by compression only. Wedging or sliding of the resilient seat is not acceptable. Valves will be supplied with 2"-square operating nuts and be designed to provide a bubble tight seal regardless of direction of flow. Opening the valve will be in the counterclockwise direction. Valves 16" and larger will have Bevel Gear Operators. For gate valves 16" and larger to be stood up straight, the 2" operating nut must have 12" of cover. Engineer of Record or Contractor must demonstrate the 12" of cover over the 2" operating nut can be achieved by showing all pertinent dimensions. Tapping valves shall have a centering ring.

1.2.2.2 Butterfly Valves, 16" and larger

Butterfly valves shall be used for above ground service. Butterfly valves shall have flanged ends, be rubber seated, 90° tight closing type, short body. The interior and exterior will be fusion bonded epoxy coated in accordance with AWWA specification C550. The valve shaft will be of 316 Stainless Steel. Body dimensions and minimum shaft diameter will be in accordance with Tables 3 and 4 of AWWA specification C504. The valve seat will be of molded natural or synthetic rubber, will be mechanically secured to the disc or to the valve body, and will mate against a stainless steel seat surface. The gear ratio will be such as to require not more than 50 foot pounds of input torque to operate the valve against the worst case of a water flow velocity of 10 feet per second at a pressure of 100 psi differential. A torque-limiting device will be supplied if the allowable operator input is less than

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450 foot pounds. Butterfly valves will have a factory installed handwheel. The valve will open when the operator nut is turned counterclockwise. **Butterfly valves will not be used for buried service.**

1.2.2.3 Valves, 2"

Two-inch valves for use with the 2" blow-off gate valve will be rated at 125 SWP or 200 WOG. All 2" gate valves must meet all EPA and DEP requirements regarding lead and zinc contents. Brass fittings and 2" brass wheel valves are shall be used on blow-offs. All valves must be manufactured in the U.S.A.

1.2.2.4 Valve Boxes

Valve boxes and lids must be manufactured in the U.S.A. Boxes and lids must be structurally equal to those produced by East Jordan Iron Works or Tyler and must have 5-1/4" minimum inside diameter. Cast iron valve boxes will consist of a circular cast iron top and bottom section. The depth must be determined and the appropriate valve box must be installed. No PVC or Ductile is permitted in the valve box. Boxes must be set flush with finished ground surface in such a manner as to permit easy use of a valve wrench and to prevent surface loads from being transmitted to the valve or pipe. Box sections must be telescopic and adjustable. Valve box lids should have the word "WATER" or "SEWER" or "REUSE", as appropriate, cast on the top. A concrete pad (24" L x 24" W x 4" D) will be poured around all boxes at finished grade level unless the valve is located in a paved roadway or parking lot.

1.2.2.5 Valve Extensions

If the depth of the valve nut is greater than 48" below grade, or 30" below grade and under the water table, a valve extension stem will be required. The extension will have a centering collar and will be mechanically attached to the valve operating nut, such as extensions manufactured by the General Engineering Company, Model #4840-0001-3, or an approved equal to be determined by the Engineering Supervisor or his/her designee.

1.2.2.6 Valve Box Debris Shield

All buried valves 4-inch through 12-inch requiring a valve box shall be furnished with a valve box shield (alignment device). The device shall minimize debris infiltration and center the valve box over the operating nut. The device shall be of HDPE or plastic and colored white or black. It shall be furnished in two pieces that will lock together under the operating nut without requiring the removal of the operating nut. The device shall not affect the operation of the valve. No one-piece device will be accepted. The device shall be Box Lok, American or approved equal.

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1.2.2.7 Insert Valve Specification

The Insert Valve shall conform to the following:

The Ductile Iron 250 p.s.i.g. Insert Valve shall be a Resilient Wedge Gate Valve designed for use in potable water, raw water, reclaimed water, wastewater and backflow control systems. The host pipe shall not be a permanent component of the Insert Valve. The ductile iron body, bonnet and wedge provide strength and a pressure rating that meets or exceeds the requirements of AWWA C515. Insert Valve shall be ductile iron construction meeting ASTM A536 Grade 65-45-12. Sizes 12" and smaller must be capable of working on Cast/Grey Iron or Ductile Iron Class A, B, C and D, IPS PVC, C900 and C909 PVC, Steel, AC pipe diameters without changing either top or bottom portion of split valve body. The Insert Valve shall have a 250 psig maximum working pressure. The pressure rating markings must be cast into the body of the insert valve. The construction of the Resilient Wedge shall comply with AWWA C509 requirements. The ductile iron wedge shall be fully encapsulated with EPDM rubber by a high pressure and high temperature compression or injection mold process. The resilient wedge shall seat on the valve body and not the pipe to obtain the optimum seating and flow control results. The resilient wedge shall be totally independent of the carrier pipe. The resilient wedge shall not come into contact with the carrier pipe or depend on the carrier pipe to create a seal. The Resilient wedge must ride inside the body channels to maintain wedge alignment throughout its travel. The insert valve is fully epoxy coated on the interior and the exterior. Valve shall be coated with a minimum of 10 mils epoxy in compliance with AWWA C550 and certified to ANSI/NSF-61. The stuffing box, operating stem and resilient wedge (complete bonnet and all moving parts) shall be removable, repairable and or replaceable under pressure.

See Appendix "A" Approved Materials for approved Insert gate valves.

1.2.3 BACKFLOW PREVENTERS

1.2.3.1 Fireline Check Valves

Check valves for fire line systems will be the Double Check Detector Assemblies (DCDA) manufactured by Febco, Watts, Ames, Apollo or Wilkins, in accordance with AWWA specification C510, ASSE 1048, UL 1469. Check valves must have bronze seats. DCDA must be supplied with a ¾-inch by-pass assembly. DCDA will be accepted as a complete approved assembly in accordance with the section on "Cross-Connection Control and Backflow Prevention" in the Utilities Handbook. The Utilities Department will inspect the interior of the DCDA prior to installation. DCDA must be installed horizontally above ground in a grassed or non-traffic area. The DCDA will be installed with 24" minimum and 30" maximum clearance from finished grade. "N" shaped DCDA will be accepted on a case-by-case basis. Fire

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lines requiring an RPZ will be handled on a case by case base. The Utilities Department shall paint the DCDA, to be paid for by the Developer/Contractor.

1.2.3.2 Meter Station Backflow Preventer

Backflow Preventers for the large meter stations are a Reduced Pressure Zone Assembly and manufactured in accordance with AWWA C-511. The assembly will be installed so as the relief valve opening will be a minimum of 12" above concrete slab. If the meter station is in a planter, the top of the planter is considered the flood rim and the relief valve opening shall be 12" above the flood plain rim. The Utilities Department shall paint the meter station assembly, to be paid for by the Developer/Contractor.

1.2.3.3 Backflow Preventer Certification Test

The Contractor will provide test certifications on the jumper backflow preventer before jumper is placed into service. Backflow preventers on fire-line and meter stations will have test certifications submitted and approved prior to final inspection.

1.2.4 FITTINGS

All fittings must be of the mechanical joint type with an approved joint restraint, or push-on joint with a gasket joint field restraint system, such as "Field Lok" as manufactured by U.S. Pipe or an approved equal. All fittings must be manufactured in the U.S.A.

1.2.4.1 Cast Iron

Cast iron fittings will be AWWA specification C110; Class 250, cement lined with inside seal coating. The fittings will be bituminous coated on the outside and be wrapped with 6 mil polyethylene (sealed with tape).

1.2.4.2 Ductile Iron, 4"-16"

Ductile iron compact fittings (sizes 4" through 16") must conform to AWWA specification C153. Ductile iron compact fittings will be mechanical joint with an interior cement lining with seal coating and an exterior bituminous coating. All fittings will be wrapped with 6 mils polyethylene (sealed with tape).

1.2.4.3 Bolts

All buried mechanical joint bolts and nuts must be CORTEN Steel. All above ground bolts and nuts for flanged fittings must be 18-8 Type 304 stainless steel. Never-seize/Anti-seize shall be applied to all SS bolts and nuts.

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1.2.4.4 Tapping Sleeve

Tapping sleeves on mains 4" to 12" in diameter will be ductile iron body mechanical joint type or All Stainless Steel Sleeve.

The All Stainless Steel Sleeve shall be fabricated from 304 Stainless Steel. They shall have a pass through bolt design and full circumferential gasket to provide 360° seal around the pipe. The tapping sleeve is to be fully passivated to return the stainless steel to its highest corrosion resistance stage.

Sleeves on mains 16" to 24" in diameter will be fabricated steel with O-ring seal, fusion bonded, epoxy coated with 304 stainless steel nuts and bolts or M.J. ductile iron body. Sleeves on mains larger than 24" will be handled on a case-by-case basis.

Tapping Sleeves for reinforced concrete mains will be handled on a case-by-case basis. The sleeves will have a fusion bonded epoxy coating on the entire body and throat assembly. The straps and bolts shall be 18-8 Type 304 stainless steel.

The tapping valve must have centering ring and conform to Section 2.2.1 -Resilient Seat Gate Valves in these Technical Provisions.

Tapping saddles to be placed on asbestos concrete (AC) pipe shall be a JCM 432 All Stainless Steel Sleeve or equal.

1.2.4.5 Line Stop Sleeve Specifications Sizes 4" through 12"

Sleeve/Body

The entire Line Stop sleeve shall be fabricated from 304 Stainless Steel. They shall have a pass through bolt design and provide 360° seal around the pipe. The line stop sleeve is to be fully passivated to return the stainless steel to its highest corrosion resistance stage. Outlet on sleeve will be full port, ie. on 8" sleeve, outlet will be 8", on 6" sleeve, outlet will be 6".

Bolts, Nuts & Washers

18-8 Type 304 Stainless Steel, the bolts shall be track head type and furnished with permanently lubricated heavy-hex nuts and stainless washers.

Gasket

The full circumferential gasket shall be molded of synthetic rubber compounded for use with water salt solutions, mild acids, bases and sewage. The gasket shall have a gridded surface, be a full 1/4" thick with 304 stainless steel bridge plates

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molded flush into the gasket and have a raised hydromechanical outlet seal to seal against line surges and water hammer.

Pressure Rating

The sleeves shall be rated at 150 PSI hydrostatic with a test pressure of 200 PSI on pipe with a full circumferential break.

Line Stop Sleeves shall be JCM 440 Line Stop Sleeve or approved equal.

1.2.5 FIRE HYDRANTS

Fire hydrants must be manufactured in accordance with AWWA specification C502. Hydrants must have bronze-to-bronze main seat threading surfaces. They will be traffic type with drain holes plugged at the factory. Fire hydrants will have 18-8 Type 304 Stainless Steel bolts and nuts (bonnet, traffic flange and shoe).

Hydrants will have a minimum 5-1/4" main valve opening, with one 4-1/2" pumper nozzle, and two 2-1/2" hose nozzles. Nozzles to have NST threads. Stem couplings are to be cast iron or stainless steel. The upper valve plate must be bronze. The hydrant shoe will be coated inside with fusion bonded epoxy, 6 mil minimum. All hydrants will be painted at the factory with Rustoleum high-performance epoxy 9100 system, non-lead, dry film thickness 5 to 8 mils, color #9143 Yellow. City crews will apply finish paint to each new fire hydrant after the Contractor has paid the appropriate fees.

Finish grade is to be established and the proper length hydrant installed be installed by the Contractor prior to acceptance by the City. All nozzles will be a minimum of 18" and a maximum of 24" above finished grade. A 6" mechanical joint hydrant connection will be provided using a hydrant valve-anchoring tee with integrally cast standard mechanical joint gland on 6" plain end branch. The Contractor will not be allowed to install risers on hydrants. At final inspection, if it is determined that a fire hydrant is not at grade, the Contractor shall purchase a proper length hydrant and install it under the direction of Utilities Inspection Department.

1.2.6 SERVICE CONNECTIONS, 3/4"-2"

All service connections will be single connections. Services that are 3/4" and 1" are to be type K annealed temper soft copper. All connections are to be of the flare type. 1-1/2" and 2" services are to be of type K drawn temper in straight lengths or annealed temper if furnished in coils. Absolutely no lead-based solder joints will be accepted. Any repairs of service lines will be by flare-to-flare coupling. No compression fittings will be accepted. Taps in the pipe will be the same nominal diameter as the service line. Service taps in PVC pipe will be drilled with a shellcutter designed to cut PVC pipe, the PVC plug will be removed.

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On January 4, 2014 the following specifications will be in effect for all brass fittings in contact with potable water.

Brass goods furnished under this specification shall be new and unused. All fittings shall conform to ANSI/AWWA Standard C800, latest revision.

All brass components in contact with potable water must be made from either CDA/UNS Brass Alloys C89520 or C89833 with a maximum lead content of .25% by weight. Brass alloys not listed in ANSI/AWWA C800 Paragraph 4.1.2 are not approved. All service fittings shall be certified as suitable for contact with drinking water by an ANSI accredited organization in accordance with ANSI/NSF Standard 61. All fittings shall be stamped or embossed with a mark or name indicating that the product is manufactured from the low-lead alloy as specified above.

Brass saddles shall be made from CDA/UNS C83600 and are exempt from the “no lead” requirement.

1.2.6.1 Saddles

Saddles must be used for all connections to PVC, AC and D.I. pipe. Saddles must be all brass with “CC” threads as manufactured by Mueller Company, Ford Meter Box Company, or Smith-Blair Company. The pipe sizes for these manufacturers are noted below:

MUELLER: For pipe sizes 4" to 12", for 3/4" and 1" services, the single strap design must be used. For 1-1/2" and 2" services, the double strap design must be used.

FORD: For pipe sizes 4" to 12", for 3/4" and 1" services, the style 101B single strap design must be used. For 1-1/2" and 2" services, the style 202B double strap design must be used. For pipe sizes 16" and larger, for 3/4", 1", 1-1/2," and 2" services, the style 202B double strap design must be used.

SMITH-BLAIR: For pipe sizes 4" to 12", for 3/4" and 1" services, the 321 series single strap design must be used. For pipe sizes 4" and larger, for 1-1/2" and 2" services, the 323 series double strap design must be used.

An approved equal may be used in lieu of any of the above-listed designs/models.

1.2.6.2 Curb Stops, 3/4" - 2"

Curb stops 3/4" and 1" in size will be Flare-by-Meter Coupling. **Curb stops must have locking wings and a swivel meter nut.** Curb stops that are 1-1/2" or 2" will be flare-by-flange with locking wing or an approved equal. All curb stops shall be centered in the meter box and installed in a horizontal position.

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1.2.6.3 Corporation Stops, 3/4" - 2"

All corporation stops for water service 3/4" thru 2" will be brass and have "CC" inlet threads and copper flare outlet. 2" Corporation stops for "jumpers" will be "CC"-by- F.I.P.

1.2.6.4 Meter Boxes

Meter boxes are to be plastic with an iron flipper lid with a full pin hinge, Service locations will be permanently cut and painted on concrete curb or the street with a blue "W" for potable water or a purple "R" for reclaimed. Reclaimed services will be located at the opposite lot corner from water services where practical or with five feet minimum separation.

For larger 1-1/2 and 2-inch meters, 17" x 30" meter boxes shall be used.

For areas that are anticipated for high traffic areas, a traffic rate H-20 meter box shall be used. Reclaimed Water services will be set in purple meter boxes per section 2.6.4 above. They are also required to have a 3" x 5" permanent plastic tag, secured to the curb stop with a nylon tie wrap, will be supplied. Tags will be inscribed, "RECLAIMED WATER DO NOT DRINK". Brass fittings used for Reclaimed Water are exempt from the "no lead" requirement.

1.3 PROTECTION OF PROPERTY AND OBSTRUCTIONS

1.3.1 PROTECTION

Temporary supports and/or adequate protection and maintenance must be provided on all underground and surface structures encountered in the progress of the work. Structures that have been disturbed will be restored to a condition equal to their original state upon completion of the work.

1.3.2 OBSTRUCTIONS

All utility owners must be notified prior to beginning construction. Any known obstructions will be shown on the plans. The utmost caution will be taken in all operations to avoid damage to existing obstructions whether or not shown on the plans. Damage to other utilities will be at the Contractors expense.

If the contractor encounters any unforeseen obstructions during construction, he shall immediately cease work in that area and notify the project engineer. The project engineer shall design and provide detailed drawings to correct the situation. The drawings shall be submitted

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to the Engineering Division for approval. After approval by the Engineering Division a set of approved drawings will be given to the contractor and they may resume work.

1.3.3 EXISTING ASBESTOS CEMENT WATERMAINS

In areas where existing asbestos cement water mains are existing, water main relocations or replacements may be necessary. If new construction of facilities is over, under, or near asbestos cement water mains, it shall require that the asbestos cement water main be changed out to poly vinyl chloride pipe or ductile iron pipe. New pipe material shall depend upon the type and location of the facilities being constructed. The Developers Engineer shall design the replacement and submit it for the Utilities Department approval. The Developer is responsible for all design, materials, labor, equipment, testing, and costs for the replacement. Contractor shall remove and dispose of AC pipe in accordance with FAC Codes 62-204.800 and 62-257.

1.4 TRENCH PREPARATION

1.4.1 EXCAVATION

A trench will be opened so that the pipe can be installed to the alignment and depth required. It will be excavated only so far in advance of pipe placement as necessary. The trench will be excavated to the depth required so as to provide a uniform and continuous bearing support for the pipe or undisturbed ground. Bell holes will be provided at each joint to permit jointing to be made and inspected properly.

During excavation, if ashes, cinders, muck or other organic material considered unsuitable uncovered at the bottom of the trench at sub-grade, it will be removed and backfilled with approved material. This material will be compacted in layers to provide a uniform and continuous bearing characteristic of that area's soil condition. Where the bottom of the trench at sub-grade consists of unstable material to such a degree that it cannot be removed and replaced with an approved material to support the pipe properly, a suitable foundation must be constructed. Excavated material will be piled in such a manner that it will not endanger work or obstruct natural watercourses, sidewalks or driveways. Fire hydrants under pressure, valve boxes, or other utility controls will be left unobstructed and accessible at all times. Gutters will be kept clear or other satisfactory provisions will be made for street drainage.

1.4.2 SHORING AND BRACING

Open cut trenches must be sloped, shored or braced as required by all governing State law, municipal ordinances, OSHA Standards, and as may be necessary to protect life, property, or the work. Trench bracing may be removed after backfilling has been completed or has been

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brought up to such an elevation as to permit its safe removal. The use of a trenching box may be used in place of sheeting and bracing where appropriate. Contractor is required to have a Competent Person designated and in charge at all times while workers are in the trench.

1.4.3 DE-WATERING

Excess water must not be allowed in the trench at any time. An adequate supply of well points, headers or pumps, all in first-class operating condition, may be used to remove the water. The use of gravel and pumps will also be an acceptable means of removing the water. The trench will be excavated no more than the available pumping facilities are capable of de-watering. Discharge from pumps will be accommodated in accordance with the St. Johns River Water Management District's requirements. The Contractor is responsible for obtaining all de-watering permits such as NPDES permit.

1.5 PIPE LINE CONSTRUCTION

1.5.1 GENERAL

All water mains, service lines and appurtenances must be installed as specified on the approved plans and in accordance with the Standard Detail Sheet. Installation will conform to AWWA specification C600 except as modified herein.

Domestic water service can only come from a Distribution main. When water service is requested and the only water main available is a Transmission main, a large tap and section of pipe shall be installed on the Transmission Main for the water service.

The minimum size tap on a Transmission Main shall be a six (6) inch.

1.5.2 MATERIAL HANDLING

1.5.2.1 Precautions

Every precaution will be taken to prevent injury to pipe and piping materials during transportation and delivery to the work site. Under no condition will pipe be dropped, bumped, dragged or picked up by inserting forks into end of pipe. Pipe lifted by placing forks into pipe shall be removed from job site.

1.5.2.2 Damaged Materials

If in the process of transportation, unloading or handling, any pipe or fitting is damaged, it will be rejected and removed from the site.

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1.5.2.3 Storage

Pipe fittings and specials will be stored in a manner which will assure the protection of the material from damage and which will keep it clean.

1.5.3 INSPECTION OF MATERIALS

Materials delivered to the job site will be subject to inspection by the Utilities Inspection Department prior to installation. Contractor shall notify Inspections 24 hours in advance. All materials found to be defective or not meeting specifications during inspection or during the progress of the work will be rejected and removed from the job site without delay. All materials delivered to the job site will be in accordance with the materials specifications. Materials not inspected by the Utilities Department prior to installation will be uncovered by the Contractor at his/her expense to verify compliance with these specifications. The Contractor will furnish copies of the packing list(s) for materials upon demand.

1.5.4 PIPE PLACEMENT

The bottom of the trench will not be excavated below the specified grade. If undercutting occurs, the bottom of the trench will be brought up to the original grade with approved material and thoroughly compacted, as directed by the Utilities Department. Before placing pipe into the trench, the outside of the spigot and the inside of the bell will be wiped clean, dry, and free from oil and grease. Every precaution will be taken to prevent foreign material from entering the pipe. During placement operation, no debris, tools, clothing or other material will be placed in the pipe.

All mechanical joints will be made up in strict accordance with the manufacturer's specifications. Beveled ends will be removed from PVC pipe entering a mechanical joint. The bell will be carefully cleaned before the gasket is inserted. Gaskets must be evenly seated, the gland placed in position with the bolts, and evenly tightened. All slip joints will be made up in strict accordance with the manufacturer's specifications.

After placing a length of pipe in the trench, the spigot end will be centered in the bell, the pipe forced home, brought to correct alignment, and covered with an approved backfill material. Ductile iron pipe will be backfilled to the centerline of the pipe and compacted to ninety-five percent (95%) of standard Proctor T-99.

Pipe will be installed with 30" minimum cover. Maximum cover of 42" will be accepted. Cover depth will be determined from proposed finish grade as indicated on the plans. At times when pipe placement is not in progress, the open ends of pipe must be closed by a water-tight plug or other approved means. This provision will apply during the lunch hour as well as overnight. If water is in the trench, the seal will remain in place until the trench is pumped completely dry.

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Pipe installed under swale shall be D.I. and have 3 feet minimum cover. D.I. pipe to be centered on swale. If more than one joint of pipe is necessary, restrained joint pipe is required. See “Swale Crossing” detail and definitions.

Pipe installed under canal or drainage ditch shall conform to all FDEP requirements. Pipe shall be restrained joint D.I. pipe with gate valves on both sides of canal/ditch. D.I. pipe shall have 5 feet minimum cover with a concrete cap. See “Canal or Drainage Ditch Crossing” detail and definitions.

1.5.5 LOCATING WIRE

A #12 Copper Clad Steel (CCS) wire that allows for the location of the pipe using an induced current line locator will be installed on all potable water, reclaimed water, and wastewater mains. The wire must be placed on the top of the pipe and taped approximately every ten feet. A run of wire must run from the main to each hydrant. Each fire hydrant must have one wrap of the wire around the barrel located at final grade.

Wire color shall be blue for water, green for wastewater, and purple for reclaimed.

A run of wire will also be brought up in each valve box. The wire will have 4 feet of excess length. Wire is to be connected together using an underground wire nut with a **silicone-based sealant**.

The CCS wire shall meet the following requirements. HDPE Insulation of 30 mils, #12 AWG conductor, maximum Ohms resistance of 7.565 ohms per 1000 ft., breaking load 256 lbs.

When directional drilling is used, one continuous #12 CCS **extra high strength** locator wire shall be installed. The CCS wire shall meet the following requirements. HDPE Insulation of 45 mils, #12 AWG conductor, maximum Ohms resistance of 7.565 ohms per 1000 ft., breaking load 1150 lbs.

1.5.6 SERVICE LINE LOCATION

Service lines will be located at alternating lot lines outside the sidewalk within two feet of the right-of-way line as shown on approved plans or in a grassed area behind the curb if located in other than a subdivision.

Reclaimed service line is to be located adjacent to sewer cleanouts.

1.5.7 BACKFILLED MATERIAL AND INSPECTION

All backfilling material will be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks, stones, or other material which is considered unsuitable. When backfill

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material is not specified on the plans, backfilling with the excavated material may be acceptable provided that such material is suitable for backfilling. Pipe should be backfilled as soon as possible to minimize the length of open trench. Pipe joints, valves, fittings, and thrust blocks will be left uncovered until inspection by the Utilities Department has been completed.

1.5.8 VALVES AND FITTINGS

All valves and fittings will be set and joined to the pipe in the proper location as shown on the plans. Valves should be installed outside of the pavement where practical. A roadway valve box will be provided for every valve. This valve box must not transmit shock or stress to the valve. Valve will have alignment ring installed and valve box centered and plumb over the wrench nut of the valve. The box cover is to be flush with the surface of the finished pavement or grade level as specified in the plans. A 24"-square concrete pad 4" in thickness will be poured around the valve box when it is located outside of pavement. A bronze or stainless steel disc will be cast into the pad for all valves 12" or larger. Valve nomenclature to be stamped into the disc will include the valve size, type, manufacturer's initials, number of turns, and direction to open the valve. (Example: 12" G.V. U.S.P. 20 c.c.w.)

All valves will be located within two feet of the tee, see detail GATE VALVE AND FITTING DETAIL.

When solid sleeves or couplings are used to join/tie-in pipelines, a SPACER PIECE shall be installed if there is a gap in the pipeline.

1.5.9 FIRE HYDRANTS

All fire hydrants (hydrants) will be located as shown on the plans and marked on the pavement with a blue reflector. On unpaved streets, a blue reflector will be affixed to a post and placed as close to the edge of the road as feasible so as to be easily visible. The hydrants will be located in such a manner as to provide complete accessibility and in a manner so that the possibility of damage from vehicles or injury to pedestrians will be minimized. All hydrants must stand plumb and the bury line of the hydrant at the finished grade. Hydrants installed in State highway rights-of-way will be placed in accordance with any F.D.O.T. requirements. Contractors shall not turn or add risers to hydrants. All hydrants will be connected to the main in the manner shown on the Standard Detail Sheet. If the installation of the hydrant requires the hydrant to be greater than 40 ft. away from the fire hydrant valve, an additional valve shall be installed. If the fire hydrant valve ends up in asphalt of a major road (not subdivision) an additional hydrant valve regardless of distance shall be installed.

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1.5.10 RESTRAINED PIPE JOINTS

The Engineer of Record shall provide a restrained joint detail on drawings submitted to the City for approval. Restraining is to apply to all new fittings installed as part of the job, including tapping saddles.

1.5.11 THRUST BLOCKS AND COLLARS

Thrust blocks may only be used with the City's prior approval at bends, fire hydrants, and as specified on the plans, in accordance with the Standard Detail Sheet. Restrained joint systems are the preferred method. Metal harnesses, tie rods, or clamps of adequate strength to prevent movement may be installed at locations where thrust blocks are not practical. Rods and clamps will be stainless steel. A 20-foot length of ductile iron pipe will be installed at all main endings and a concrete thrust collar will be poured around the pipe at a distance of 10 feet from the end of the joint. In lieu of concrete thrust collar, restrained pipe upstream of the proposed concrete thrust collar may be used.

1.5.12 JACK AND BORE, PIPE INSTALLED IN CASINGS

Pipe to be installed under pavement where open trenching is not permitted will be installed through a steel casing that has been jacked and bored. The casing pipe will be six to eight inches larger than the outside diameter of the bells on the Ductile Iron pipe. The Engineer of Record will design the casing and bore to meet FDOT or FECRR requirements.

Ductile Iron pipe of the appropriate Class will be installed in the casing. Water mains must be pushed or pulled through the casing on stainless steel casing spacers with polyethylene skids attached to the pipe with stainless steel straps. The stainless steel casing spacers with polyethylene skids will be placed in accordance with manufacturer's recommendations. Casing spacers must be manufactured by Cascade or an approved equal. Restrained joints are required on mains installed inside casings.

JACK AND BORE

J&B installed under FDOT roadways shall conform to latest FDOT Design Standard. In the FDOT Standard Specifications for Road and Bridge Construction 2013, Section 556 applies. J&B installed under FECRR shall conform to FECRR requirements.

1.5.13 HORIZONTAL DIRECTIONAL DRILLING

Only DIP and Fusible PVC may be horizontal directional drilled (HDD) under pavement or surface water way crossings. The HDD pipe shall only extend to 10 feet on each side of the crossing. Then the piping will change to the standard piping material.

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HDD installed under FDOT roadways shall conform to latest FDOT Design Standard. In the FDOT Standard Specifications for Road and Bridge Construction 2013, Section 555 applies.

ENGINEERING PROCEDURE HORIZONTAL DIRECTIONAL DRILLS

PRECONSTRUCTION CONFERENCE:

1. A preconstruction conference will be required. The preferred attendees for the preconstruction shall be but not limited to:

- The directional bore contractor (preferably the Field Superintendent)
- The permitting agency
- Engineer of Record
- Engineering Technician
- Inspection Supervisor
- Engineering Inspector for the project

HDD CONTRACTOR:

1. Approval required prior to the HDD, the HDD contractor shall submit a bore plan (see sample drawing in Appendix "B") to the Engineering Supervisor for approval. The bore plan shall be a scaled drawing or computer generated drawing showing the following information but not limited to: *(see drawing typical bore plan)*

- The entrance and exit location
- Profile of the bored pipe
- All utilities including their depths and clearances from reamer
- Width of the right of way
- Pavement width
- Length of the bore
- The bore plan shall be signed by the responsible person in charge of the bore.

2. The HDD contractor shall follow the minimum clearances as shown below from the bottom of the water main to the top of the reamer:

- Water mains 12" and greater minimum clearance is 18"
- Water mains 10" and less minimum clearance is 12"

3. The HDD contractor will be responsible for obtaining locates for all utilities in accordance with Chapter 556 of the Florida Statutes.
4. The HDD contractor shall notify the City of Cocoa Inspection Division 48 hours in advance of the bore and notify the appropriate permitting agency per the conditions of the permit.

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ENGINEERING INSPECTOR:

1. An approved copy of the bore plan will be given to Engineering Inspection Division.
2. The Inspector for the project will have a copy of the bore plan at the project site.
3. Prior to the HDD the Inspector shall verify that the materials at the project site for the directional bore are in accordance with the City of Cocoa's latest technical provisions and standard details.
4. The Engineering Inspector shall verify the following prior to the commencement of the HDD:
 - a. Verify that the HDD contractor has obtained his/her utility locates.
 - b. Verify that all utilities have been visually spotted by the HDD contractor.
 - c. Verify that the permitting agency has been notified of the HDD.
 - d. Witness the calibration of the sonde.
5. The Inspector shall remain at the project site until completion of the HDD. Any discrepancies shall be immediately reported to one or all of the following:
 - Engineering Supervisor
 - Engineering Technician
 - Inspection SupervisorOnce the above persons have been notified by the Inspector, the proper authority will be notified for corrective action.

COMPLETION OF THE BORE:

1. A bore log shall be submitted to the Engineering Division after completion of the bore.

1.5.14 BLOWOFFS

Flushing blow-offs are to be installed and constructed as shown on the Standard Detail Sheet. Blow-off materials include 2" brass for nipples, brass threaded fittings, 2" brass angle wheel valve, and plastic meter box (purple for reclaimed). The plastic meter box is to be installed at grade over the wheel valve. The angle wheel valve will be within six inches of finished grade and will be plugged with a brass plug. 4" blow-offs will be required on both potable water and reclaimed water mains 12" and larger and must be constructed as shown on the Standard Detail Sheet. A reclaimed tag will be installed on reclaimed main blow-offs in a reclaimed meter box.

Brass used in potable water shall meet the low lead requirements as set forth in Section 2.6

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1.6 TIE-INS TO EXISTING SYSTEMS

1.6.1 GENERAL

The Contractor is not to operate any valve or remove any thrust block from City-owned mains except under direct supervision of an Inspector of the Utilities Department. All Contractors must follow the procedures listed below for connecting new mains to existing water systems.

1.6.1.1 Mains 8" and smaller

Tie-in valves will be operated and pressure tested to verify water tightness prior to the tie-in. Valves that are not water tight, shall have a new valve installed immediately adjacent (within 2') to the existing valve. The Contractor will provide a 2" tap on the new main and a 2" tap on the existing main at the tie-in valve. A 2" jumper equipped with a City supplied meter and contractor supplied backflow preventer (double check) will be installed. The jumper will be utilized for filling the main, flushing the main, providing water for bacteriological sampling, and maintaining pressure in the main after a successful bacteriological test. The tie-in valve is not to be operated and the jumper is not to be removed until clearance has been obtained from FDEP and the City. The Engineer of Record will be required to provide an executed FDEP certificate of completion prior to clearance. After clearance, the tie-in valve will be opened, the jumper removed, and the main thoroughly flushed under the supervision of the City Inspector. All other existing valves closed as part of the job will be opened by the contractor under the supervision of Utilities Department Inspector.

1.6.1.2 Mains 10" and larger

The same procedure as noted for mains 8" and smaller will be used for mains 10" and larger except that the jumper will be utilized only for filling the main, providing water for bacteriological sampling, and maintaining pressure in the main after a successful bacteriological test. The tie-in valve can be opened for flushing and during chlorination only under the supervision of the Engineering Inspection Division. The tie-in valve is not to be operated and the jumper is not to be removed until clearance has been obtained from FDEP and the City. After clearance, the tie-in valve will be opened, the jumper removed, and the main thoroughly flushed under the supervision of the City Inspector. All other existing valves closed as part of the job will be opened by the contractor under the supervision of Utilities Department Inspector.

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1.7 TESTING

1.7.1 GENERAL

All newly installed pipe and services that have been backfilled must be tested in accordance with AWWA specification C651.

1.7.2 JUMPER METER ASSEMBLY

All filling, and flushing, must be accomplished through a jumper meter assembly. The jumper meter assembly shall consist of a meter (provided by the City, paid for by the Developer/Contractor), and a double check backflow preventer and galvanized piping (provided by the Contractor). The jumper meter assembly shall be installed by the Contractor under the direct supervision of the Utilities Department Inspector. After installation the Contractor shall have the backflow preventer certified by a backflow technician, and a copy of the test report shall be provided to the Utilities Department.

1. A temporary jumper connection is required at ALL connections between existing active water mains and proposed new water main improvements, per the City of Cocoa Utilities Handbook. The only exception is the installation of a new fire hydrant involving a tap and using an anchoring/swivel nipple. In this case all fittings and fire hydrant SHALL be swabbed with a 100 ppm chlorine solution prior to installation.
2. The details to be used for filling any water main of any size from existing active water mains and for flushing of new mains up to 8" diameter (2.5 FPS minimum velocity) and for pulling bacteriological samples from any new water main of any size. The jumper connection shall be maintained until after filling, flushing, testing and disinfection of the new main has been successfully completed and clearance for use from the Florida Department of Environmental Protection (FDEP) and other pertinent agencies has been received. The jumper connection shall also be used to maintain a minimum pressure of 20 psi in the new mains all the time after disinfection and until the FDEP clearance letter is obtained. Adequate thrust blocking and/or restraints shall be provided temporarily, as required. Pipe and fittings used for connecting the new pipe to the existing pipe shall be disinfected prior to installation in accordance with AWWA C651. This tapping sleeve and the exterior of the main to be tapped shall be disinfected by spraying or swabbing per Section II of AWWA C561.
3. Flushing of 10" diameter and larger water mains may be done through the tie-in valve, in the presence of the Utility Department. The Utility Department will be notified in writing 48 hours prior to the flushing of said mains.

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The following procedures shall be followed:

- A. The tie-in valves shall be operated and pressure tested in the presence of the Engineering Inspection Division or Engineer to verify water tightness prior to the tie-in. Valves which are not watertight shall be replaced or a new valve installed immediately adjacent to the leaking valve.
- B. The temporary jumper connection shall be constructed as detailed. The jumper connection shall be used to fill the new water main and for providing water for bacteriological sampling of the new main as required by the FDEP permit.
 - Flushing shall not be attempted during peak demand hours of the existing water main.
 - All downstream valves in the new system must be open prior to opening the tie-in valve.
 - Provide for and monitor the pressure at the tie-in point, the pressure in the existing main must not drop below 35 psi.
 - Tie-in valve shall be opened a few turns only, ensuring a pressure drop across the valve is always greater than 10 psi.
4. The contractor shall provide documentation demonstrating that the double check backflow prevention device has been tested and is in good working order at the time of installation. The test shall be performed by a qualified backflow prevention technician.
5. Except as required to flush lines of greater than 8" in diameter, the tie-in valve shall remain closed. The tie-in valve shall remain closed until the new system has been cleared for use by FDEP and all other pertinent agencies.
6. Upon receipt of clearance for use from FDEP and all other pertinent agencies, the contractor shall remove the jumper connection. The corporation stops are to be closed and plugged with 2" brass plugs.
7. All installation and maintenance of the temporary jumper connection and associated backflow prevention device fittings, valve, etc., shall be the responsibility of the contractor.

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1.7.3 FLUSHING AND SWABBING

The City will provide an adequate volume of water for the filling, flushing, and testing of mains. The Contractor will notify the Engineering Inspection Division prior to flushing or filling mains. The pressure in the City's system will be monitored during the flushing; at no time should the pressure in the City's system be allowed to drop below 40 psi. Water used during flushing will be billed to the Contractor.

The City of Cocoa Utilities Department requires all new mains regardless of size or material to be pigged/swabbed. In an effort to make sure all footages of a pipeline are pigged, the following procedures are to be used as a guide and in no way to be construed as means and methods.

The following terminology may be used in the discussion or operation of the pigging procedure.

Pigs shall be manufactured of a 2lb. per cu/ft density open cell polyurethane foam body (swab) complete with rear polyurethane drive seal.

Pig launching station may be a “wye”, “tee” or simple inserting the pig at the very beginning of the pipeline. The beginning of the pipeline is defined at the jumper assembly location.

Pig retrieval point or cannon is a “wye”, “tee” or open end of pipe at which point the pig will exit the pipeline.

The pipeline will be filled through the jumper assembly the day before of the pigging operation.

The pig will be advanced through the pipeline at a rate of 2 feet per second, 80 gpm for 4”; 180 gpm for 6”; 320 gpm for 8”. Flow rates and jumper assemblies for mains 10” and larger will be determined by the Engineer of Record and approved by the City of Cocoa Utilities Department.

The pig retrieval point or cannon will project at least one foot above the surrounding grade. The water from the pig retrieval station discharge and its location to discharge shall be approved by the Utilities Department. The contractor will be responsible for following the National Pollutant Discharge Elimination System (NPDES) requirements to remove chlorine from discharge as well as protect retrieval area from erosion. Retrieval cannons will not be left in place. After pigging and flushing are complete, the cannon will be removed and capped below ground in accordance with Engineer of Record details or City of Cocoa Standard Details.

The contractor may insert the pig into the first section of pipe between the isolation valve and the downstream point of jumper assembly. By inserting the pig between the isolation valve and the downstream jumper assembly point it will allow the pipeline to be filled without moving the pig down the pipeline. If the pig is moved during filling operation another pig will

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be inserted into the pipeline. The isolation valve may be cracked open for a few seconds under the direction of Utility personnel to move the pig past the jumper assembly downstream point so the jumper assembly can advance the pig through the pipeline.

When the pig exits the pipeline, the flushing will continue until the water is clear. A simple way to determine if water is running clear is to capture some water in a WHITE cup. If water is clear and no particles in cup then flushing is complete, if not flushing will continue until water is clear.

1.7.4 HYDROSTATIC TEST

A blow-off or fire hydrant will be installed at the end of the pipeline under test. The line being tested will be slowly filled with water to the specified test pressure. Before applying the specified test pressure, all air will be expelled from the test section including service connections. If fire hydrants or blow-offs are not available at high elevations, taps at points of highest elevation will be made to facilitate air removal and testing. When testing is complete, the service lines installed for air removal must be removed.

The line must hold the 150-psi test pressure for a two-hour test period and must be witnessed by Engineering Inspection Division personnel. Sufficient human resources are to be employed to insure inspection. If the line fails to meet the test, it will be repaired and re-tested until the test requirements are satisfied. Line pressure will be maintained to within 5 psi of the test pressure at all times.

1.7.5 LEAKAGE TEST

A leakage test at 150 psi will be performed on all newly installed sections of pipe in accordance with AWWA C600 or C605 after installation of all service connections. Any leakage observed must be less than the following per thousand feet of pipe:

SIZE	ALLOWABLE LEAKAGE
2"	0.20 Gallons/Hour
4"	0.33 Gallons/Hour
6"	0.50 Gallons/Hour
8"	0.67 Gallons/Hour
10"	0.83 Gallons/Hour
12"	1.06 Gallons/Hour
14"	1.16 Gallons/Hour
16"	1.32 Gallons/Hour

$$L = \frac{SD \sqrt{P}}{148000}$$

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L = testing allowance (makeup water), in gallons per hour

S = length of pipe in feet

D = nominal diameter of pipe, in inches

P = average test pressure during the hydrostatic test, in pounds per square inch (gauge). P has the square root taken.

On small main extensions where the allowable leakage loss cannot be reasonable measured (.25 gallons or less), NO LOSS OF PRESSURE shall be allowed.

1.8 DISINFECTION & BACTERIOLOGICAL TESTING

1.8.1 GENERAL

The Contractor must flush mains and arrange for complete disinfection by chlorination in coordination with the Engineering Inspection Division. Work will conform to applicable provisions of AWWA specification C651, "Disinfecting Water Mains." Water with a chlorine concentration of 50 ppm will be evenly distributed throughout the pipe system and allowed to remain in the pipe for twenty-four hours. Transmission mains may be chlorinated using the "slug method". If the slug method is used, a detailed written procedure shall be submitted for approval. The main shall be dechlorinated to zero ppm chlorine before any flushing is performed. The method for dechlorination shall be approved by the Engineer of Record. After flushing, the water shall remain in the pipe for 24 hours before sampling. Service connections and tie-ins made before testing must be disinfected in accordance with AWWA specification C651. Samples will be taken by a Utilities Department approved laboratory. Two consecutive day samples are required for potable water mains. Water mains shall not be flushed between samples. The Contractor will be responsible for ALL bacteriological testing fees. Sample points are determined by the Engineer of Record and approved by FDEP. If samples taken do not demonstrate satisfactory results, re-chlorination is required.

Disinfection of reclaimed water mains is performed in the same manner as potable water mains. Bacteriological testing of the repaired reclaim water main will be performed in compliance with regulatory agencies such as the Florida Department of Environmental Protection, and requires one day of satisfactory bacteriological results. Sample points for reclaimed water mains are determined by the Engineer of Record. Samples are collected Monday through Thursday by City of Cocoa designated personnel. To schedule a sample pickup, please contact the Lab Manager at 321-433-8707. If samples taken do not demonstrate satisfactory bacteriological results, re-chlorination and re-sampling is required. A fee will be charged by the City for additional sample collection and analysis.

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CONTRACTORS WORKING ON EXISTING MAINS

When existing water mains are taken out of service by contractors, and water service to existing customers is interrupted causing a PBWN, the water main will be taken out of service on Monday or Tuesday. If for some reason the water main cannot be taken out of service on Monday or Tuesday, then the contractor at their expense shall have the laboratory perform bacteriological testing after normal working hours. This procedure is to lessen the time water customers are under a PBWN.



Utilities Department
351 Shearer Blvd. | Cocoa, FL 32922-7203
Phone: (321) 433-8700 | Fax: (321) 433-8708

BACTERIOLOGICAL TESTING PROCEDURES BY PRIVATE LABORATORIES

The following information shall be completed and certified by the Testing Lab and Sampling Company. If any of the information is not completed, is answered “no”, or is not certified, the bacteriological results will not be accepted by the City.

A copy of the City of Cocoa pressure test report must be provided to the Sampling Company prior to samples being collected.

If any of the samples do not pass the bacteriological test, then all the sample points shall be retested.

Testing Laboratory Certification

1. The private laboratory is certified by the State of Florida in microbiology membrane filtration and/or MMO-MUG. YES _____ NO _____ **Attach a copy of the certification.**

I certify that the bacteriological testing has been completed in accordance with the applicable provisions of F.A.C. and the previous information.

Lab Official _____ Cert. # _____ Date _____

Signature

Company _____





Utilities Department
351 Shearer Blvd. | Cocoa, FL 32922-7203
Phone: (321) 433-8700 | Fax: (321) 433-8708

Sampling Certification

2. The Sampling Company is a private laboratory or a company solely in the business of collection of bacteriological samples. YES _____ NO _____

Personnel collecting samples must follow the procedures outlined in AWWA C651 Section 7.3 Sampling Procedure and Standard Methods for the Examination of Water and Wastewater.

3. The Sampling Company assumes the chain of custody for the bacteriological samples. The samples were taken by the private Sampling Company personnel from the locations indicated on the project's FDEP permit. YES _____ NO _____

4. The chlorine residual was determined at the time of sampling and was no greater than 5.0 parts per million (PPM). **Total and Free chlorine residuals are to be indicated for each sample taken.** YES _____ NO _____

5. Two consecutive sets of acceptable samples were taken at least 24 hours apart. YES _____ NO _____

I certify that the bacteriological sampling has been completed in accordance with the applicable provisions of F.A.C., AWWA specifications, and items 2, 3, 4, and 5 above.

Sampling Official _____ Cert. # _____ Date _____

Signature

Company _____

This form (not a copy) must accompany the original forms of the bacteriological results and the Testing Laboratory Certification. The bacteriological test reports and a copy of the pressure test report are to be sent to the City of Cocoa Engineering Division for approval.

If any of these procedures and certifications is not followed, the bacteriological tests will not be accepted by the City of Cocoa and will delay the FDEP Permit clearance process.



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1.9 CONNECTION TO EXISTING SYSTEM

1.9.1 GENERAL

Connections to existing City transmission mains (16" and larger) will be made by Approved Tapping Contractor under the direction of the Engineering Inspection Division. On transmission mains, the Approved Tapping Contractor will install the tapping sleeve and valve. For all connections from 4" – 12" the Contractor may install tapping saddles under the supervision of the Engineering Inspection Division. For all water main connections, the Contractor must obtain all required permits; provide a dry pit area, all pit preparation including shoring and bracing, maintenance of traffic, all right-of-way restoration; and notify all utilities prior to construction. Taps on RCP, PVC, AC, or DIP mains must be made by a tapping Contractor who has been approved by the Utilities Department.

Tapping saddles and valves supplied by the Contractor will be inspected by the Engineering Inspection Division prior to installation. The installed tapping saddle and valve must be tested with water at 100 psi for 15 minutes prior to tapping to insure a watertight installation. Saddles installed on RCP mains will be tested 10% over line pressure. The pressure test will be performed by the Contractor and witnessed by the Engineering Inspector. After the pressure test of the saddle has been completed an Approved Tapping Contractor can tap the main.

1.9.2 TAPPING AND LINSTOP PROCEDURES

- ALL 0.75" – 12" TAPS or LINSTOPS on City of Cocoa potable, reclaimed and wastewater mains will be performed by an Approved Tapping Contractor (see approved list).*
- ALL 16" and larger TAPS or LINSTOPS on City of Cocoa Transmission Mains will be performed by bonafide tapping contractors ONLY. Contractors will be approved on a case-by-case basis. Bonafide means the Contractor is in the business of doing taps or line stops.*
- Absolutely NO taps or linestops will be performed on Friday or any day preceding a holiday.
- Approved contractors to disinfect tapping machine with AWWA approved disinfectant. This will be witnessed by a City of Cocoa inspector.
- The contractors tapping or linestop machines will be in good working order with appropriate bits and shell cutters for the type of pipe being worked on (ie. shell cutter for PVC)**
- When taps or linestops are installed on Transmission Mains (> 12"), a preconstruction meeting will be held with the tapping contractor prior to ANY work being performed. The meeting maybe held at the job site.

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- Taps and linestops on the Utilities reinforced concrete mains will be a two (2) day process. Day one the saddle is installed and grouted, Day two tighten straps, cut prestressing wires, install throat and valve. Pressure test on saddle is 10-15% over line pressure for 30 minutes. After successfully completing pressure test, tap can be made.
 - ALL excavations must conform to current OSHA Trench Safety Act.
 - The City of Cocoa reserves the right to remove any contractor from the approved list for any work considered substandard.
- * Tap or linestop to include: Material, installation, labor, drilling and testing
** Bit, boring bar & adaptor

1.10 FINAL CLEAN-UP AND ACCEPTANCE

1.10.1 GENERAL

Upon completion of the work and before acceptance by the Utilities Department, the Contractor will meet all permit conditions, remove all debris, and complete sodding, sprigging, or seeding if required by the plans. The Contractor will leave all areas affected by his/her operations in a neat and presentable condition.

Acceptance of completed work by the City will be contingent on the following work items completed to the satisfaction of the Engineering Inspection Division.

- Pressure Test
- Bacteriological Testing
- Restoration
- Payment of fees
- Approved As-Builts
- Easements
- Bill of Sale
- Final Inspection

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1.11 FIRE SERVICE

1.11.1 GENERAL

All Fire Lines shall be installed by a licensed Fire Line Contractor in accordance with Florida Statute Chapter 633 and Rule Chapter: 69A-46. Where wet pipe sprinkler service is used, an appropriate backflow prevention device will be installed in accordance with the "Cross-Connection Control and Backflow Prevention" section of the Utilities Handbook.

Fire line DCDA shall be installed in non-traffic areas. Four to six bollards maybe required.

1.12 CONNECTION OF BUILDINGS OVER FOUR FLOORS

1.12.1 GENERAL

Connection of domestic water supply systems serving buildings over four floors in height to the City's water distribution system will be subject to the following requirements:

- A fixture unit analysis will be performed by the Owner's engineer to determine peak domestic flow requirements. This analysis is to be provided to the Engineering Division.
- A water meter and a reduced pressure backflow preventer, sized in accordance with the domestic flow requirements, will be installed above ground at the developer's expense.
- Upon written request, the City will provide the site engineer with the minimum expected system pressure. The site engineer will be responsible for providing this information to the architect and building owner. Means for providing an adequate supply of domestic water and fire protection to all parts of the building during periods of minimum pressure will be the responsibility of the building Architect or Engineer of Record.
- Repair costs for damage to the water meter caused by flows exceeding its rated capacity will be charged to the customer.

1.13 BACKFLOW PREVENTERS

1.13.1 GENERAL

Backflow preventers must be installed at locations where cross-connections may occur. The need for backflow preventers will be determined by the Utilities Department. Backflow

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preventers will be the reduced pressure type assemblies. Backflow preventers will have interior fusion bonded epoxy coating 5 to 12 mils, and will be installed above grade in accordance with manufacturer's recommendations on a concrete slab adjacent to the meter. Backflow preventers are to be approved in accordance with the "Cross-Connection Control and Backflow Prevention" section of the Utilities Handbook.

1.14 RECORD DRAWINGS

1.14.1 GENERAL

Record drawings are required for all systems to be accepted by the Engineering Division. Record drawings will be prepared by a surveyor or an engineer registered in the State of Florida and will contain the following information:

- Location of all valves, service lines, fittings and fire hydrants using at least two ties to permanent points (manholes, power poles, curbs, or storm water inlets). An acceptable station and offset system may be used for service lines and fittings only.
- Location of mains from property easement lines or edge of pavement at intervals of 300 feet.
- Elevations to the top of the water line at intervals of 300 feet and at all drainage and sewer main crossings. Bench mark to be shown on record drawings.
- Separation between reclaimed water or force mains and water mains if they are installed within 10 feet of water mains.
- Water main material and distance of mains from buildings or structures within 20 feet of the water main.
- Distance from hydrant to hydrant valve.
- Pertinent easement information.
- Certification by the surveyor or Engineer of Record accepting responsibility for accuracy of information supplied on the record drawings and a statement certifying that all mains are within easements and/or public right-of-way. The name "City of Cocoa" must appear on all record drawing survey information.

Record drawings will be drawn at an engineering scale that is legible and readable as determined by city staff. Areas requiring additional detail may be enlarged as necessary. Right-

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of-way, easements, and lot lines will be accurately shown. After the surveyor or engineer has certified the locations, the engineer will certify on DEP Form 62-555.900(9) that the system depicted on the record drawing was constructed in substantial conformance with approved plans and will function as intended. Lot, block numbers, and street names will be included. Provide two (2) sets of signed and sealed record drawings and one (1) digital file including all reference files (XREF). AutoCAD 2010 or higher, or DXF format shall be provided to the City.

CAD drawing standards for record drawings will be available from the Engineering Division upon request. These standards will provide for isolated layer information, text height, font, line type and weight, specific standard symbols (blocks), etc. which will allow transfer of record drawing data to city as-built maps in a standardized format.

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2.1 SCOPE OF WORK

2.1.1 GENERAL

Refer to Water - Potable & Reclaimed, Section 1.1 - Scope of Work in these Technical Provisions.

2.2 MATERIAL SPECIFICATIONS

2.2.1 GENERAL

The contractor will furnish all new materials of the size and kind shown on the drawings which will meet the following specifications or requirements. If the type of material is not specified on the drawings, the contractor may use any of the types listed in this specification. The use of concrete for repairs on gravity sewer piping and lateral tie-ins is not permitted.

2.2.2 CONCRETE STRUCTURES

2.2.2.1 Precast Manholes

Precast manholes must be constructed in accordance with American Society of Testing and Manufacturing (ASTM) specification C478. Concrete will have a minimum 28-day compressive strength of 4,000 PSI. Cement will be Type II sulfide resistant. Steel will be minimum Grade 40 and placed as shown on the drawings. Shop drawings of manholes and lift station wet wells will be submitted to the Engineering Division for approval prior to casting. Chairs for supporting reinforcing steel will be non-corrosive plastic or Grade 316 stainless steel. Standard manholes will be 4 feet in diameter with a wall thickness of 5" for manholes of 6 feet in depth or less and wall thickness of 8" for manholes deeper than 6 feet.

Resilient connectors (boots) shall be used where PVC pipe penetrates manhole walls. Boots shall be NPC Kor-N-Seal or approved equal, watertight and shall be manufactured of materials resistant to decay caused by the sanitary sewer environment or by ambient soil conditions. All hardware shall be stainless steel. Boots shall be installed in accordance with manufacturer's recommendations.

2.2.2.2 Flotation Uplift of Fiberglass Manhole

When a fiberglass manhole is specified, the EOR shall provide the design analysis showing where flotation uplift is counteractive.

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2.2.3 PIPE

2.2.3.1 PVC Pipe and Fittings, DR35

PVC pipe and fittings (DR 35) will be manufactured in accordance with ASTM specification C3034. DR 35 pipe is acceptable on gravity installations with a depth of 12.0 feet or less. Pipe will be of the elastomeric gasket joint type supplied in lengths of 12.5 feet. Solid wall ribbed PVC pipe with a stiffness of 60 psi or greater will be considered on a case-by-case basis at the discretion of the Engineering Division. Critical installations, as determined by the Engineering Division, will require use of poly-lined ductile iron pipe.

2.2.3.2 PVC Pipe, DR-18

PVC pipe (DR-18) will be manufactured in accordance with AWWA specification C900. DR-18 pipe is required for pressure force main installation. Pipe will be of the elastomeric gasket joint type. Color-coded identification tape will be installed on all force mains.

2.2.3.3 Ductile Iron

Ductile iron pipe will be Protecto 401 ceramic Epoxy for force main, gravity, and valve pit installation. Exposed piping in valve pits will be pressure Class 350 with coal tar epoxy exterior coating. Buried ductile iron pipe will be wrapped in a color coded polyethylene encasement in accordance with ANSI/AWWA C105-T1.

2.2.4 MANHOLE ACCESS COVERS

2.2.4.1 Cast Iron

Cast iron manhole covers and rings must be traffic load bearing similar to USF No. 225-AS-ORS having an O-Ring seal. Bearing surfaces will be machined to produce a tight, even seating surface without rocking. Minimum clear opening will be 24". The word(s) "SEWER" or "SANITARY SEWER" will be cast into manhole covers. Manholes installed in high water areas will be sealed by a method approved by the Engineering Division.

2.2.4.2 Aluminum

Aluminum access covers will be designed for 300 PSF live load and will be equipped with stainless steel hinges, automatic lock mechanism in the open position, closed position lock hasp, and retractable grip for opening.

See Detail Sheets:

Manhole Ring and Cover

Check Valve Vault

Lift Station

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2.2.5 COATINGS

2.2.5.1 Water Based Acrylic

The interior and exterior surfaces of manholes shall be coated with a three-coat water based acrylic coating. The interior and exterior coats shall be factory applied, with a total of 12 mils DFT. Each of the coats will be 4 mils thick of contrasting colors. The interior shall be coated red, black and a final grey coat. The exterior shall be coated red, gray and a final black coat.

2.2.5.2 HDPE Sheet Lining

Where an HDPE liner is specified, the entire wall surface of the manhole will be protected with a high density polyethylene liner cast into the concrete. This liner must be AGRU Sure Grip as manufactured by Alois Gruber or approved equal. All joints will be heat fusion welded to create a water-tight lining. Such lining must be warranted against defects in materials and workmanship for a period of five years from date of installation.

2.2.5.3 Exposed Piping

Exposed piping, pumps, and equipment exposed to raw sewage in manholes, valve pits and wet wells will be coated with a two-coat coal tar epoxy exterior coating system with a minimum DFT of 12-15 mils. Coal tar epoxy will be Rustoleum 9578 or approved equal. Equipment and pump information tags will not be painted. Pump discharge piping in lift station wet wells will be stainless steel, refer to Section 9.3.2.

2.2.6 MISCELLANEOUS MATERIALS

2.2.6.1 Manhole Steps

Manhole steps are not permitted.

2.2.6.2 Hardware

All nuts, bolts, washers, anchors and brackets inside the wet well or manhole must be manufactured from Grade 316 stainless steel. Bolts for fastening flanged fittings inside the valve pit may be steel, coated with the specified piping coating system. Never-seize/Anti-seize shall be applied to all SS bolts and nuts.

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2.3 CONSTRUCTION

2.3.1 LOCATION AND GRADE OF SEWERS

The line and the grade of the sewer, as well as the location of manholes, services and all other appurtenances, will be as shown on the drawings. The grade line as given on the drawings indicates the grade of the invert of the sewer pipe.

Gravity sewer shall be designed and constructed with the following maximum and minimum slopes:

SIZE	MAXIMUM	MINIMUM
4"	1.14%	1.04%
6"	.66%	.60%
8"	.36%	.33%
10"	.28%	.25%
12"	.22%	.20%

The Engineer of Record shall certify that the slopes of the gravity sewer meet the above maximum and minimum slopes. Sewer lines with slopes not meeting the above maximum and minimum slopes will be rejected.

"As-built" drawings shall show the gravity line slopes.

Sewers shall be laid with uniform slope and straight alignment between manholes. Gravity sewer pipe shall be installed with the bell end upstream. The pipe shall be installed from downstream to upstream unless specific permission is obtained from the Utilities Division. Manholes shall be designed with a minimum difference of 0.04 feet between the invert elevations of the incoming and outgoing sewers.

2.3.2 MATERIAL HANDLING

2.3.2.1 Precautions

All supplies shall be stored and maintained by the contractor per manufacturer's recommendations. Every precaution will be taken to prevent injury to pipe and piping materials during transportation and delivery to the work site. Under no condition will pipe be dropped, bumped, dragged or picked up by inserting forks into end of pipe. Pipe lifted by placing forks into pipe shall be removed from job site.

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2.3.2.2 Damaged Materials

If in the process of transportation, unloading or handling, any pipe or fitting is damaged, it will be rejected and removed from the site.

2.3.2.3 Storage

Pipe fittings and specials will be stored in a manner which will assure the protection of the material from damage and which will keep it clean. Sun damaged materials exposed to adverse conditions will be rejected.

2.3.3 TRENCH EXCAVATION, SHORING, AND SHEETING

2.3.3.1 Trenches

Sewer trenches will not be opened in advance of the placing of the sewer pipe for a distance greater than that required to install the sewer pipe. In no case will the open trench ahead of the sewer pipe exceed 25 feet. Backfill in the pipe zone will be accomplished immediately after jointing the pipe to prevent movement.

2.3.3.2 Shoring, Sheeting, and Bracing of Excavations

The excavation must be sheeted and braced when necessary to prevent cave-in during excavation in unstable material or to protect adjacent structure, property, workers, and the public. The sheeting will be maintained in place until the pipe or structure has been placed and backfilled. Shoring and sheeting will be removed, as the backfilling is done, in a manner that will not damage the pipe or structure or permit voids in the backfill. All sheeting, shoring, and bracing of excavations will conform to the Trench Safety Act and requirements of the Federal, State, or local public agency having jurisdiction. The most stringent of these requirements will apply. The Contractor shall have a Competent Person (trench safety) on the job site at ALL times.

2.3.4 CONTROL OF WATER

2.3.4.1 Equipment

The contractor will furnish, install, and operate all necessary machinery, appliances and equipment to keep the excavations reasonably free from water during construction. The contractor will de-water and dispose of the water so as not to cause damage to public or private property or to cause a nuisance or a menace to the public. The contractor will at all times have on hand sufficient pumping equipment and machinery in good working condition for all ordinary emergencies and will have available at all times competent human resources for the operation of the pumping equipment. The de-watering system will not be shut down between shifts, on holidays or on weekends, or during work stoppages.

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All equipment shall conform to The City of Cocoa's noise ordinance Chapter 13.5, Article II, Section 13.5-21 through Section 13.5-26

2.3.4.2 Ground Water

The control of ground water must be such that softening of the bottom of excavations or formation of "quick" conditions or "boils" will be prevented. De-watering systems will be designed and operated so as to prevent the removal of the natural soils. Discharge from pumps will be accommodated in accordance with the St. Johns River Water Management District's requirements. The Contractor is responsible for obtaining all de-watering permits such as NPDES permit.

2.3.4.3 Static Water

The static water level will be drawn down below the bottom of the excavation so as to maintain the undisturbed state of the natural soils and allow the placement of backfill to the required density. The de-watering system will be installed and operated so that the ground water level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property.

2.3.5 PIPE PLACEMENT AND JOINTING

Pipe placement will progress upgrade with the spigot ends of the pipe pointing in the direction of flow. Each pipe will be placed true to line and grade with a laser beam system. All pipes will be joined in a professional manner and in accordance with the manufacturer's instructions.

Pipe ends will be carefully cleaned prior to jointing. Pipe will be placed either on a prepared bed of undisturbed earth in the bottom of the trench shaped as required to fit the pipe or upon a layer of properly placed bedding material.

2.3.6 MATERIAL FOR BEDDING AND BACKFILLING

2.3.6.1 Unsuitable Material

Wherever excavations of the trench expose unsuitable materials such as peat, soft clay, quicksand, rock, boulders, stones, or unstable material in the bottom of the trench which, in the opinion of the Engineer of Record or Inspector, is unsuitable foundation upon which to lay or support the pipe, backfill and expected superimposed loads, such unsuitable materials will be removed to a depth necessary to reach material having adequate bearing capacity and at a width of trench at least equal to the minimum trench width as specified. The space created by removal of this unsuitable material will be backfilled using suitable backfill or bedding material as specified.

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2.3.6.2 Suitable Material

Suitable material for bedding and backfilling will be dry, clean natural sand or gravel. The material will be placed in 6" layers and compacted, using mechanical compacting equipment, to a dry density equal to 98 percent (98%) of the maximum dry density as determined by the standard Proctor compaction test ASTM specification D698, each layer being compacted to the required density prior to placing the next layer. The Utilities Department shall require the density to be checked by a licensed laboratory at each manhole and at two points between manholes as selected by the Engineer of Record or Inspector, at no cost to the City.

2.3.7 MANHOLE INSTALLATION

2.3.7.1 Base Unit

The base unit for manholes and wet wells will be reinforced concrete with a monolithically poured base and bottom riser section. The base unit will be placed before the sewer pipe is placed to or away from the manhole. The base unit will be placed in a dry hole on a bedding of 6" to 8" of $\frac{3}{4}$ " to 1" rock (57 stone or concrete).

2.3.7.2 Manhole Channel

Invert channels will be constructed, smooth and semicircular in shape, conforming to the inside of the adjacent sewer section. Changes in direction of flow will be made in a smooth curve of as large a radius as possible. Change in size and grade of channels will be made gradually and evenly. Invert channels will be formed by one of the following methods: formed directly into poured concrete manhole base, built up with brick and mortar, half tile set in concrete, or full section of sewer pipe installed through the manhole with the top half cut out. The manhole floor outside of channels will be made smooth and will be sloped toward channels. Free drop in manholes from inlet invert to top of floor outside the channels will not exceed two feet. Standard drop manholes will be constructed wherever free drop exceeds two feet.

2.3.7.3 Joints

Precast manhole joints must be water tight and sealed with plastic pre-formed joint filler similar to Ram-Nek. All joint areas will be factory primed. Manhole-to-pipe connections will be by factory-supplied flexible boots

2.3.7.4 Non-Shrink Grout

The annular space between the sewer pipe and the opening in the manhole will be grouted with non-shrink grout to insure a water-tight joint.

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2.4 WATER MAIN CROSSINGS

2.4.1 GENERAL

In all cases where sewer mains cross water mains there shall be a minimum of 6"; 12" preferred clear distance between the top of the sewer and the bottom of the water main. With less than 12", the sewer main will be constructed of ductile iron pipe (with 401 Protecto coating) for a distance of ten feet on either side of the point of crossing.

2.5 SERVICE CONNECTIONS

2.5.1 GENERAL

The contractor must install commercially manufactured wye branches compatible with the material used in the sewer main. Where the service line piping is of a different material than the sewer main, the fittings and transition pieces will be specially designed for the connection of the different materials and must be approved by the Utilities Department.

2.5.1.1 Connecting to Manholes

Service connections made directly to a manhole shall be core drilled and fitted with a flexible coupling to provide a seal around pipe. Pipe will be a minimum of 6" in diameter and shall include a wye and clean-out in a green meter box located on the Customer side of the right-of-way or easement (see detail). Connections requiring a drop will be piped to the bottom of the manhole on the outside (see manhole with outside drop detail).

Force mains coming from private lift stations into a gravity manhole requiring a drop will be piped to the bottom and fitted with 45 degree bends directed toward the invert of the gravity main (see detail Force Main Connected to Manhole).

2.6 FIELD TESTING OF SEWER SYSTEMS

2.6.1 GENERAL

All sewer lines will be subject to a leakage test at the discretion of the Utilities Department. The test shall be either an infiltration, exfiltration, or air pressure test as determined by the Utilities Department. The test will be conducted by and at the expense of the contractor in the presence of a Utility Inspector.

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Maximum allowable leakage is 100 gallons per day, per inch diameter of pipe, per mile of pipe. If the amount of maximum leakage is exceeded, the contractor will make the necessary repairs and schedule a re-test. Acceptable methods of repairing leaks are by excavation.

2.6.1.1 Visible Leaks

All visible leaks in structures will be eliminated regardless of the amount of flow.

2.6.1.2 Televised Inspection

Television inspection must be provided by the contractor and will be performed after final compaction of the job site or roadway. A Digital Video Disc (DVD) record of the inspection with an audible description of the run, including its direction and location, the location and description of any service laterals, and a description of any defect or abnormality must be included. A leakage test will not be required on runs which have been televised and show no defects.

2.6.1.3 Pressure Testing

Force mains will be hydrostatically tested at a pressure of 100 psi for one hour. The contractor will install air reliefs as necessary for relieving air prior to testing. The maximum allowable leakage of water per thousand feet of pipe is as indicated on the following table:

SIZE	ALLOWABLE LEAKAGE
4"	0.27 Gallons/Hour
6"	0.41 Gallons/Hour
8"	0.54 Gallons/Hour
10"	0.68 Gallons/Hour
12"	0.81 Gallons/Hour
16"	1.08 Gallons/Hour
20"	1.35 Gallons/Hour

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2.6.1.4 Vacuum Testing of Manholes

All sewer manholes shall be required to meet the requirements of the vacuum test as per the current ASTM C 1244 "Standard Test Method for Concrete Sewer Manholes by the negative Air Pressure (Vacuum) Test" prior to acceptance.

A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time for the vacuum to drop to 9 inches of mercury shall not be less than that shown in the table below:

DEPTH (FEET)	MANHOLE DIAMETER (INCHES)		
	48	60	72
0-8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

(Times shown are minimum elapsed times, in seconds, for a drop in vacuum of 1 inch of mercury.)

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2.7 RECORD DRAWINGS

2.7.1 GENERAL

Record drawings are required for all systems to be accepted by the Engineering Division. Record drawings will be prepared by a surveyor or an engineer registered in the State of Florida and will contain the following information:

- Location of all gate valves, fittings and air release valves using at least two ties to permanent points (manholes, power poles, curbs, or storm water inlets). An acceptable station and offset system shall be used for lateral lines.
- The as-builts must include the location of the wye branch, the end of the sewer service referenced to the next downstream manhole of each run, the offset of the end of the service referenced from the centerline of the main sewage pipe, and the depth at the end of the service.
- Location of sewer mains from property easement lines or edge of pavement at intervals of 300 feet.
- Separation between reclaimed water or force mains and water mains if they are installed within 10 feet of water mains.
- Sewer main material and distance of mains from buildings or structures within 20 feet of the water main.
- Elevations of the top (rim) and pipe inverts at each manhole and the length and slope of each run of pipe are required on the as-builts.
- Pertinent easement information.
- Certification by the surveyor or Engineer of Record accepting responsibility for accuracy of information supplied on the record drawings and a statement certifying that all mains are within easements and/or public right-of-way. The name "City of Cocoa" must appear on all record drawing survey information.

Record drawings will be drawn at an engineering scale that is legible and readable as determined by city staff. Areas requiring additional detail may be enlarged as necessary. Right-of-way, easements, and lot lines will be accurately shown. After the surveyor or engineer has certified the locations, the engineer will certify on DEP Form 62-604.300(8)(b) that the system depicted on the record drawing was constructed in substantial conformance with approved plans and will function as intended. Lot, block numbers, and street names will be included. Provide two (2) sets of signed and sealed record drawings and one (1) digital file including all reference files (XREF). AutoCAD 2010 or higher, or DXF format shall be provided to the City.

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2.8 FORCE MAIN VALVES

2.8.1 GENERAL

Valves for use in force mains must be epoxy coated resilient seat gate valves. The resilient seating surface will be bonded to the gate and will seal under compression without wedging or sliding.

Requirements stated in Potable & Reclaimed Water Section 2.2 –Valves, and Section 5.8 - Valves and Fittings shall also be met for force main valves.

Air release valves will be of the Combination Air Release and Vacuum (CARV). CARV shall have a working pressure range of 3-150psi, Testing pressure of 250psi, Maximum operating temperature: 140°F, 2" threaded inlet and 1.5" outlet, Reinforced nylon body, 316 SS internal parts. See Appendix A, Approved Materials.

CARV valves will be installed in a concrete pit at high points in the main. See Detail Air Release Valve.

2.9 LIFT STATIONS

2.9.1 PRECAST WET WELLS

Precast wet wells must be constructed in accordance with American Society of Testing and Manufacturing (ASTM) specification C478. Concrete will have a minimum 28-day compressive strength of 4,000 PSI. Cement will be Type II sulfide resistant. Steel will be minimum Grade 40 and placed as shown on the drawings. Shop drawings of manholes and lift station wet wells will be submitted to the Engineering Division Supervisor for approval prior to casting. Chairs for supporting reinforcing steel will be non-corrosive plastic or Grade 316 stainless steel. Linings for wet wells shall conform to Section 2.9.3. EOR shall approve precast wet well design.

2.9.2 WET WELL ACCESS COVERS

Aluminum access covers will be designed for 300 PSF live load with a safety factor times three (3). There shall be two 24" x 48" swing covers equipped with Grade 316 stainless steel hinges and Grade 316 stainless steel tamper-proof fasteners, closed position lock hasp, and retractable grip for opening. The cover will open to 90 degrees and lock automatically in the open position with a stainless steel positive locking arm. The release will be made by a stainless steel release handle. The cover will be flush with the top of the frame and rest on a 3/4"-wide lip around the inside of the frame. The hatch will be a Bilco or Halliday product. Hatch size of the cover will

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be determined by the wet well size and pump size to provide at least 12" of clearance on all sides of the pump with a minimum hatch dimension of 48" x 48".

2.9.3 COATINGS

2.9.3.1 HDPE Sheet Lining

The entire interior wall and top surface of the wet well will be protected with a High Density Polyethylene (HDPE) liner designed to protect concrete from corrosion in a collection system pump wet well. The liner shall be a minimum thickness of 0.079 inches. Anchoring studs shall be the same material and shall be integrally extruded with the sheet and shall have a minimum height of 0.39 inches and a length of 0.55 inches. The HDPE sheeting will be cast into the concrete. This liner will be AGRU Sure Grip as manufactured by Agru America Inc. or approved equal. Flat liner used for overlapping joints shall have a minimum thickness of 0.018 inches. All joints will be heat fusion welded to create a water-tight lining. Such lining shall be warranted against defects in materials and workmanship for a period of five years from date of installation.

2.9.3.2 Exposed Piping

Pump discharge riser pipes and fittings inside the wet well will be Grade 316 10S stainless steel with flanged fittings. Piping, exposed to raw sewage in valve pits will be coated with a two-coat coal tar epoxy exterior coating system with a minimum DFT of 12-15 mils. Coal tar epoxy will be Rustoleum 9578 or approved equal. Equipment and pump information tags will not be painted.

2.9.4 SUBMERSIBLE LIFT PUMPS

Lift station submersible pumps will be Hydromatic, ABS, or Flyght with three-phase power and 3" minimum solids handling capacity. Pump volute, seal housing, and motor housing will be cast iron. Pump impeller will be two vane, one piece cast iron construction. Pump shaft will be one piece 316 stainless steel, equipped with tandem seals with separate chambers for each seal. Seals will have tungsten carbide faces with 316 stainless steel hardware. Seal chambers will be equipped with probes to detect water intrusion. Motors will be oil-filled with automatic reset over-temperature sensors embedded in the motor windings. Pumps will be equipped with a stainless steel slide rail system, dual rail type. The pump discharge coupling will be flanged cement-lined ductile iron, 4" minimum diameter, bolted to the wet well floor by 316 stainless steel fasteners. Flanges will be machine threaded. (Compression-type flanges will not be allowed.) Flange bolts, washers, and nuts will be 316 stainless steel. All pipes entering or exiting the wet well shall be sealed in a manner that will prevent water leaks around pipes.

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2.9.5 VALVE PIT

A separate valve pit shall be constructed adjacent to the wet well to house a check valve for each pump, a gate valve for each pump, and one gate valve for emergency pump-out. The valve pit shall be configured to allow a minimum of 8 inches between the bottom of pipe flanges and the floor or wall. The emergency pump outlet will include a brass 4" male quick-disconnect complete with brass cover. The valve pit is to be made of precast or cast-in-place concrete with a cast concrete cover equipped with an aluminum access hatch cast in the concrete. The dual swing access hatch will be a Bilco or Halliday product. Hatch size will be determined by the installation with a minimum dimension of 48 x 48 inches. A 0-100 PSI glycerin filled pressure gauge will be installed in tapped cross boss with a brass gate valve.

2.9.6 CHECK VALVES

Check valves will be flanged, with fusion bonded epoxy coating with an outside weight and lever, cast iron housing, 316 stainless steel seat ring, clapper with neoprene sealing surface, O-ring-sealed stuffing box (minimum size 4"). Bolts, washers, and nuts will be Grade 316 stainless steel. Check valves shall meet AWWA specification C508. Flanged end dimensions will be drilled to ANSI standard B16.1 class 125.

2.9.7 GATE VALVES

Gate valves will be resilient seated, 4" minimum diameter, with flanged ends, hand wheel operated, non-rising stem, epoxy coated, equipped with double O-ring-sealed stuffing box and Grade 316 stainless steel fasteners. Gate valves will meet AWWA specification C509 and C515. Flanged end dimensions will be drilled to ANSI standard B16.1 class 125.

2.9.8 CONTROL PANEL

The control panel will be isolated with a 200 amp non-fuseable disconnect housed in a NEMA 4X, stainless steel lockable cabinet.

The control panel enclosure will be Grade 316 stainless steel, NEMA 4X rated with a heat reflecting hood. The minimum inside dimensions will be 36" wide x 48" high x 12" deep. Control voltage will be 120 vac. **Control voltage transformer will be sized to support a 20 amp circuit.** Control wiring will be 14 AWG stranded. The enclosure will be equipped with an aluminum dead front inner panel with cutouts for all circuit breakers; elapsed time meter (non-reset, hour and one-tenth hour, five digits); one duplex 120 vac convenience outlet (GFI protected); an analog amp meter for each pump; a top mounted fluorescent work light minimum 18 inches in length; hand-off-automatic (HOA) switch for each pump; seal failure light

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for each pump (amber); run light for each pump (red); one trip light for each pump (amber), SCADA bypass switch, inside and outside light on-off switch.

The interface between the control cabinet and the separate SCADA cabinet will be through Phoenix Contact terminals and component plugs and Allen-Bradley 24 VDC relays, catalog # 700-HK-36Z24 and relay bases, catalog # 700-HN121. An isolated 20 amp circuit will be provided to power SCADA equipment. Pumps will be controlled by SCADA RTU. Floats will be used to provide level control. There will be one float for pump shut-off, one for lead pump turn-on, one for lag pump turn-on, and one for high level alarm. Floats will be Roto-Float type-S as manufactured by Anchor Scientific with all weights and switches encapsulated. Floats will operate on normal 24 VDC from SCADA RTU.

Motor starters will be NEMA-rated with three-leg protection, as manufactured by Allen-Bradley, General Electric, or Square-D. Circuit breakers will be molded case as manufactured by General Electric, Square-D, or Cutler-Hammer. All pilot devices (switches, relays, lights) will be manufactured by General Electric, Square-D, or Allen-Bradley.

The control panel will be equipped with a **Russel Stoll model JRS 1044FR 100 amp emergency generator receptacle** and emergency main circuit breaker with lock-out from the normal main breaker. Panel will be equipped with ground and neutral terminal bars. Analog amp meter shall be installed for each pump. A power distribution block will be installed after the main breaker. A 60-foot copper-clad ground rod will be driven into the ground adjacent to the control panel and must test less than 25 ohms resistance. Grounding wire will be Cad welded to the ground rod. The door will be equipped with a three-point latching system with hasp and staple for locking. The wiring system will be configured to allow the pumps to operate on floats if the SCADA system is by-passed. A separate by-pass switch will be installed. A Diversified Electronics phase sequence and loss relay with fault light will be installed for each pump. Line voltage will be monitored with a Wilkerson Instruments Line Power Monitor-part# DR 6305. The control panel will be mounted on stainless steel unistrut and hardware supported by a minimum of three- 4 inch square concrete posts. The post will be a minimum of 10 foot in length and located adjacent to the wet well.

A NEMA 4X stainless steel junction box with back plate, a terminal strip, a power distribution block for each pump, and a ground bar will be installed below the main control panel. The box will be connected to the control panel with a ¾ inch diameter conduit for float wiring and a 2 inch diameter conduit for each pump. The conduits will be equipped with seal-offs to protect electrical equipment from corrosive atmosphere in the wet well.

A laminated as-built electrical wiring diagram (minimum 8.5" x 11") will be securely attached to the inside of the control panel door. A separate copy of the as-built wiring diagram will be provided to City of Cocoa Engineering Division. An information plate will also be located inside

2. WASTEWATER

June 1, 2017

panel door and will include Cocoa's station number, pump information, station voltage, Florida Power & Light account number, if a high leg is present and if so identify the leg.

2.9.8.1 Disconnect Panel

A lightning suppressor shall be installed on the exterior side of the disconnect panel. It will not be permitted on the inside of the control panel.

2.9.8.2 SCADA

SCADA equipment will be housed in a separate Eurobex, model number 5412 ESSPCH, lockable, NEMA 4X cabinet with an inner panel for equipment mounting and a separate inner panel on the door for mounting radio. Lift station operation and monitoring will be accomplished via SCADA, utilizing Motorola Moscad-L Remote Terminal Unit (RTU) consisting of one 15X15 chassis-part# FHN6028, frame-part# FHN5890, 3 I/O motherboard-part # FRN5809, a 117 vac transformer-part# FPN5554, power supply module-part# FPN5555, Central Processing Unit (CPU)-part# F6836, external radio interface board-part # FRN5907, three mixed I/O modules-part# FRN5819, battery bracket-part # FHN6058, battery-part# FLN9059, UHF radio 438-470 MHz-part# FUE1067, radio install kit-part# FLN3268, one antenna cable-part# FKN4473, TCP/IP interface to port 1-part# V527, and all associated cables.

The antenna shall be a gold anodized fully welded UHF directional Yagis, model Y4503, as manufactured by Antenex. The antenna shall be mounted on a minimum 20 foot tall galvanized mast. The mast shall be rigid pipe, two and one half inches in diameter at the base. The upper 5 feet of mast will be rigid pipe, one and one quarter inches in diameter. The bottom of the mast will be set 3 foot below ground level and encased in a column of concrete a minimum of 12 inches in diameter and 3 foot deep. Antenna cable shall be Times Microwave Systems 3/8 inch diameter flexible low loss coaxial cable, part# LMR-400-DB and shall be fed into the antenna mast through a 1/2 inch diameter chase nipple at the top and exit the bottom through a 1/2 inch Seal Tite flexible conduit to the RTU cabinet. The mast shall be grounded to separate ground rod. A 60-foot copper-clad ground rod will be driven into the ground adjacent to the control panel and must test less than 25 ohms resistance. Grounding wire will be Cad welded to the ground rod. Coordination of SCADA programming will be provided by DCR Inc.

2.9.8.3 Surge Protection

A surge protection unit, Ditek, model KX-(applied voltage) shall be installed in a separate cabinet.

2. WASTEWATER

June 1, 2017

2.9.8.4 Variable Frequency Drive

Variable Frequency Drive (VFD) may be required for some pumping stations and will be determined by the City of Cocoa Engineering Division at the time of plan review based on pump horsepower, force main pressure, and pumping distance. VFD's will be manufactured by ABB, Square-D, or Toshiba. VFDs will be housed in a separate NEMA 4X stainless steel cabinet with heat reflecting hood and ventilation system to ensure internal temperature does not exceed VFD design requirements. A submersible pressure transmitter manufactured by Blue Ribbon Industries will be installed to provide a 4-20mA signal for pump speed control. SCADA programming will be required.

2.9.9 EMERGENCY GENERATOR

Stand-alone emergency electrical generators may be required for some pumping stations and will be determined by the Engineering Division at the time of plan review. Generators shall be manufactured by Baldor or Kohler and equipped with John Deere diesel engines. Generator will be equipped with a fuel tank sized to provide a minimum of 30 hours operation under full load conditions. Automatic Transfer Switch (ATS) will be installed in a separate NEMA 4X enclosure.

2.10 CONDUIT

Exposed electrical conduit will be galvanized rigid with protective coating where it penetrates concrete, buried conduit will be Schedule 40 PVC. Conduits will be sized in accordance with NEC or larger with a minimum diameter of 2 inches. PVC conduits for pump and float wiring will be installed through the side of the wet well, below the lid, and above the high water level.

Each pump power cable will be installed through a separate conduit from the wet well to the control panel junction box. Seal failure and over-temperature wiring for the pump will be installed in the same conduit. One (1) conduit will be provided to accommodate float wiring. Conduits for power and float wiring will be installed in close proximity and located to provide the straightest possible run to the junction box. Wiring from the wet well will be terminated in the junction box. Continuous wiring through the box will not be permitted.

A separate 2 inch diameter PVC conduit will be installed through the side of the wet well with the ends capped for future use. This conduit will be located at 90, 180, or 270 degrees from the others. The Engineering Division will determine the exact location during plan review.

APPENDIX A
APPROVED MATERIAL

APPENDIX A APPROVED MATERIAL

VALVES AND ACCESSORIES

Item	Manufacturer	Part	Comments
Air Release Valves			
1.	A.R.I. USA, Inc.	D-025	Wastewater
2.	A.R.I. USA, Inc.	S-025	Wastewater
3.			
4.			
5.			
Air Release Valve Vault Frame and Cover			
1.	See detail		
2.			
3.			
Blow Off Valve			
1.	See detail		
2.			
3.			
Gate Valves 4 thru 12-inch (Resilient Seated Only)			
1.	American Flow Control	AFC-2500	18-8 Type 304 Stainless Steel nuts and bolts
2.	American AVK	Series 65	18-8 Type 304 Stainless Steel nuts and bolts
3.	M&H	Style 4067, Style 7000	18-8 Type 304 Stainless Steel nuts and bolts
4.	U.S. Pipe	A-USP0	18-8 Type 304 Stainless Steel nuts and bolts
5.	Mueller	A-2360 Resilient Wedge Gate Valve	18-8 Type 304 Stainless Steel nuts and bolts
6.	Clow	Model 2638	18-8 Type 304 Stainless Steel nuts and bolts
7.	Kennedy Valve	KS-RW	18-8 Type 304 Stainless Steel nuts and bolts
8.			
9.			

APPENDIX A APPROVED MATERIAL

Item	Manufacturer	Part	Comments
Gate Valves 16-inch thru 48-inch (Resilient Seated Only with Bevel Gear Operator)			
1.	Mueller	A-2361	18-8 Type 304 Stainless Steel nuts and bolts
2.	American Flow Control	AFC-2500	18-8 Type 304 Stainless Steel nuts and bolts
3.	U.S. Pipe	A-USP1	
4.	American AVK	Series 45	16" only, 18-8 Type 304 Stainless Steel nuts and bolts
5.	American AVK	Series 45	18-24" only, 18-8 Type 304 Stainless Steel nuts and bolts
6.	M&H	Style 7000	16-54" only, 18-8 Type 304 Stainless Steel nuts and bolts
7.	Clow	Model 2638	18-8 Type 304 Stainless Steel nuts and bolts
8.	Kennedy Valve	KS-RW	18-8 Type 304 Stainless Steel nuts and bolts
Valve Extensions			
1.	<u>General Engineering Company</u>	Model #4840-0001-3	
2.			
Valve Boxes			
1.	East Jordan Iron Works		5-1/4" minimum inside diameter
2.	Tyler		5-1/4" minimum inside diameter
3.			
4.			
5.			
Valve Boxes Alignment Rings			
1.	BOXLOK	#1	
2.	BOXLOK	#2	
3.	AFC		
4.			

APPENDIX A APPROVED MATERIAL

SERVICE MATERIALS

Item	Manufacturer	Part Number	Comments
Brass Service Saddles			
1.	Mueller	BR 1 B	.75-1.00" CC thread
	Mueller	BR 2 B	1.5-2.00"; CC thread
2.	Ford	101B single	pipe sizes 4" to 12", for 3/4" and 1"
3.	Ford	style 202B	1-1/2" and 2" services
4.	Ford	style 202B	pipe sizes 16" and larger, for 3/4", 1", 1-1/2," and 2" services
5.			
Corporation Stops			
1.	Ford	FB600, FB600-3, FB600-4, FB600-6, FB600-7	CC x Flare; .75-2.00"
2.	Ford	FB1600	CC x F.I.P 2" Only
3.	Mueller	B-25000	CC x Flare; .75-2.00"
4.	Mueller	B-25045	2" only
5.			
Curb Stops			
1.	Ford	B23-232W	
2.	Ford	B23-444W	
3.	Ford	BF23-666W	
4.	Ford	BF23-777W	
5.	Mueller	B-24352	.75 - 1.00"
6.	Mueller	B-24334	1.50 - 2.00"
7.	Mueller	H-14352	.75 - 1.00"
8.			
Meter Boxes (With cast Iron Reader)			
1.	Carson	L-1419-12CIR	
2.	CDR Systems Corporation	<u>A00-1730-12</u>	1-1/2 and 2-inch meters
3.	DFW Plastics, Inc.	DRW 36F-12-3C	
4.	DFW Plastics, Inc.	DFW 1730-12-	
5.	DFW Plastics, Inc.	DFW 37F-12-3c	

APPENDIX A APPROVED MATERIAL

PIPE MATERIALS AND APPURTENANCES

Item	Manufacturer	Part Number	Comments
Casing Spacers (All Sizes)			
Stainless Steel with Vinyl Runners			
1.	Cascade	CCS	Fasteners 304 SS
2.	Cascade	CCS-ER	Fasteners 304 SS
3.	BWM Co.	BWN-SS	Fasteners 304 SS
4.	CCI Pipeline Systems	CSS8/12	Fasteners 304 SS
5.			
Casing End Seals			
1.	Cascade	CCES	Bands, 304 SS
2.	BWM Co.	BWM-	Bands, 304 SS
3.	CCI Pipeline Systems	ESW/ESC	Bands, 304 SS
4.			
Ductile Iron Cement Lined			
1.	American	FASTITE	AWWA C104 for Cement Lining
2.	U.S. Pipe	TYTON	AWWA C104 for Cement Lining
3.	Griffin	TYTON & FASTITE	AWWA C104 for Cement Lining
4.	McWane	TYTON & FASTITE	AWWA C104 for Cement Lining
5.	American	FASTITE	401 Protecto coating for wastewater
6.	U.S. Pipe	TYTON	401 Protecto coating for wastewater
7.	Griffin	TYTON & FASTITE	401 Protecto coating for wastewater
Polyethylene Encasement			
1.	Multiple		AWWA C105
PVC			
1.	Multiple	C-900 DR18	Water, Reclaimed and Sewer Force Main
2.	Multiple	SDR-35	Gravity Sewer
Tracer Wire and Appurtenances			
1.	Multiple	#12 CCS	See Spec 1.5.5
2.	Multiple	Wire Nut	Underground Silicone Based

APPENDIX A APPROVED MATERIAL

PIPE FITTINGS

Item	Manufacturer	Part Number	Comments
Restraining Glands			
1.	EBBA Iron		Domestic
2.	Ford Meter Box		Domestic
3.	Union Tyler		Domestic
4.	SIP Industries		Domestic
5.	JCM Industries	610, 611, 620	Undercoat & wrap rods and clamps
6.	JCM Industries	621, 630, 631	Undercoat & wrap rods and clamps
Fittings C153 SSB / C110 Flange (Cement or fusion bonded epoxy lined)			
1.	Tyler Union		Domestic
2.	American		Domestic
3.	U.S. Pipe		Domestic
4.	Tyler Union		401 Protecto coating for wastewater
5.	American		401 Protecto coating for wastewater
6.	U.S. Pipe		401 Protecto coating for wastewater
Restrained Joints - Ductile iron pipe			
1.	American	Fast Grip	
2.	American	Flex-Ring	
3.	Lok-Ring	Lok-Ring	
5.	Griffin	Talon RJ Gaskets	
6.	U.S. Pipe	TR Flex	
7.	U.S. Pipe	HP Lok	
8.	U.S. Pipe	Field-Loc	
Restrained Joints - PVC pipe			
1.	JM	Eagle Loc 900	C-900, DR18
2.	Underground Solutions	Fusible PVC	C-900/C-905, DR18
3.	Certain Teed	Certa-Lok	C-900, DR18
4.	Diamond Plastics	Diamond Lok-21	C-900, DR18
5.			

APPENDIX A APPROVED MATERIAL

Item	Manufacturer	Part Number	Comments
Transition Coupling			
1.	Romac	Macro HP, XR501	ACP to DIP, CIP, PVC
3.	TPS	Hymax-2000	ACP to DIP, CIP, PVC
4.	FORD	FC2A, FC2W	ACP to DIP, CIP, PVC
5.			
Tapping Sleeve			
1.	Ford	FTSS	18-8 Type 304 Stainless Steel, bolts and flange
2.	Mueller	H-304SS	18-8 Type 304 Stainless Steel, bolts and flange
3.	JCM	#432 SS	18-8 Type 304 Stainless Steel, bolts and flange
4.	JCM	#415	18-8 Type 304 Stainless Steel nuts, bolts and straps, Epoxy Coated Body
5.	Smith-Blair	625	18-8 Type 304 Stainless Steel nuts, bolts and straps
6.	Robar	6606 SS Bolt Bracket	18-8 Type 304 Stainless Steel, bolts and flange
7.	TPS	Triple Tap Tapping Sleeve	18-8 Type 304 Stainless Steel, bolts and flange
Line Stop Sleeve			
1.	JCM	440	All SS 4"-12", Full opening outlet

HYDRANTS

Item	Manufacturer	Part Number	Comments
Hydrants			
1.	American-Darling	B-84-B-5	5 1/4" Valve Opening
2.	American-Darling	6 B84B-5	6" Valve Opening
3.	Mueller	Super Centurion 250/HS A-423	5-1/4" Valve Opening
4.	Clow	Medallion	5-1/4" Valve Opening
5.			

APPENDIX A APPROVED MATERIAL

FIRELINES

Item	Manufacturer	Part Number	Comments
Firelines DCDA			
1.	Ames	3000SS	
2.	Ames	Colt Series C300Na	Limited Space
3.	Febco	806YD/856 ST	
4.	Febco	876V-OSY-G	Limited Space
5.	Watts	774DCDA	
6.	Watts	757NDCDAOSY	Limited Space
7.	Wilkins	350DA	
8.	Apollo	DCDALF4AN, Type 1	Limited Space
Domestic Backflow Preventors - RPZ			
1.	Ames	4000S	
2.	Febco	825YD	
3.	Watts	994	
4.	Wilkins	375	

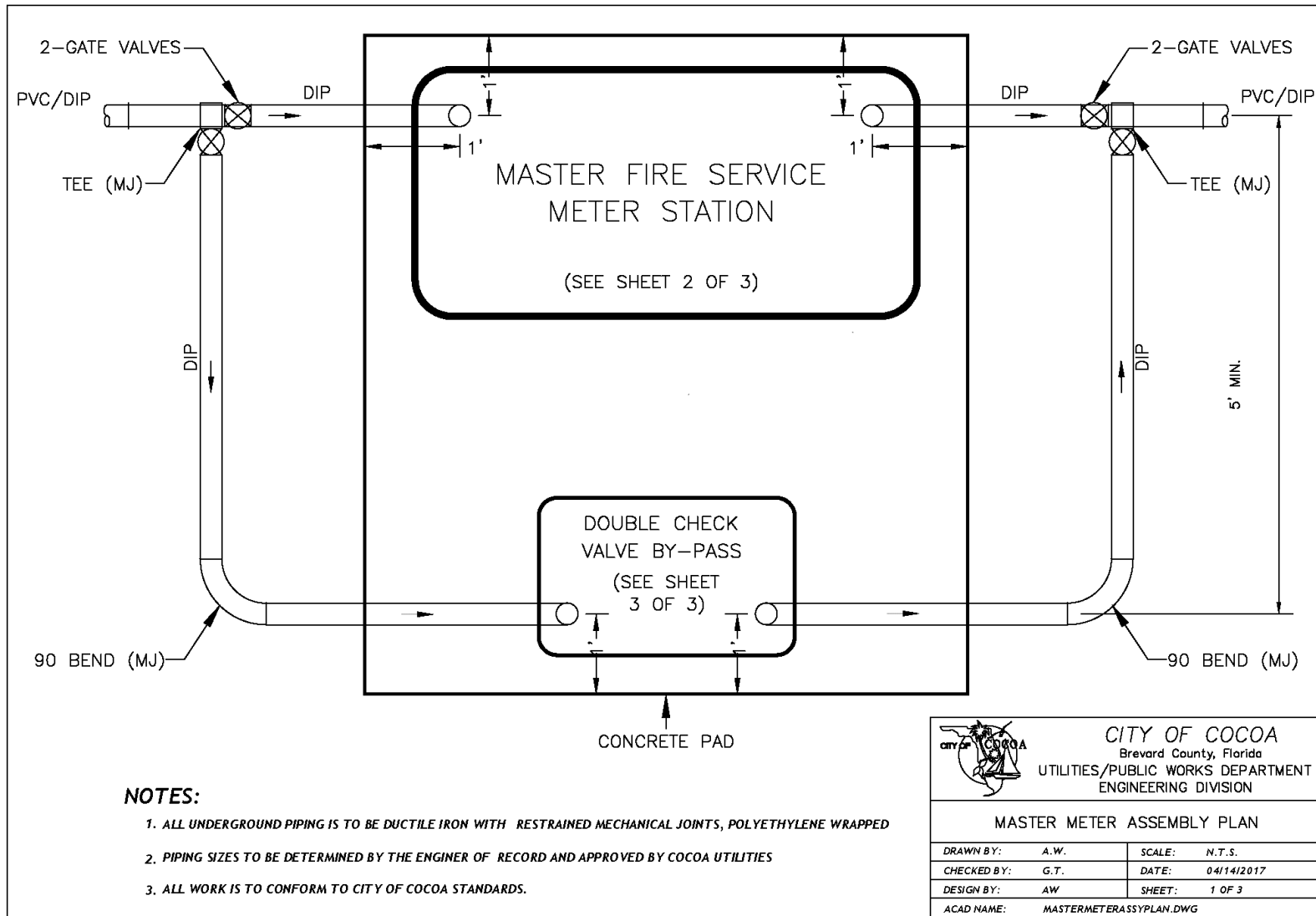
WASTEWATER CATEGORY

Item	Manufacturer	Part Number	Comments
1.	US Foundry	No. 225-AS-ORS	See spec 2.2.4
2.	Conseal	CS-55	Manhole coating
3.	ARGU America	HDPE SURE GRIP	Installation performed by qualified and authorized Agru installers.
4.	Multiple	Hardware	316SS
5.	Multiple	NEMA 4X SS	36" x 48" x 12"
6.	Multiple	Check Valves	See spec 2.9.6
7.	Multiple	L.S. Gate Valves	See spec 2.9.7
8.	Bilco	Aluminum access covers	300 PSF, 316 Hardware
9.	Halliday	Aluminum access covers	300 PSF, 316 Hardware
10.	Multiple	L.S. Control Panel	See spec 2.9.8
11.	Hydromatic		See spec 2.9.4
12.	ABS		See spec 2.9.4
13.	Flyght		See spec 2.9.4
14.	SCADA		See spec 2.9.8.2

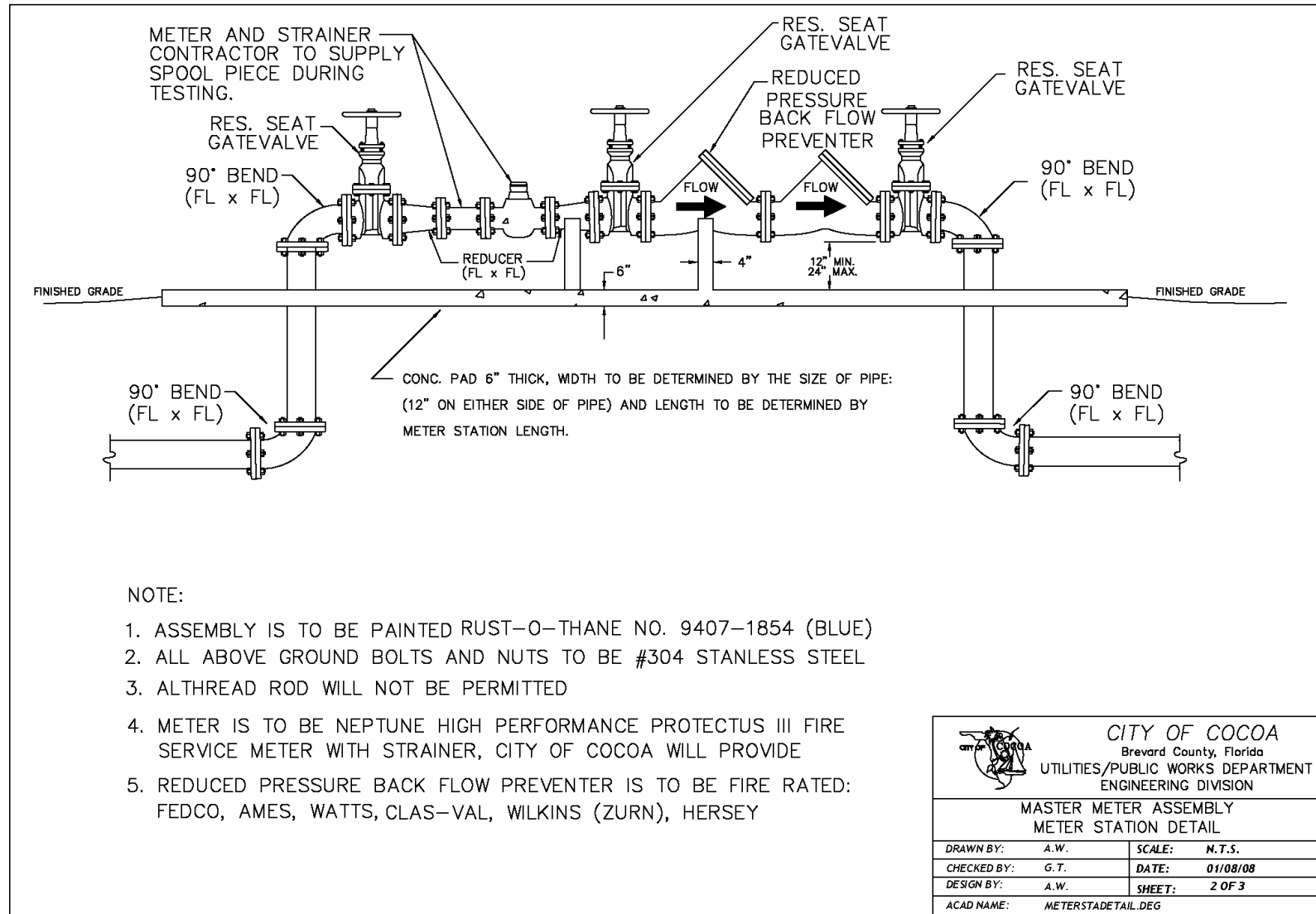
APPENDIX B

APPROVED DRAWINGS AND DETAILS

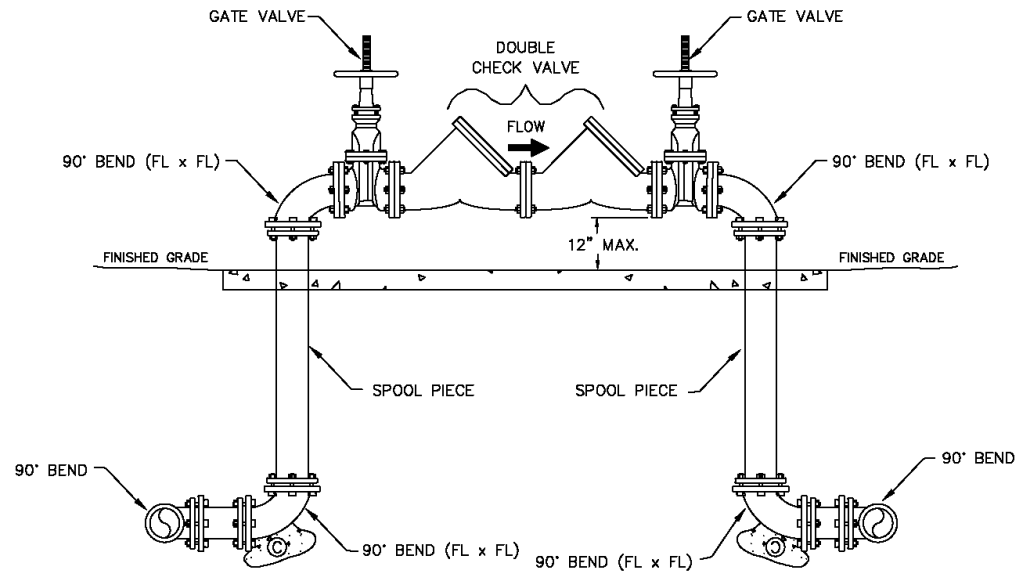
APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS

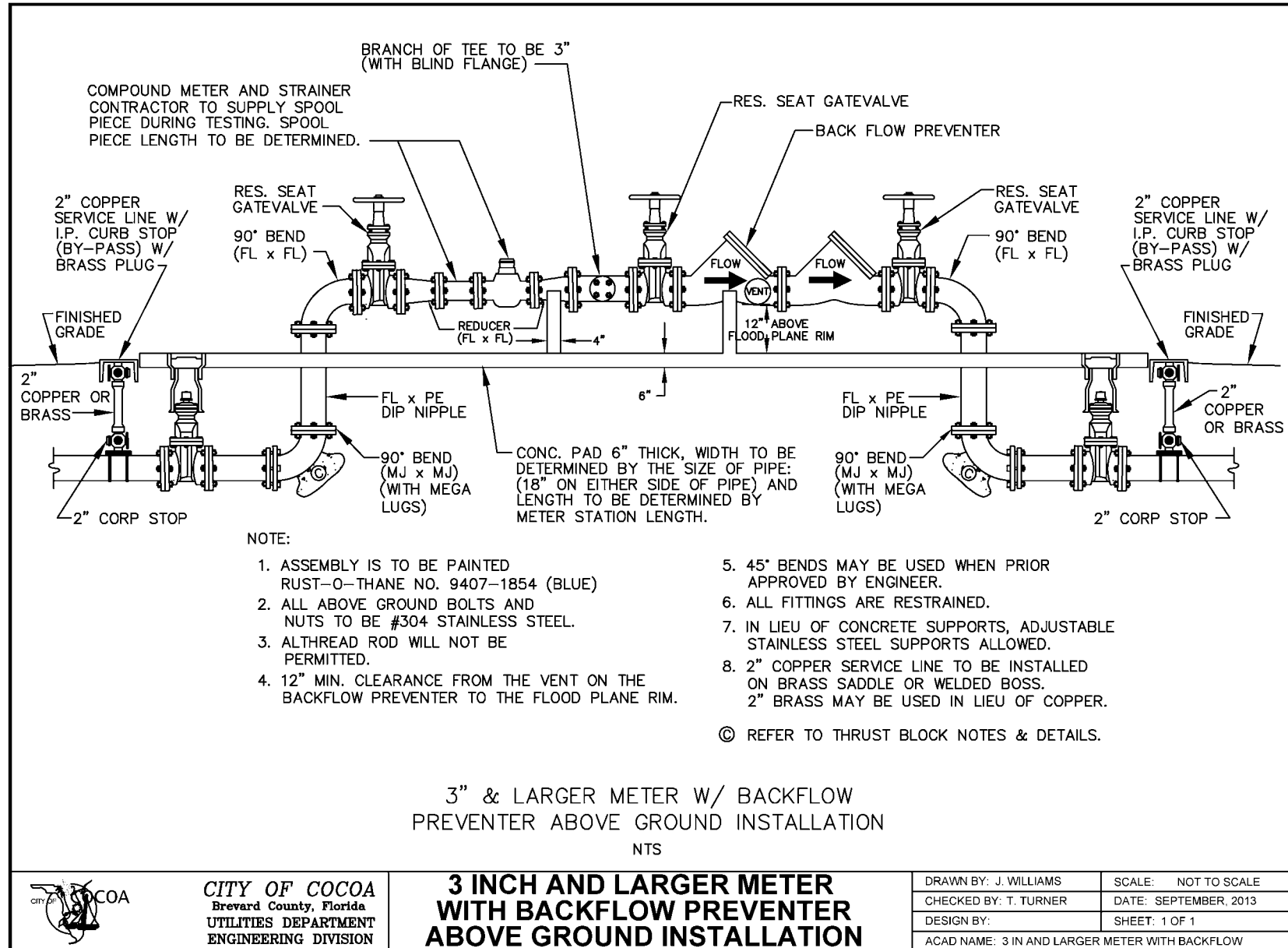


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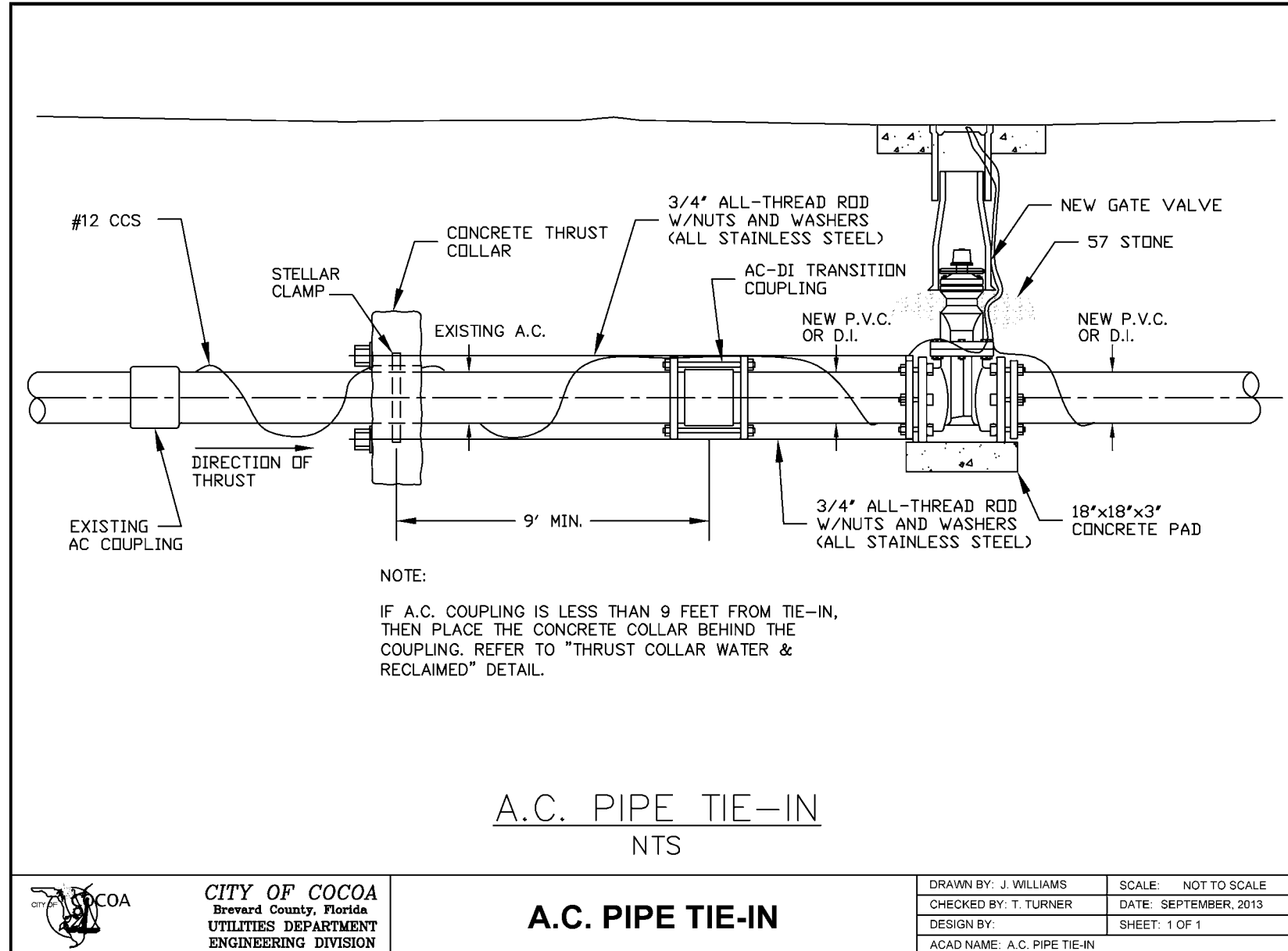
1. ASSEMBLY IS TO BE PAINTED RUST-O-THANE NO. 9407-1854 (BLUE)
2. ALL ABOVE GROUND BOLTS AND NUTS TO BE #304 STANLESS STEEL
3. ALTHREAD ROD WILL NOT BE PERMITTED
4. DOUBLE CHECK VALVE IS TO BE FIRE RATED: FEDCO, AMES, WATTS, CLAS-VAL, WILKINS (ZURN), HERSEY

	CITY OF COCOA	
	Brevard County, Florida	
UTILITIES/PUBLIC WORKS DEPARTMENT		
ENGINEERING DIVISION		
MASTER METER ASSEMBLY DOUBLE CHECK BYPASS		
DRAWN BY:	A.W.	SCALE: N.T.S.
CHECKED BY:	G.T.	DATE: 01/08/08
DESIGN BY:	A.W.	SHEET: 3 OF 3
ACAD NAME:	METERVAULT ASSEMBLY	

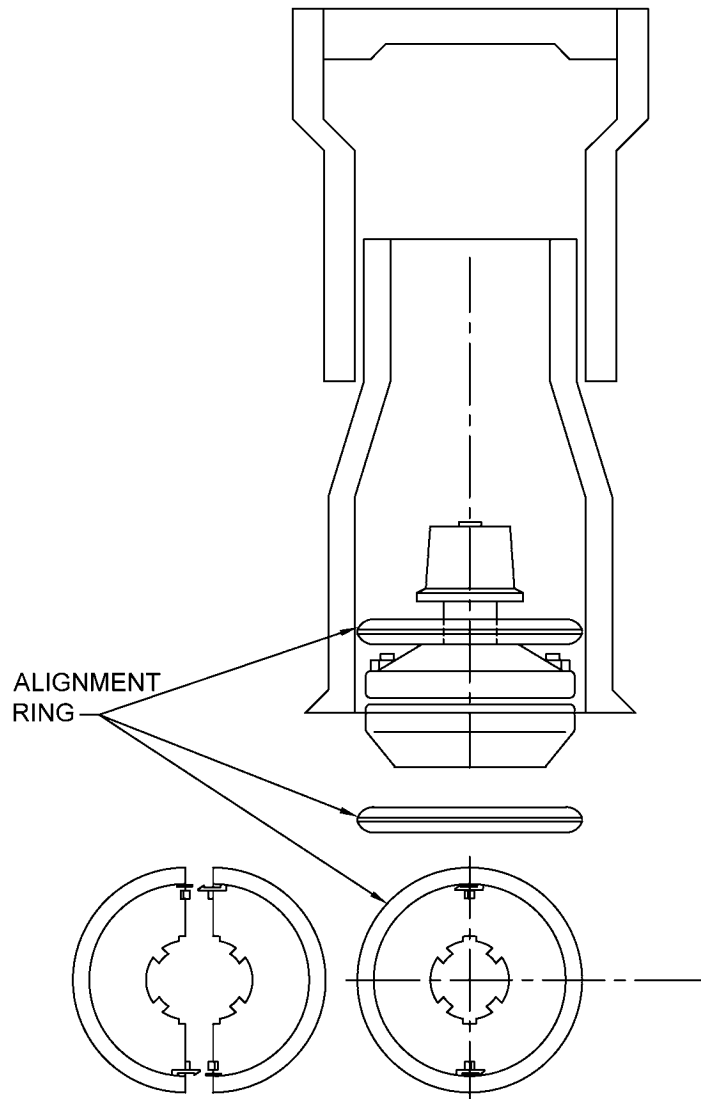
APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS



NOTES:

1. FOR ALL VALVES REGARDLESS OF SIZE AND DEPTH.

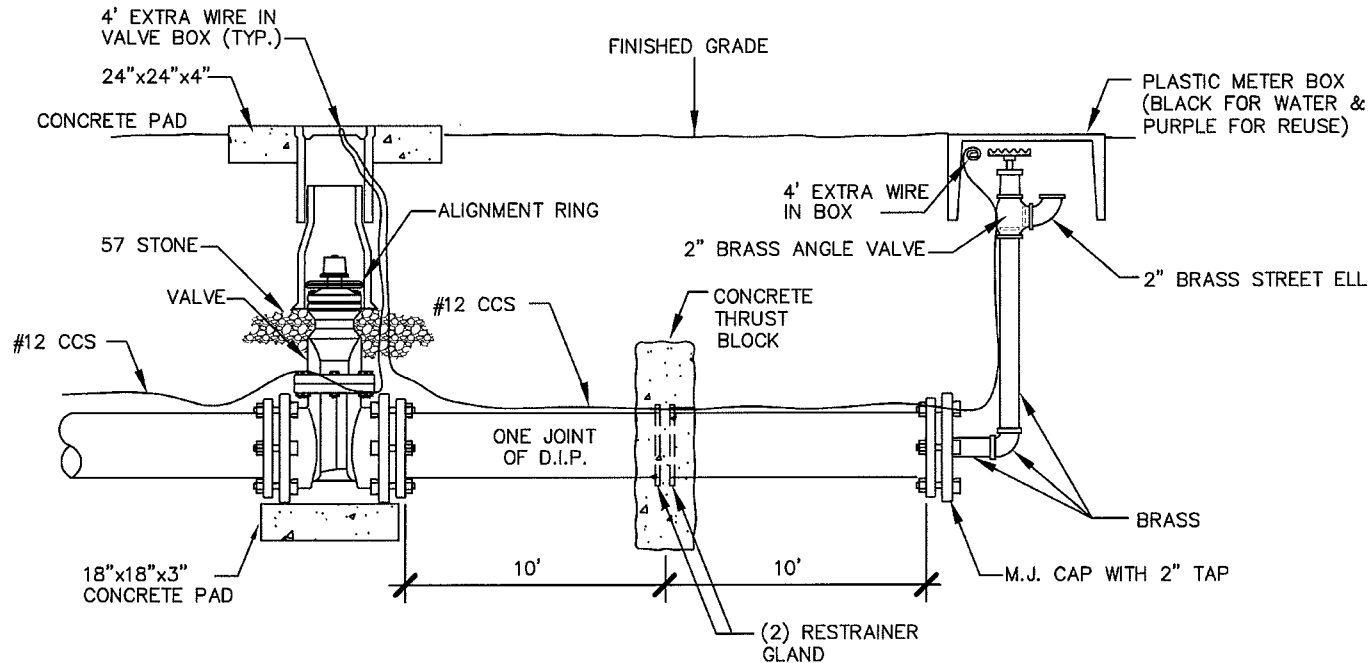


CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

ALIGNMENT RING

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: ALIGNMENT RING	

APPENDIX B APPROVED DRAWINGS AND DETAILS



NOTE: PERMANENT BLOW-OFFS DO NOT REQUIRE A JOINT OF D.I.P. OR A VALVE.
ALSO ALL BLOW-OFFS NEED TO BE PLACED AT PROPERTY LINES.

PROPER AMOUNT OF RESTRAINED PIPE UPSTREAM OF VALVE MAY BE USED
IN LIEU OF THRUST COLLAR.

2" BLOW-OFF DETAIL
10" WATER MAINS
AND SMALLER

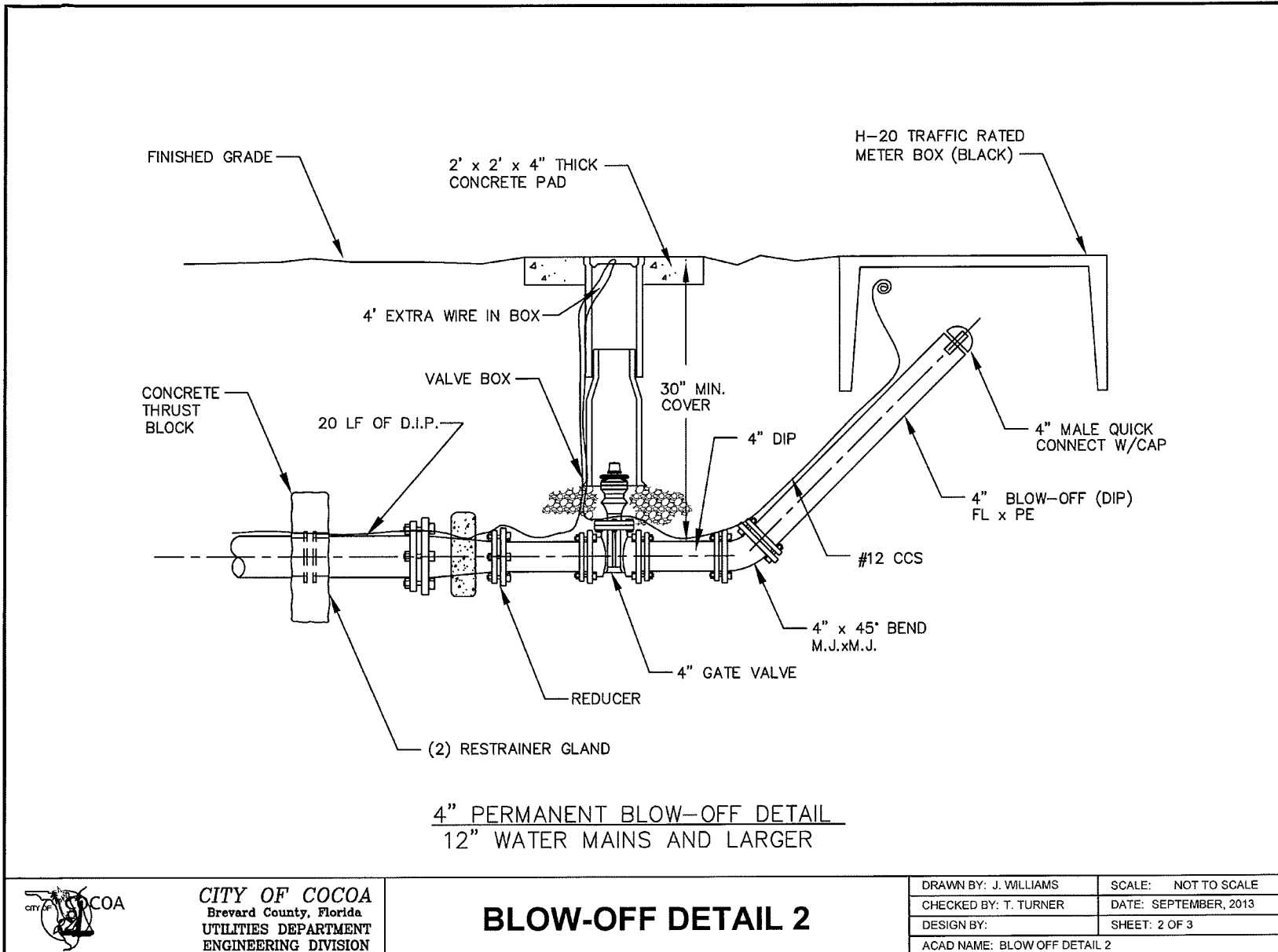


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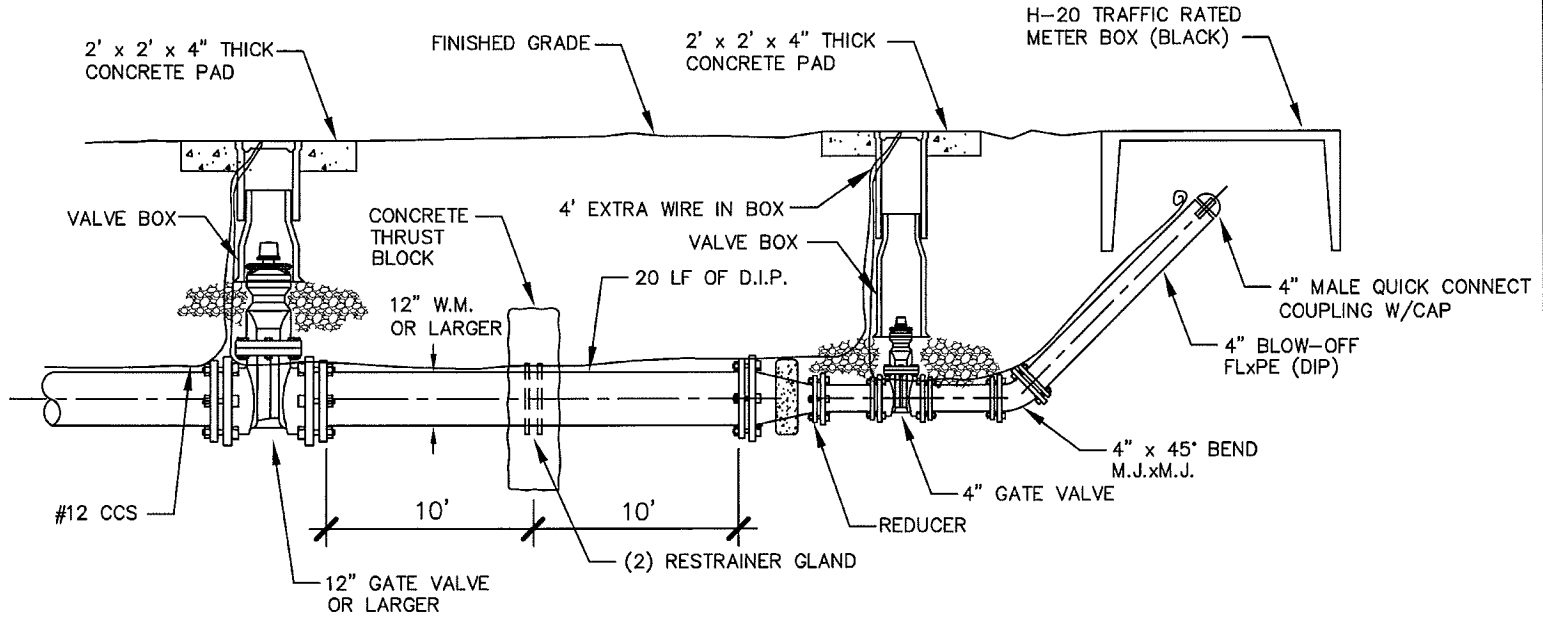
BLOW-OFF DETAIL 1

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 3
ACAD NAME: BLOW OFF DETAIL 1	

APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS



4" TEMPORARY BLOW-OFF DETAIL
12" WATER MAINS AND LARGER



CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

BLOW-OFF DETAIL 3

DRAWN BY: J. WILLIAMS

SCALE: NOT TO SCALE

CHECKED BY: T. TURNER

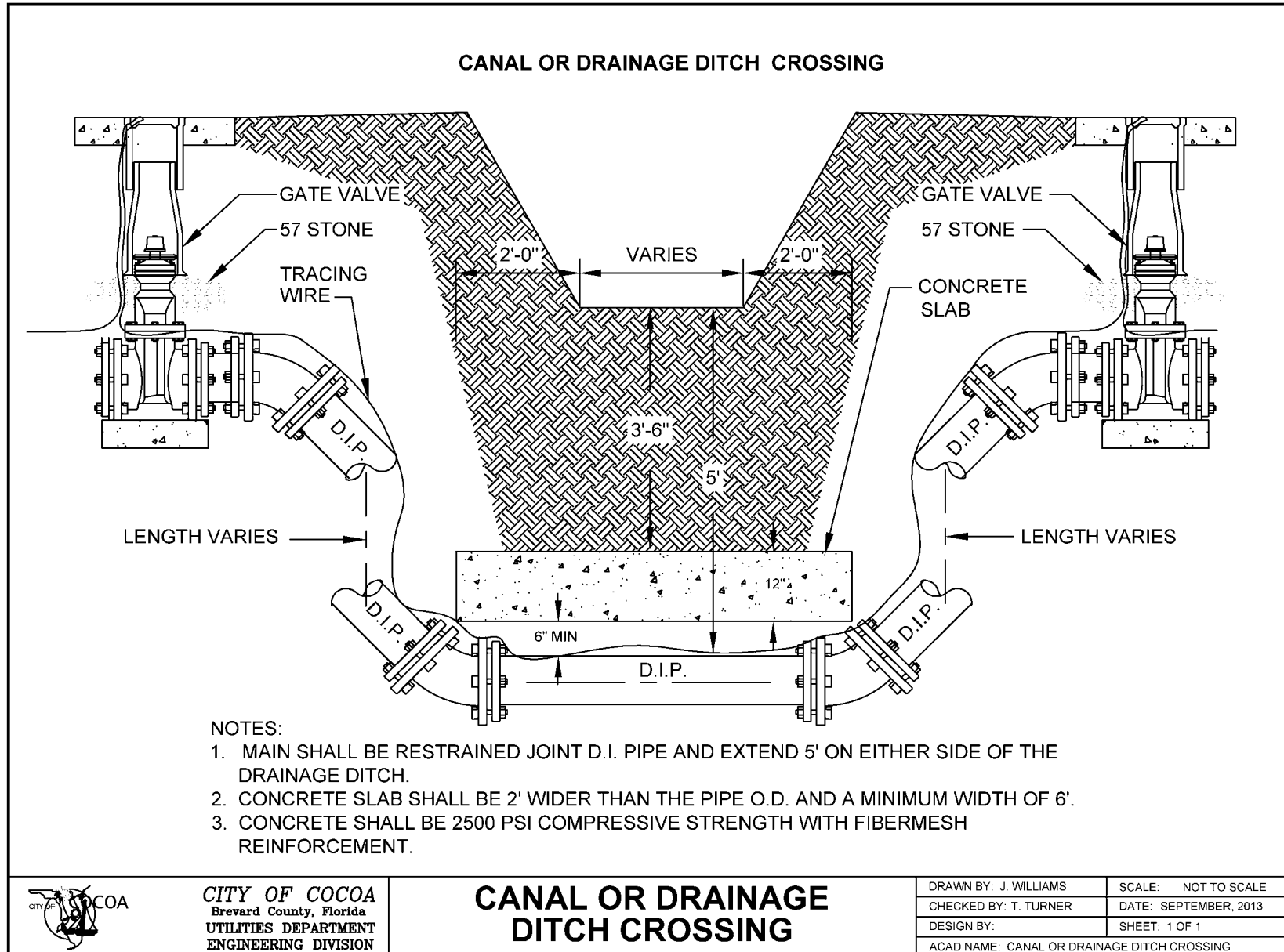
DATE: SEPTEMBER, 2013

DESIGN BY:

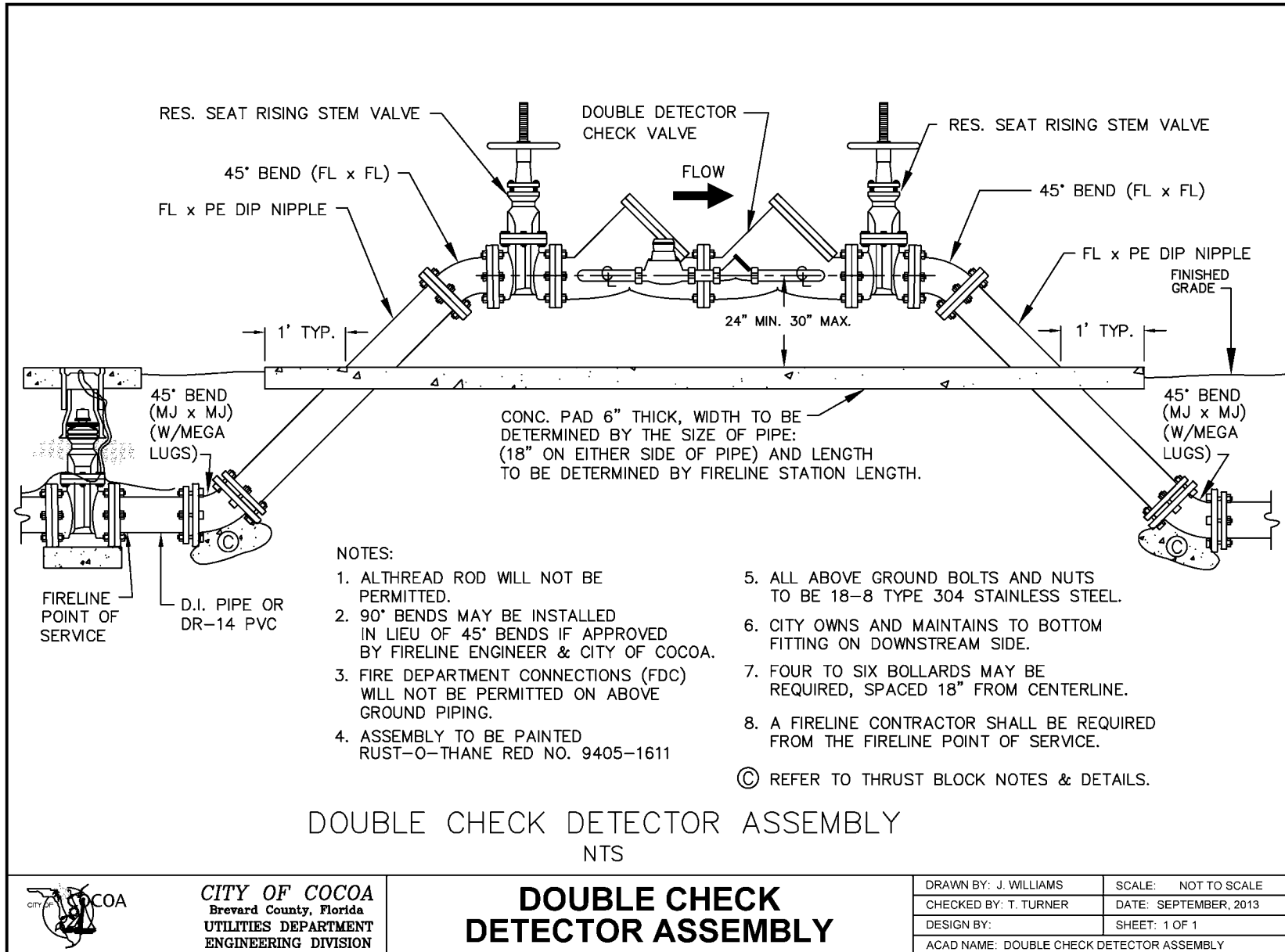
SHEET: 3 OF 3

ACAD NAME: BLOW OFF DETAIL 3

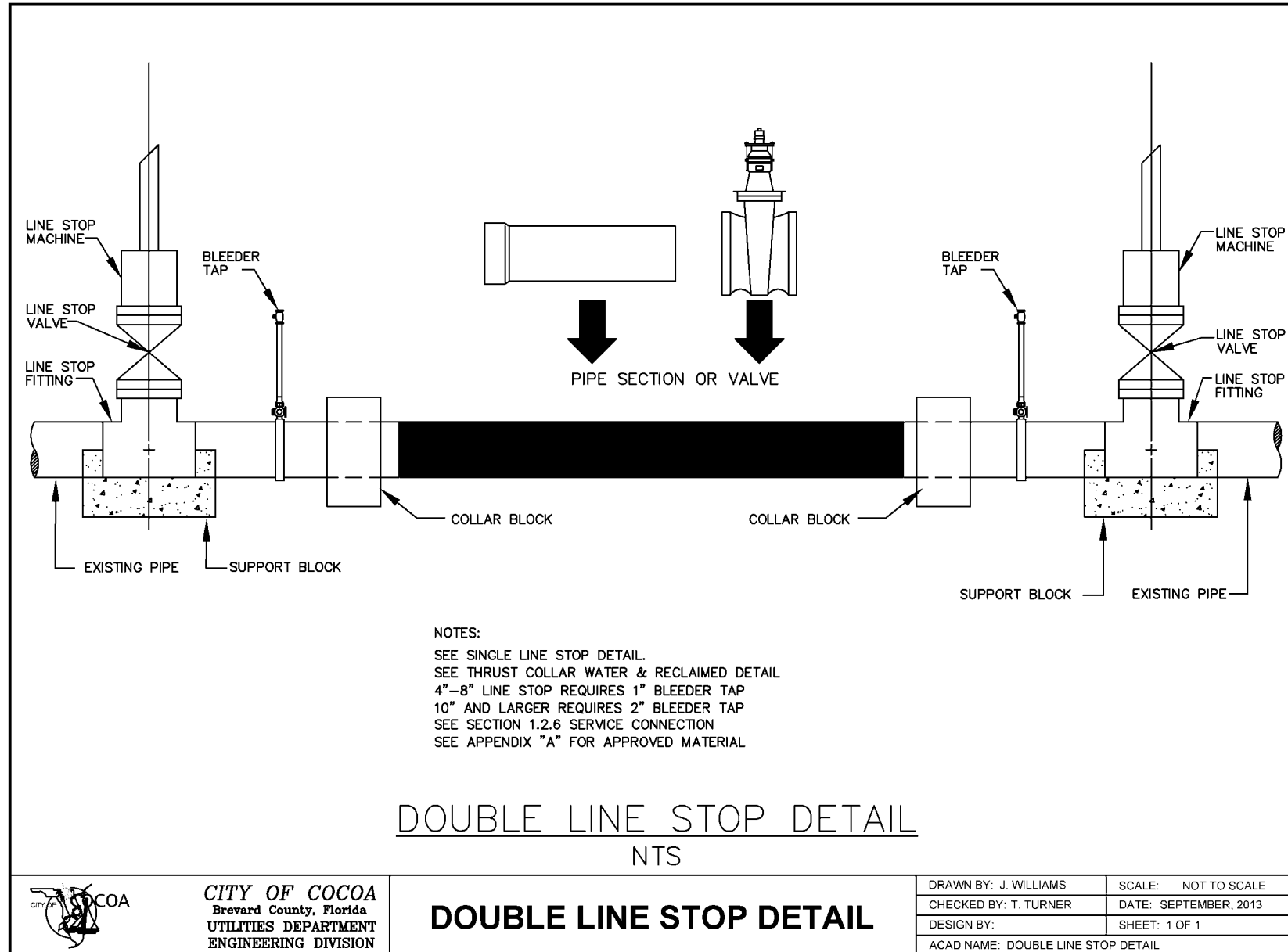
APPENDIX B APPROVED DRAWINGS AND DETAILS



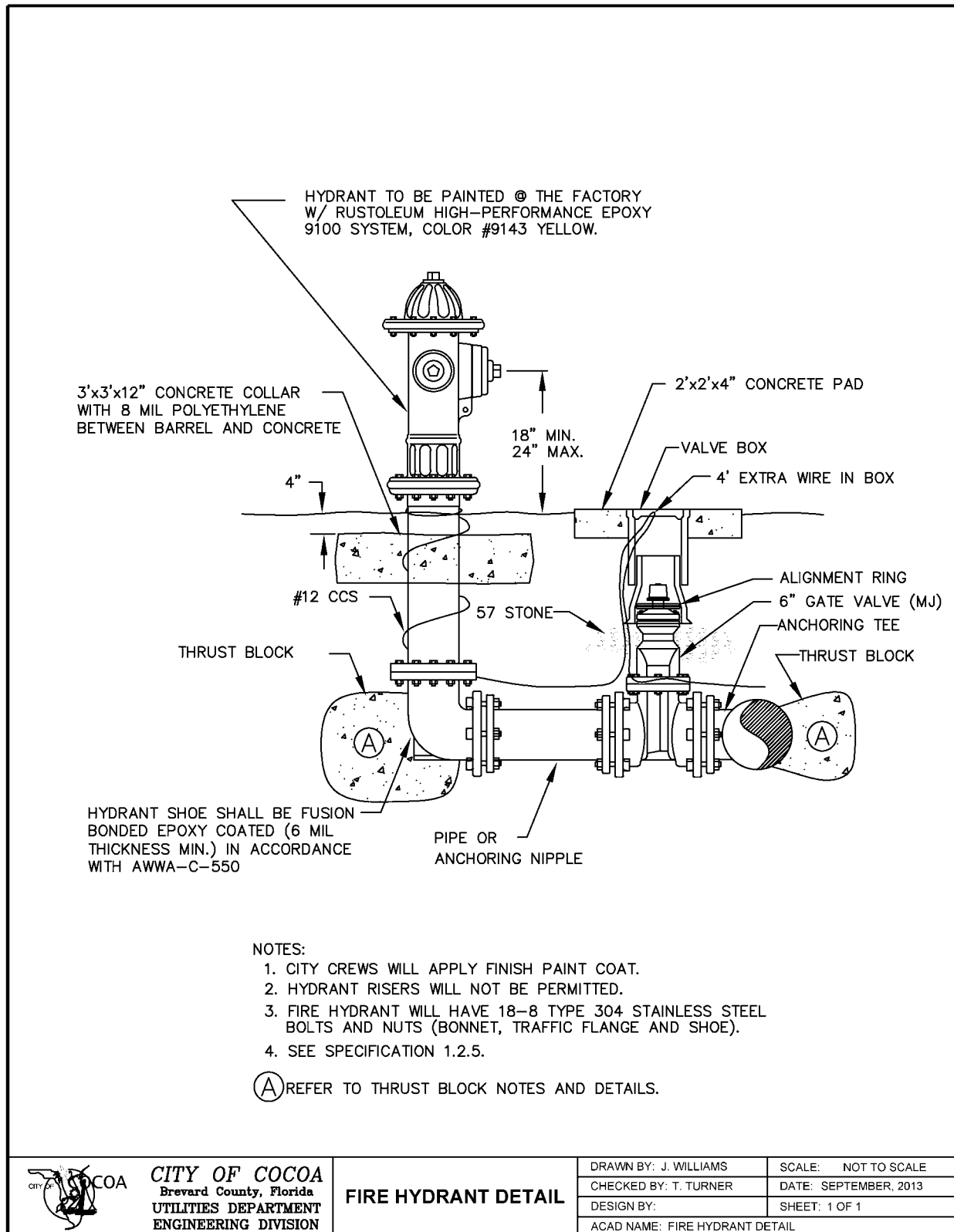
APPENDIX B APPROVED DRAWINGS AND DETAILS



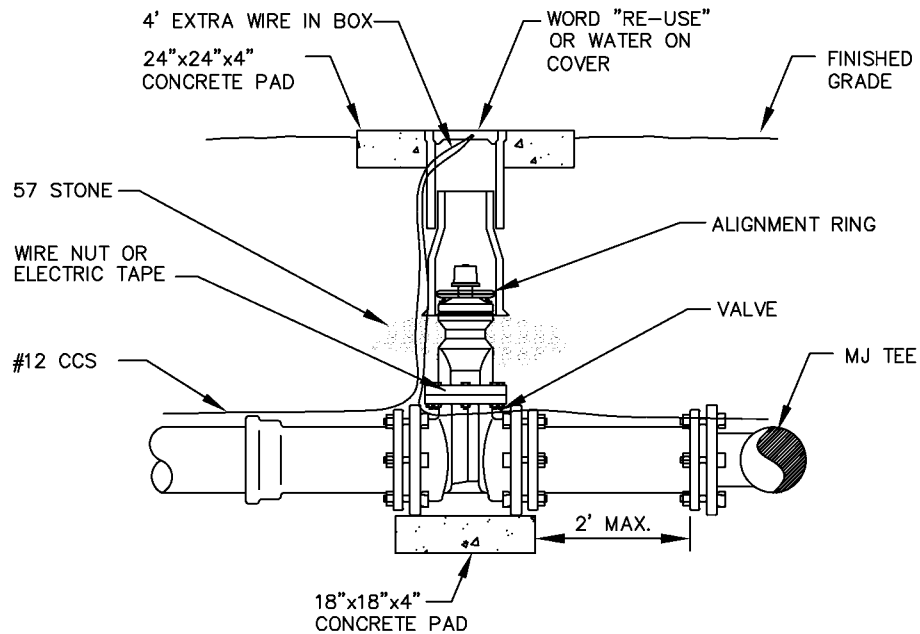
APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS



NOTE: PROPER SIZE VALVE BOX SHALL BE INSTALLED. PIPE NOT ALLOWED.

GATE VALVE AND FITTING DETAIL NTS



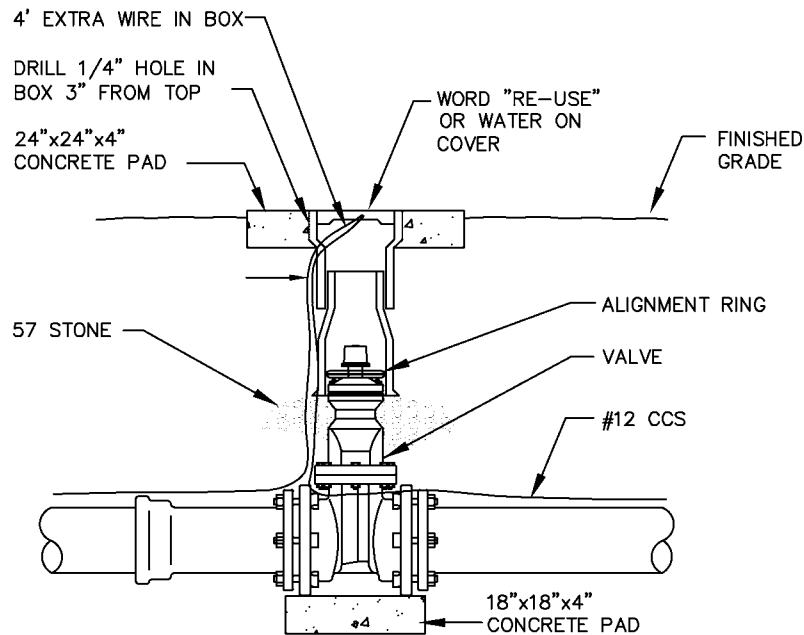
CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

GATE VALVE AND FITTING DETAIL

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: GATE VALVE & FITTING DETAIL	

APPENDIX B APPROVED DRAWINGS AND DETAILS

GATE VALVE AND VALVE BOX DETAIL NTS



NOTES:

1. PVC PIPE OR DUCTILE IRON PIPE EXTENSIONS SHALL NOT BE USED ON VALVE BOX INSTALLATION.
2. IF THE DEPTH OF THE VALVE NUT IS GREATER THAN 48" BELOW GRADE, OR 30" BELOW GRADE AND UNDER THE WATER TABLE, A VALVE EXTENSION WILL BE REQUIRED. SEE VALVE EXTENSION STEM DETAIL.
3. PROVIDE A PLASTIC DEBRIS SHIELD/ALIGNMENT RING WHICH INSTALLS BELOW THE VALVE ACTUATING NUT. THIS SHIELD SHALL CENTER THE RISER PIPE BOX OVER THE ACTUATING NUT AND MINIMIZE INFILTRATION.
4. LOCATING WIRE SHALL BE CONTINUOUS WITH NO SPLICES AND SHALL EXTEND 24" ABOVE TOP OF COLLAR. WIRE SHALL BE COLOR CODED TO MATCH THE UTILITY INSTALLED.
5. FOR NEW CONSTRUCTION, THE VALVE BOX SHALL BE ADJUSTED TO MIDRANGE TO ALLOW FOR FUTURE BOX ADJUSTMENTS.

THIS DETAIL APPLIES TO ALL BURIED VALVES.

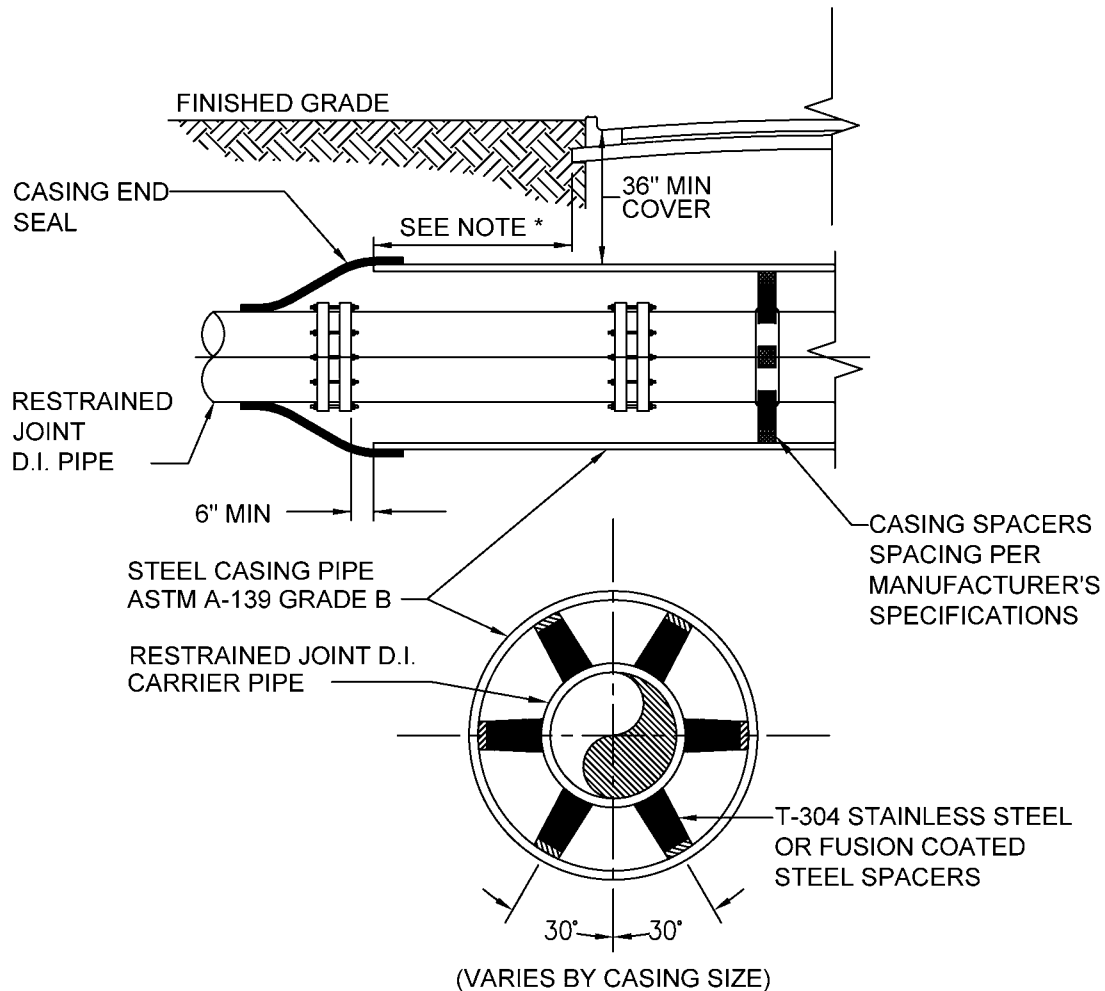


CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

GATE VALVE AND VALVE BOX DETAIL

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: GATE VALVE & VALVE BOX DETAIL	

APPENDIX B APPROVED DRAWINGS AND DETAILS



NOTES:

1. WHEN CONSTRUCTION IS WITHIN FDOT JURISDICTION, ADDITIONAL REQUIREMENTS OF THE UTILITY ACCOMMODATION GUIDE SHALL BE MET.
2. DISTANCE BETWEEN SPACERS TO BE PER MANUFACTURER'S SPECIFICATIONS.
3. NO FLOWABLE FILL BETWEEN THE ANULAR SPACE OF THE CASING OR CARRIER PIPE.

* SHALL BE A MINIMUM OF 6' OR MEET FDOT REQUIREMENTS, WHICHEVER IS GREATER.

SEE SECTION 1.5.12.



CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

JACK AND BORE

DRAWN BY: J. WILLIAMS

SCALE: NOT TO SCALE

CHECKED BY: T. TURNER

DATE: SEPTEMBER, 2013

DESIGN BY:

SHEET: 1 OF 1

ACAD NAME: BORE AND JACK

PROPOSED 2" DOUBLE CHECK OR REDUCED PRESSURE ZONE BACKFLOW PREVENTER (PROVIDED BY CONTRACTOR)

OPTIONAL SECONDARY 2" DOUBLE CHECK OR REDUCED PRESSURE PROVIDED BY CONTRACTOR CAN BE INSTALLED WITH A TEE BETWEEN METER AND BACKFLOW FOR ON SITE TEMP WATER

PROPOSED JUMPER METER (FLANGE) PROVIDED BY CITY (CONTRACTOR TO INSTALL)

PROPOSED 2" GATE VALVE

PROPOSED 2" BALL VALVE

PROPOSED 2" GATE VALVE

PROPOSED 90° BEND

GRADE

BRASS OR GALVANIZED PIPING NO PVC

2" CORPORATION STOP (TYP. 2 PLCS.)

* PROPOSED BRONZE SADDLE

CEMENT SUPPORT BY CONTRACTOR

BRASS OR GALVANIZED PIPING NO PVC

* PROPOSED BRONZE SADDLE

INSTALLATION OF SWAB IN NEW WATER MAIN TO BE FLUSHED OUT WITH JUMPER ASSEMBLY AND WITNESSED BY CITY OF COCOA INSPECTION

PROPOSED WATER MAIN

EXISTING WATERMAIN

NO TEES OR SPIGOTS UPSTREAM OF METER

JUMPER & METER ASSEMBLY

NTS

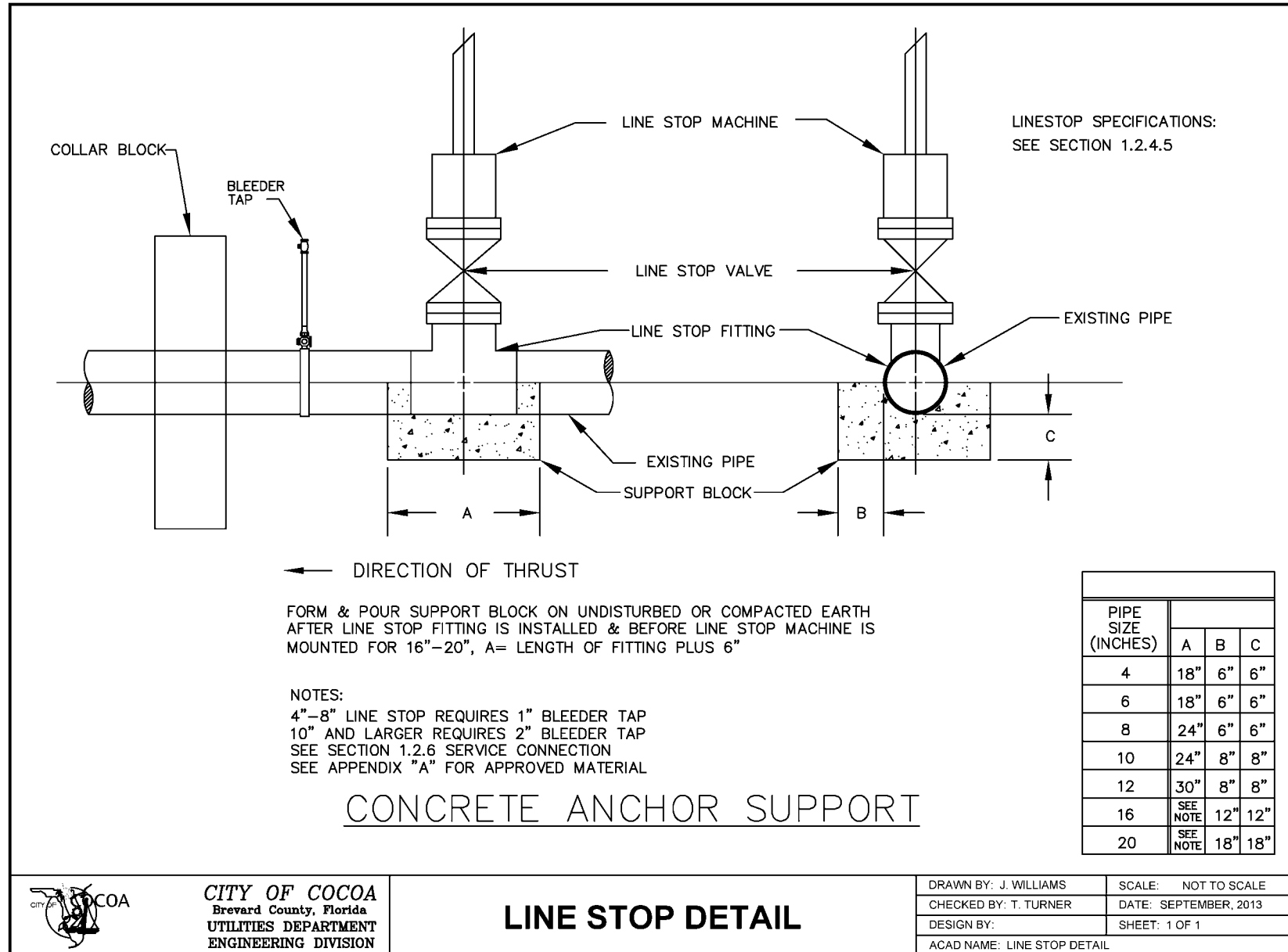
NOTES:

1. REQUIRED AT ALL CONNECTIONS BETWEEN EXISTING ACTIVE WATER MAINS AND PROPOSED WATER MAIN IMPROVEMENTS.
2. ONLY EXCEPTION TO JUMPER AND METER ASSEMBLY IS INSTALLATION OF FIRE HYDRANT WHERE AN ANCHORING NIPPLE IS USED.

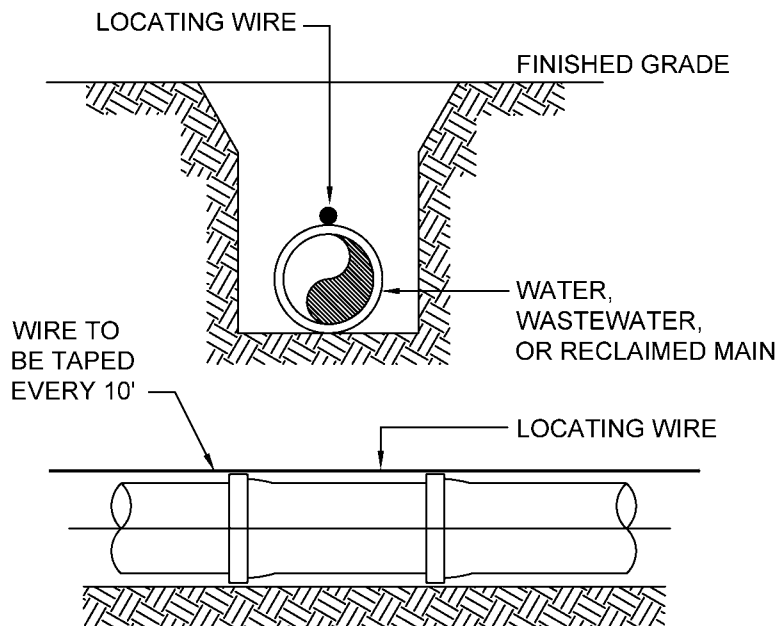
* BACKFLOW PREVENTER TO BE TESTED AFTER INSTALLATION. CONTRACTOR TO PROVIDE TEST RESULTS TO INSPECTORS.

* INLET: AWWA TAPER ("CC")
THREAD OUTLET: F.I.P. THREAD

APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS



NOTES:

1. ALL PIPE SHALL REQUIRE INSULATED LOCATING WIRE (#12 CCS) CAPABLE OF DETECTION BY A CABLE LOCATOR AND SHALL BE TAPED EVERY 10' TO TOP CENTERLINE OF THE PIPE.
2. WIRE IS TO BE CONNECTED TOGETHER USING AN UNDERGROUND WIRE NUT WITH A SILICON BASED SEALANT.
3. SEE SECTION 1.5.5.

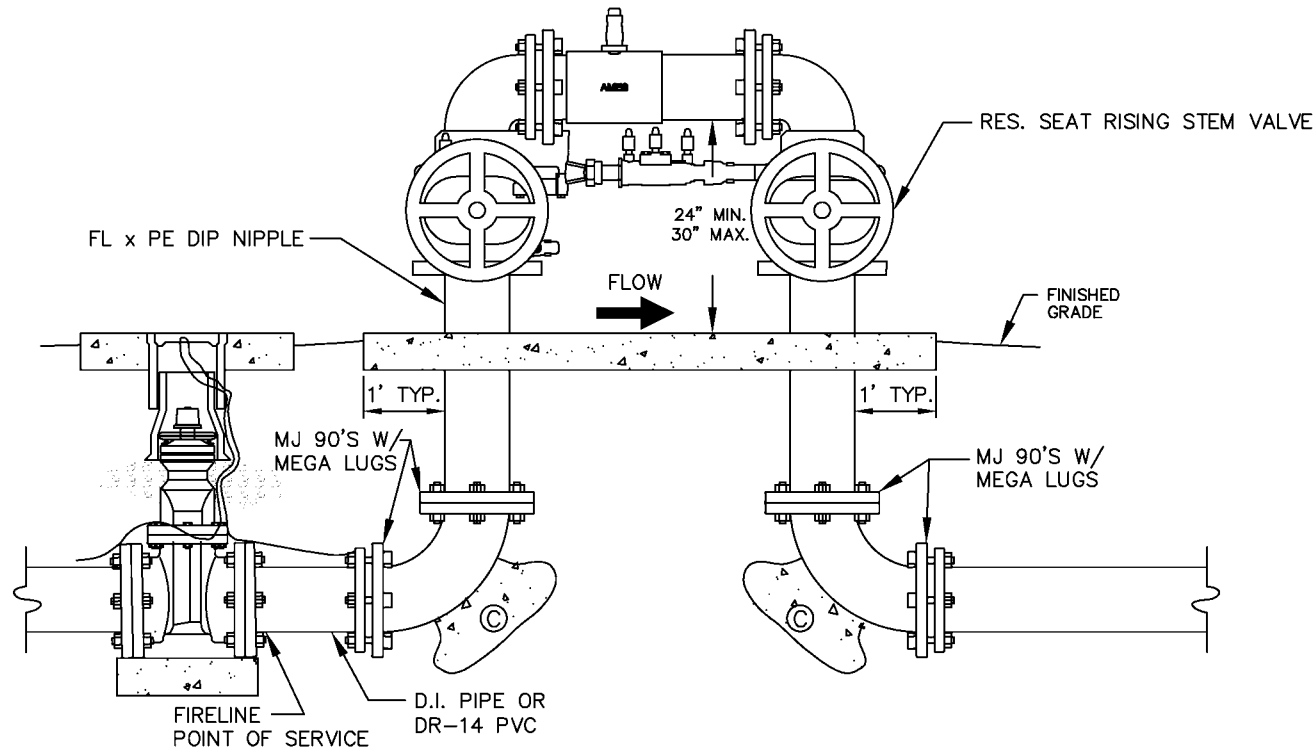


CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

LOCATING WIRE DETAIL

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: LOCATION WIRE DETAIL	

APPENDIX B APPROVED DRAWINGS AND DETAILS



NOTES:

1. ALTHREAD ROD WILL NOT BE PERMITTED.
2. FIRE DEPARTMENT CONNECTIONS (FDC) WILL NOT BE PERMITTED ON ABOVE GROUND PIPING.
3. ASSEMBLY TO BE PAINTED RUST-O-THANE RED NO. 9405-1611
4. ALL ABOVE GROUND BOLTS AND NUTS TO BE 18-8 TYPE 304 STAINLESS STEEL.
5. CITY OWNS AND MAINTAINS TO BOTTOM FITTING ON DOWNSTREAM SIDE.
6. FOUR TO SIX BOLLARDS MAY BE REQUIRED, SPACED 18" FROM CENTERLINE.
7. A FIRELINE CONTRACTOR SHALL BE REQUIRED FROM THE FIRELINE POINT OF SERVICE.

© REFER TO THRUST BLOCK NOTES & DETAILS.

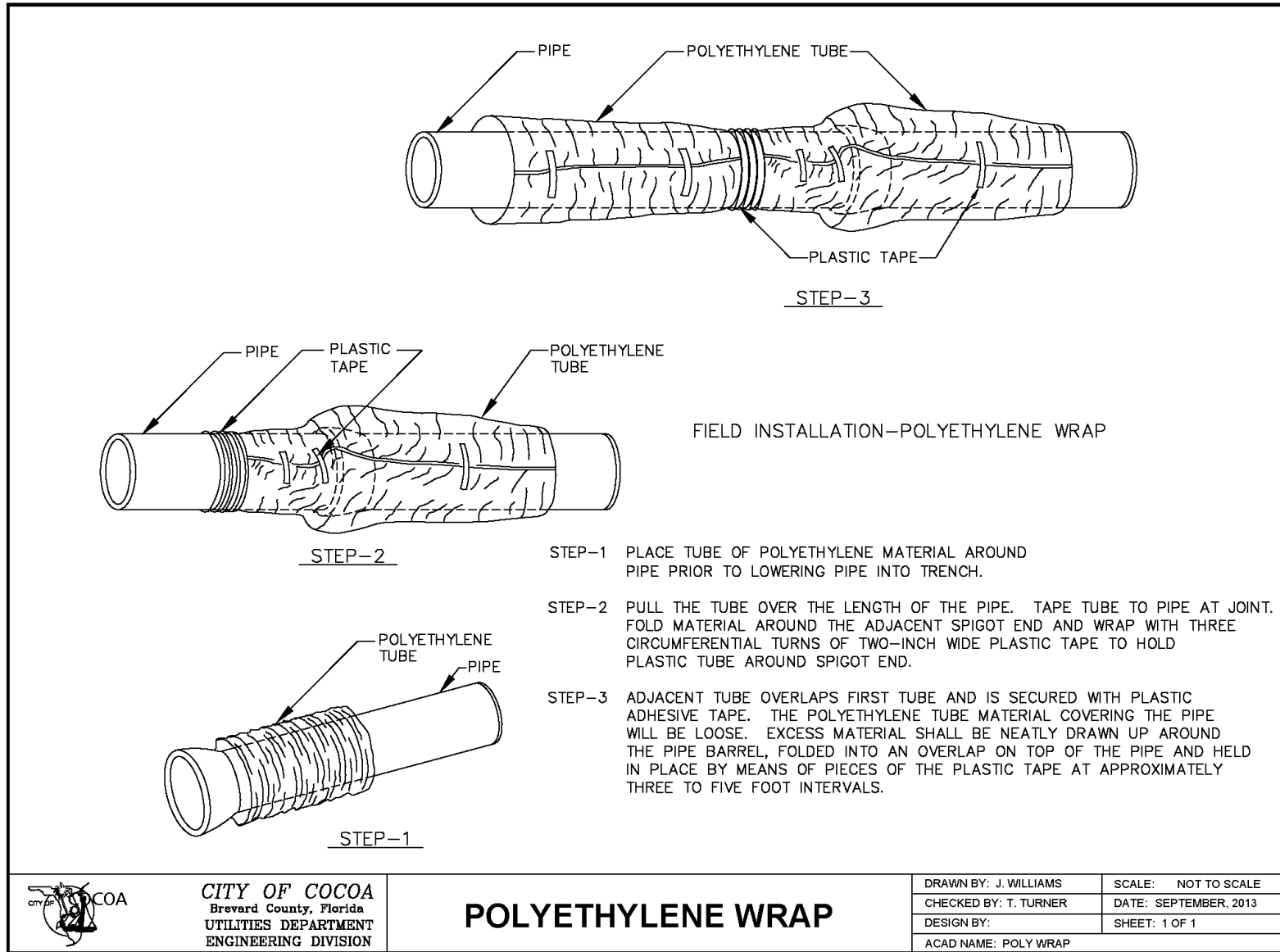


CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

"N" PATTERN DOUBLE CHECK DETECTOR ASSEMBLY

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: N PATTERN DOUBLE CHECK DETECTOR ASSEMBLY	

APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS

CITY OF COCOA UTILITIES
TECHNICAL PROVISIONS

RESTRAINED PIPE TABLE
WATER AND RECLAIMED WATER MAINS

MINIMUM LENGTH (FT) TO BE RESTRAINED ON EACH SIDE OF FITTING(S)								
TYPE	PIPE SIZE							
	4"	6"	8"	10"	12"	16"	20"	24"
90° BEND	21	29	38	45	53	66	79	91
45° BEND	9	12	16	19	22	45	33	38
22-1/2° BEND	5	6	8	9	11	14	16	19
11-1/4° BEND	3	3	4	5	6	7	8	9
PLUG, BRANCH OF TEE, VALVE	58	82	107	128	151	193	234	273

NOTES:

1. FITTINGS SHALL BE RESTRAINED JOINTS.
2. INSTALL FULL LENGTH JOINTS WITH TOTAL LENGTH EQUAL TO OR GREATER THAN SHOWN IN THE TABLE.
3. WHERE TWO OR MORE FITTINGS ARE TOGETHER, USE FITTING WHICH YIELDS GREATEST LENGTH OF RESTRAINED PIPE.
4. ALL LINE VALVES AND THROUGH RUN OF TEES SHALL BE RESTRAINED.
5. LENGTHS SHOWN IN THE TABLE HAVE BEEN CALCULATED IN ACCORDANCE WITH THE PROCEDURE OUTLINED IN "THRUST RESTRAINT DESIGN FOR DUCTILE IRON PIPE" AS PUBLISHED BY DIPRA, WITH THE FOLLOWING ASSUMPTIONS:

WORKING PRESSURE: 150 PSI
SOIL DESIGNATION: SM (SAND SILT)
LAYING CONDITIONS: 3

6. TABLE IS FOR PVC AND WRAPPED DUCTILE IRON.

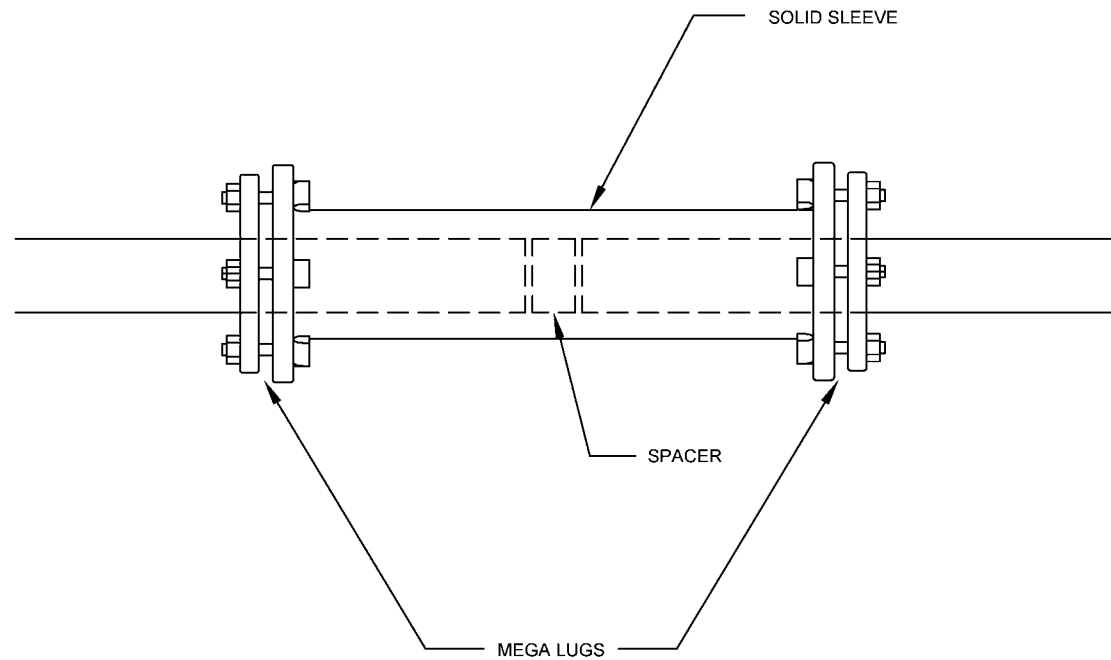


CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

RESTRAINED PIPE TABLE
WATER & RECLAIMED
WATER MAINS

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: RESTRAINED PIPE TABLE WATER AND RECLAIMED	

APPENDIX B APPROVED DRAWINGS AND DETAILS

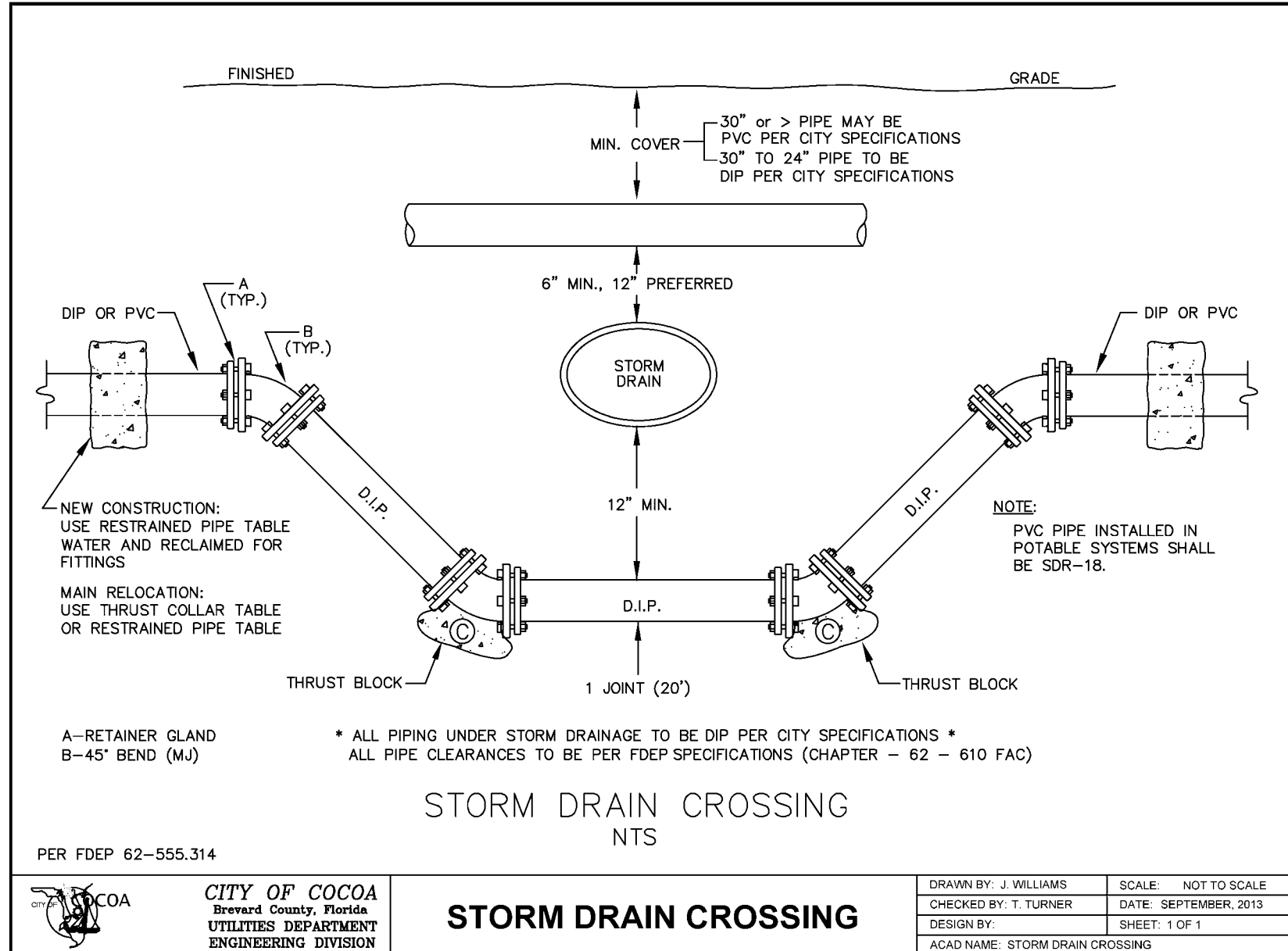


CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

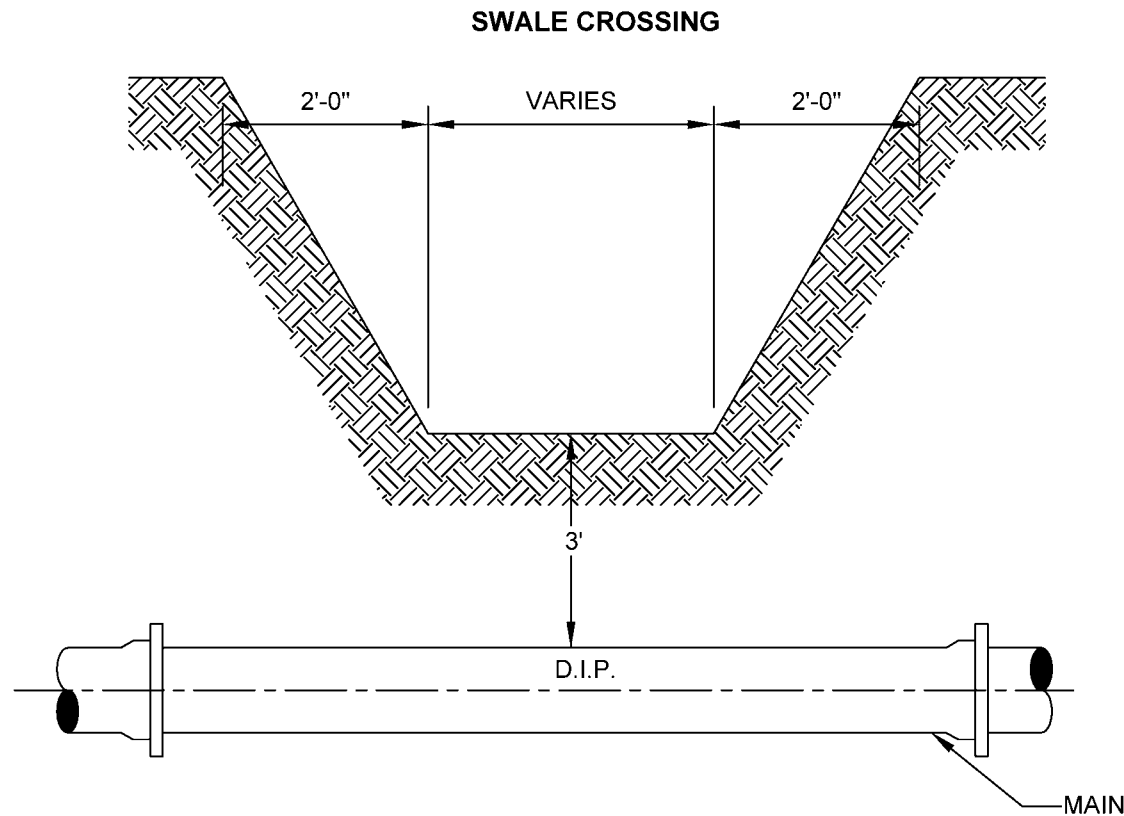
SOLID SLEEVE DETAIL

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: SOLID SLEEVE DETAIL	

APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS



NOTES:

1. MAIN SHALL BE A CONTINUOUS LENGTH OF D.I. PIPE TO EXTEND 2 FEET MINIMUM EITHER SIDE OF THE DRAINAGE SWALE.
2. IF 1 OR MORE JOINTS OF PIPE IS REQUIRED, JOINT MUST BE RESTRAINED.

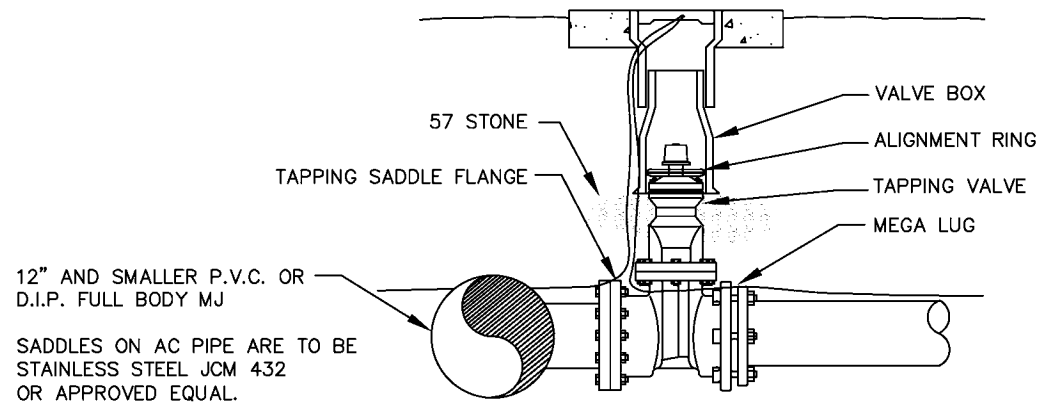


CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

SWALE CROSSING

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: SWALE CROSSING	

APPENDIX B APPROVED DRAWINGS AND DETAILS



TAPPING SADDLE AND VALVE

NTS



CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

TAPPING SADDLE AND VALVE

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: TAPPING SADDLE AND VALVE	

APPENDIX B APPROVED DRAWINGS AND DETAILS

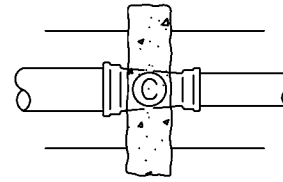
THRUST BLOCK NOTES

- 1.) WRAP ALL FITTINGS WITH POLYETHYLENE FILM BEFORE POURING THRUST BLOCK, MAKING CERTAIN TO KEEP CONCRETE AWAY FROM ALL BOLTS, GLANDS, AND FLANGES.
- 2.) THRUST BLOCKS TO BE POURED AGAINST UNDISTURBED EARTH.
- 3.) REQUIRED VOLUMES OF BEARING AREAS TO BE AS SHOWN IN CHART. ADJUSTMENTS, IF NEEDED, WILL BE ALLOWED TO CONFORM TO TEST PRESSURE AND ALLOWABLE SOIL BEARING STRESS AS SHOWN IN SPECIFICATIONS.
- 4.) BEARING AREA FOR TRANSIT BLOCKS ON HORIZONTAL BENDS IS BASED ON A TEST PRESSURE OF 150 P.S.I. AND SOIL BEARING STRESS OF 2,000 P.S.F.. THE DEPTH TO THE THRUST BLOCK BASE TO BE EQUAL TO OR GREATER THAN TWICE THE HEIGHT. (EXAMPLE: IF BLOCK IS 2' THICK, THE BASE IS TO BE NO GREATER THAN 4' BELOW GRADE.)
- 5.) VERTICAL BEND THRUST BLOCKS TO BE THE SAME AS HORIZONTAL BENDS.
- 6.) BEARING AREA OF THRUST BLOCK TO BE NOT LESS THAN ONE SQUARE FOOT.

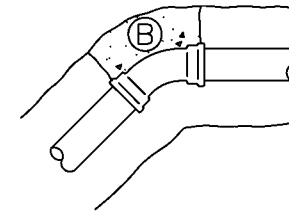
MINIMUM BEARING AREA (SQ. FT.)

LETTER	PIPE SIZE						
	4"	6"	8"	10"	12"	16"	20"
A	1-1/2	2-3/4	5	7-1/4	10-1/4	18	27-1/2
B(22-1/2)	3/4	1	2	3	4	7	11
B (45°)	1	2-1/4	3-3/4	5-1/2	8	13-3/4	21
C	2	4	7	11-1/4	14-1/2	25-1/4	39

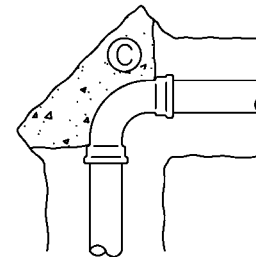
THE FIGURES IN THIS TABLE REPRESENT AREA OF CONCRETE BLOCKING AGAINST THE VERTICAL TRENCH WALL OF UNDISTURBED EARTH IN SQUARE FEET AT 2000 P.S.F. SOIL BEARING CAPACITY.



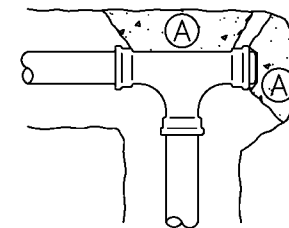
REDUCER
NTS



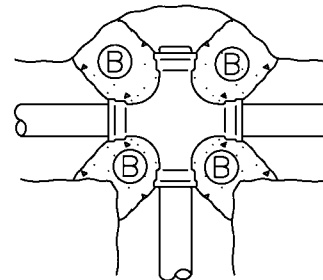
BEND
NTS



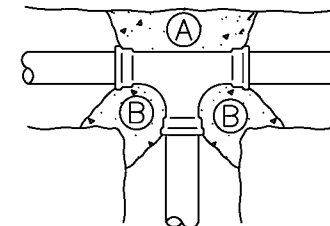
90° ELBOW
NTS



TEE & PLUG
NTS



CROSS & PLUG
NTS



TEE
NTS

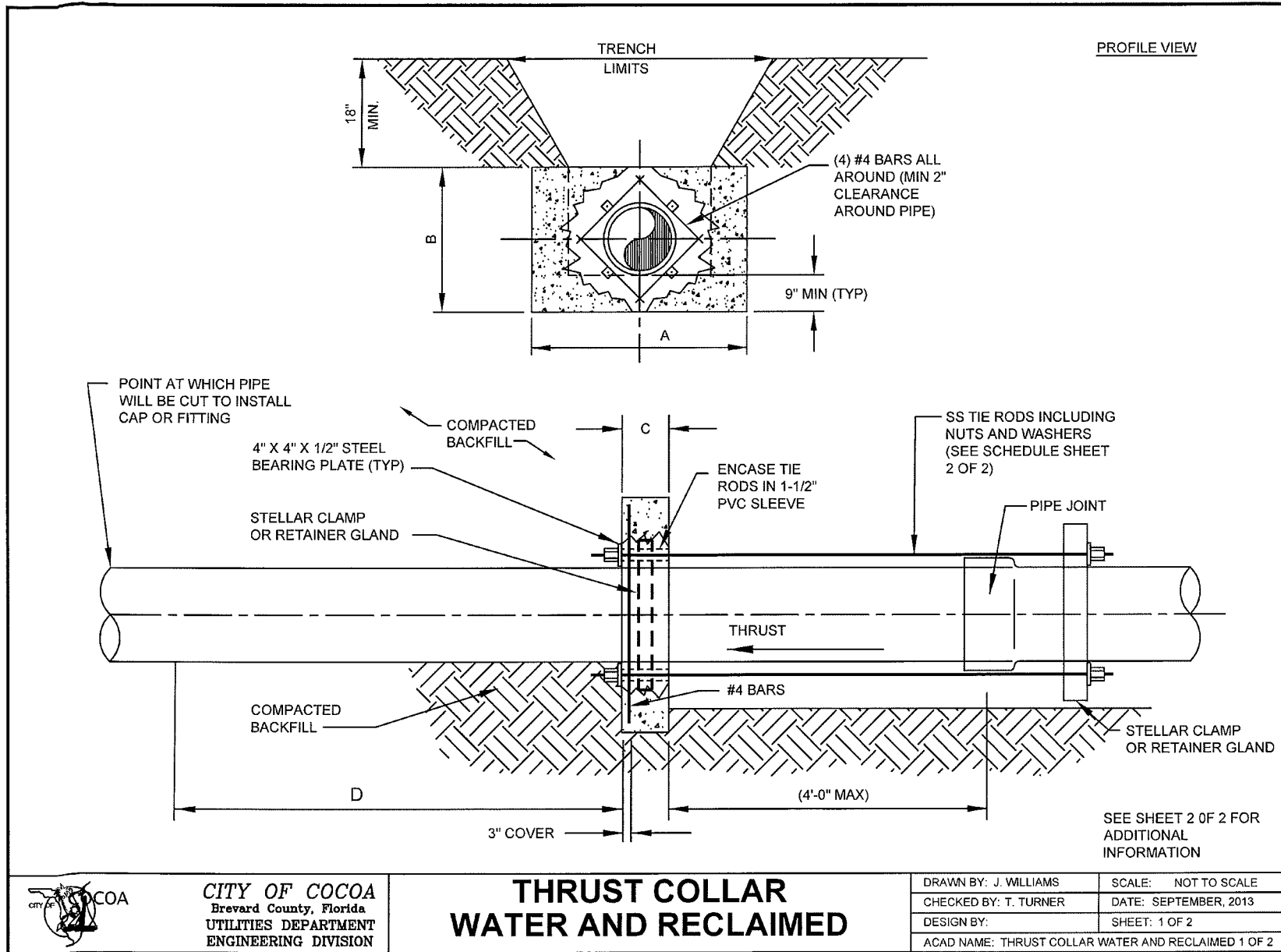


CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

THRUST BLOCK NOTES & DETAILS

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: THRUST BLOCK NOTES & DETAILS	

APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS

SCHEDULE OF DIMENSIONS AND MATERIALS						
PIPE SIZE (INCHES)	DIMENSIONS (FT.)				TIE RODS REQ'D	
	A	B	C	D	DIA. (in.)	NO.
4	2.0	2.0	1.0	2.0	3/4	2
6	2.0	2.0	1.0	4.0	3/4	2
8	3.0	3.0	1.0	5.0	3/4	2
10	4.0	3.0	1.0	8.0	3/4	4
12	5.0	3.0	1.0	10.0	3/4	4
16	*	*	*	*	*	*
20	*	*	*	*	*	*
24	*	*	*	*	*	*
NOTE: THRUST COLLAR AREAS TO BE COMPUTED ON BASIS OF 2000 LBS/SF SOIL RESTRAINT BEARING. SOIL DENSITY ASSUMED 120 PCF. SOIL COHESION 20°.						

NOTES:

1. ADDITIONAL REINFORCEMENTS SHALL BE AS SPECIFIED BY THE ENGINEER.
2. MINIMUM COMPRESSIVE STRENGTH FOR CONCRETE SHALL BE 3000 PSI.
3. BEDDING, BACKFILL AND COMPACTION SHALL BE AS SPECIFIED ELSEWHERE IN THE STANDARD DRAWINGS.
4. ALL FORM BOARDS SHALL BE REMOVED PRIOR TO BACKFILL.
5. NO ALLOWANCE SHALL BE MADE FOR FRICTION BETWEEN THE PIPE WALL AND THE THRUST COLLAR.
6. DESIGN PRESSURE: 150 PSI.
7. TIE RODS TO BE 3/4" SS 18-8 TYPE 304.

* TO BE DESIGNED BY ENGINEER OF RECORD.

SEE SHEET 1 OF 2 FOR
ADDITIONAL
INFORMATION

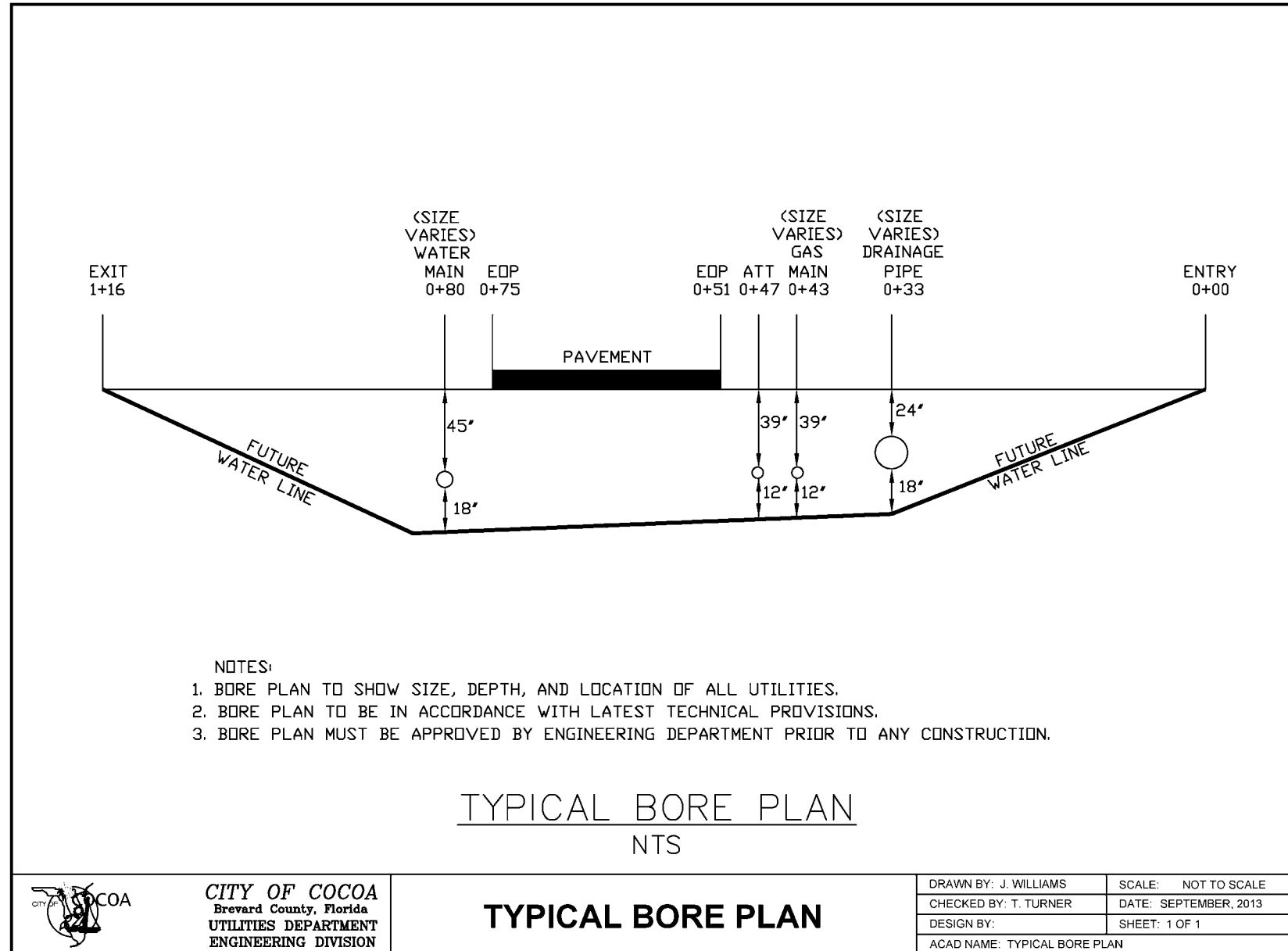


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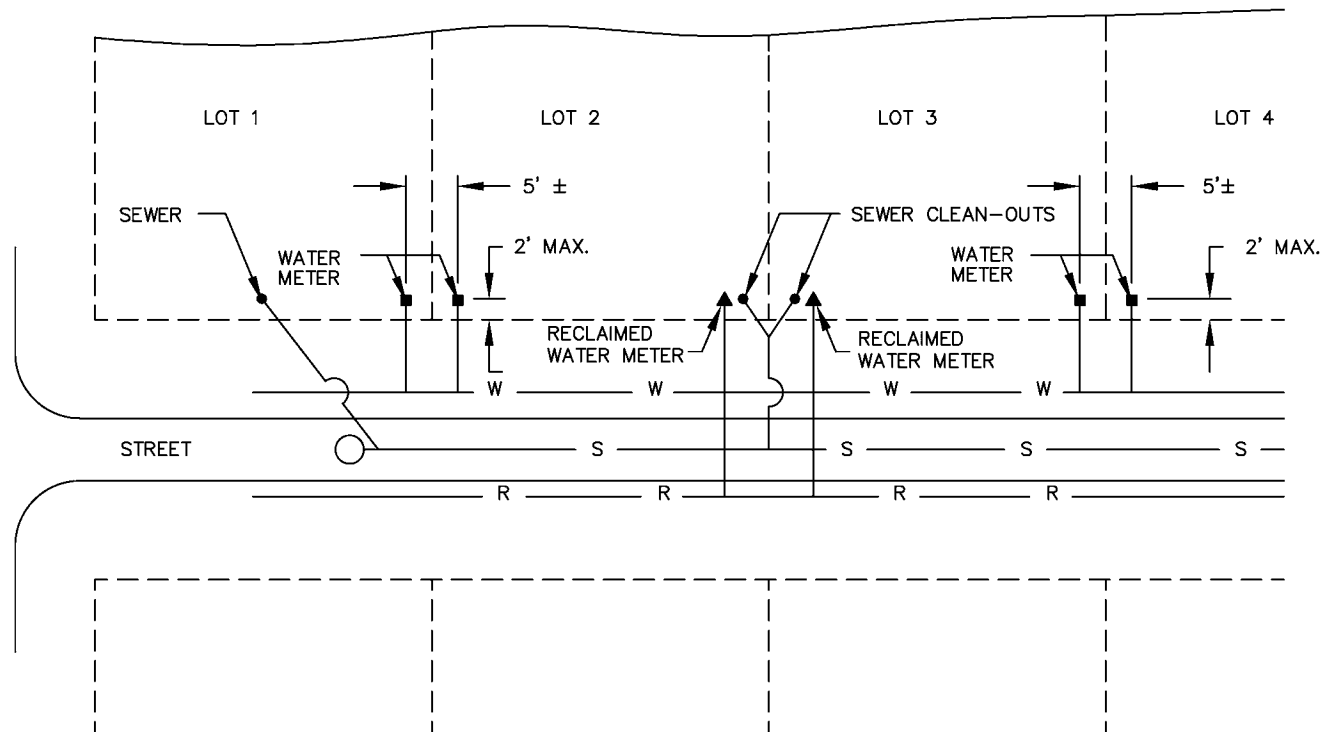
THRUST COLLAR WATER AND RECLAIMED

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 2 OF 2
ACAD NAME: THRUST COLLAR WATER AND RECLAIMED 2 OF 2	

APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS



TYPICAL LOT SERVICE LINE LOCATION
NTS



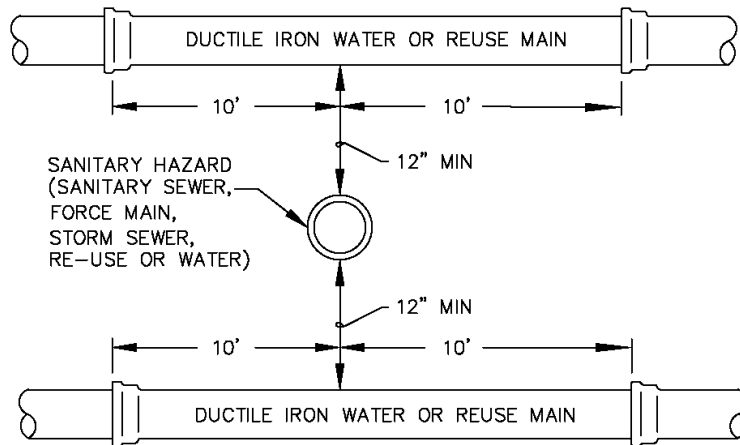
CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

TYPICAL LOT SERVICE LINE LOCATION

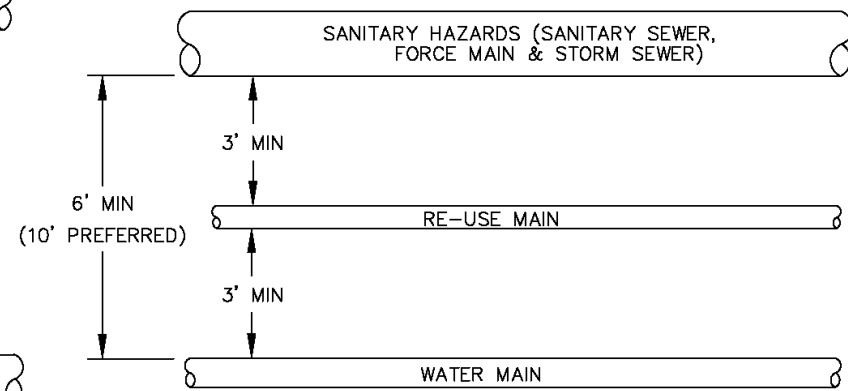
DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: TYPICAL LOT SERVICE LINE LOCATION	

APPENDIX B APPROVED DRAWINGS AND DETAILS

30" or > PIPE MAY BE
PVC PER CITY SPECIFICATIONS
30" TO 24" PIPE TO BE
DIP PER CITY SPECIFICATIONS



VERTICAL CLEARANCE



HORIZONTAL CLEARANCE

TYPICAL REQUIRED SEPARATION
NTS

PER FDEP 62-555.314

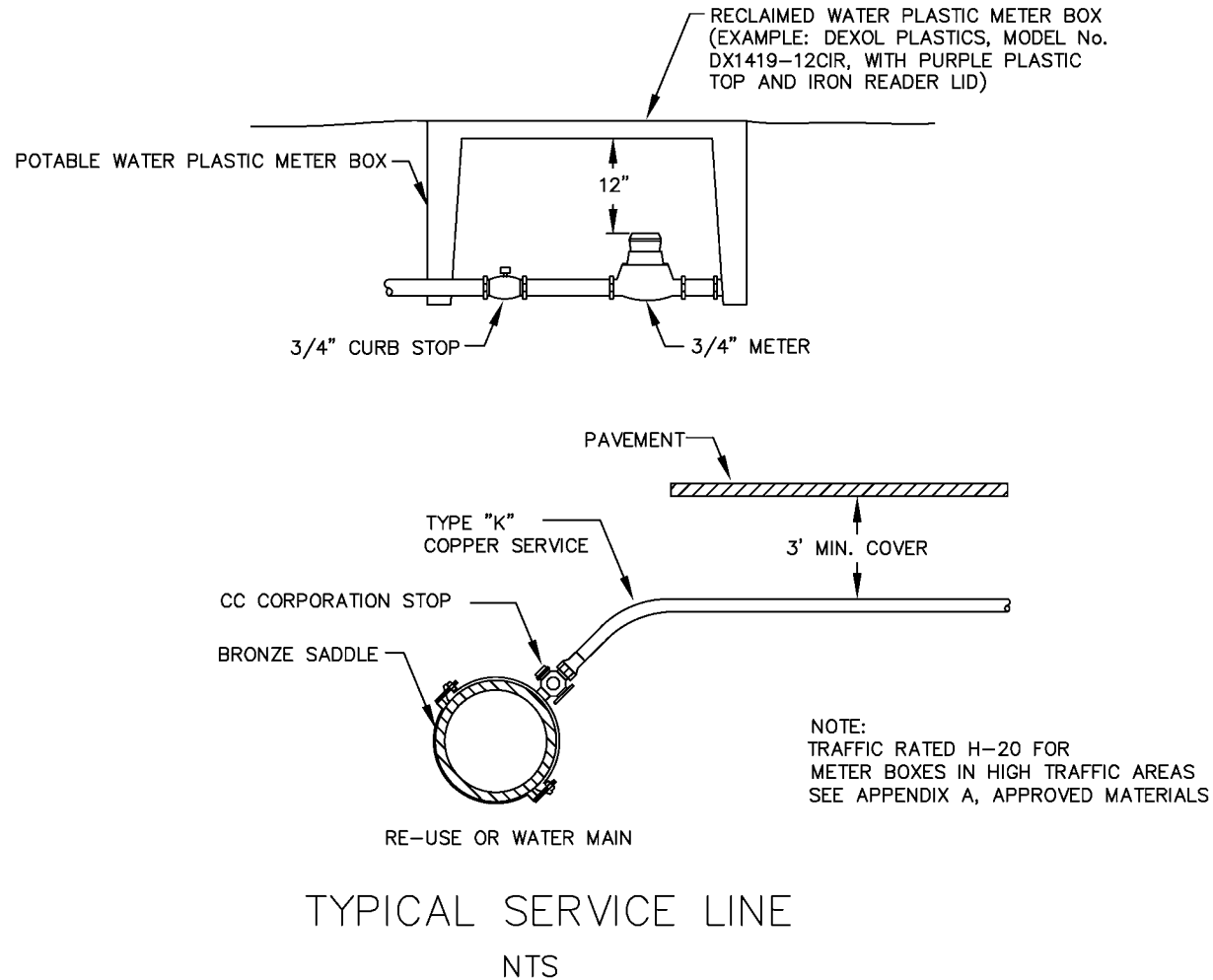


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Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

TYPICAL REQUIRED SEPARATION

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: TYPICAL REQUIRED SEPARATION	

APPENDIX B APPROVED DRAWINGS AND DETAILS

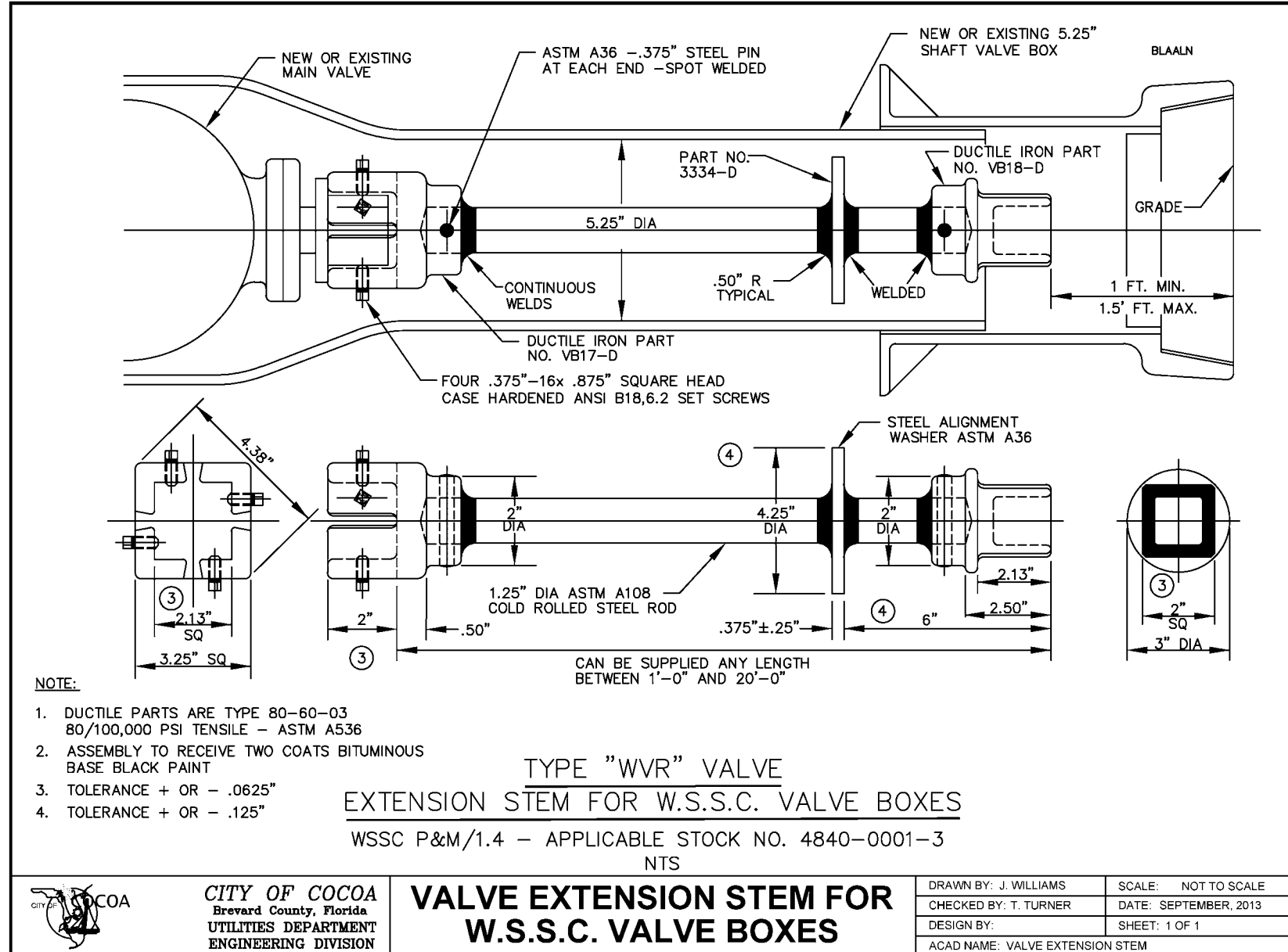


CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

TYPICAL SERVICE LINE

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: TYPICAL SERVICE LINE	

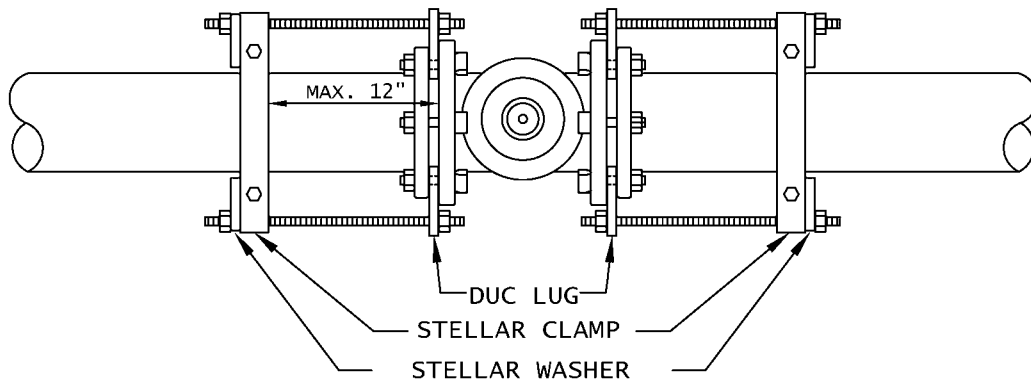
APPENDIX B APPROVED DRAWINGS AND DETAILS



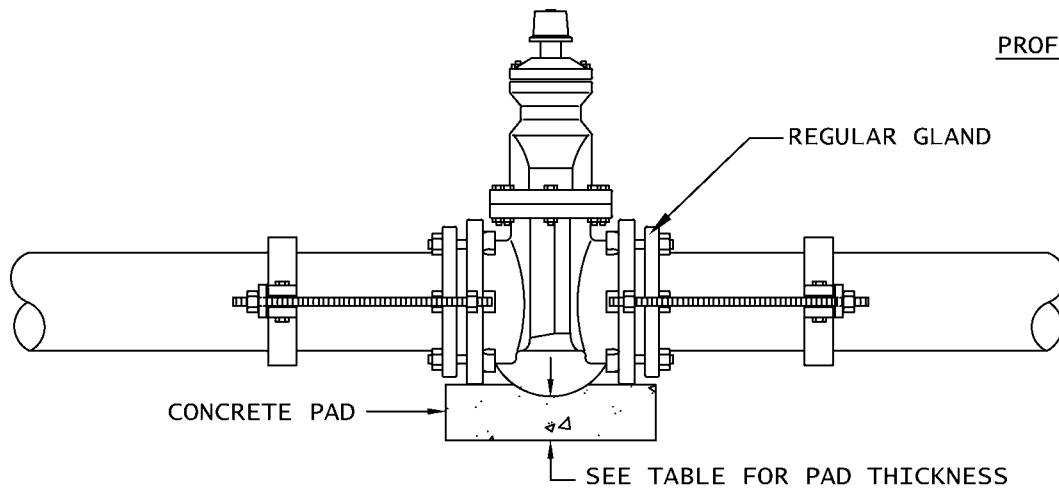
APPENDIX B APPROVED DRAWINGS AND DETAILS

VALVE INSERT FOR A.C. PIPE

PLAN



PROFILE



SIZE	MIN. COVER OF PIPE	CONCRETE PAD SIZE FROM LOWEST POINT OF FITTING
4"	24"	16"x16"x6"
6"	26"	18"x18"x6"
8"	30"	20"x20"x6"
*10"	36"	24"x24"x8"
*12"	40"	30"x30"x8"

* NOTE: 10" AND 12" REQUIRE TWO CLAMPS AND FOUR RODS PER SIDE.

VALVES INSTALLED PER MANUFACTURER'S RECOMMENDATION ON
DIP AND PVC.

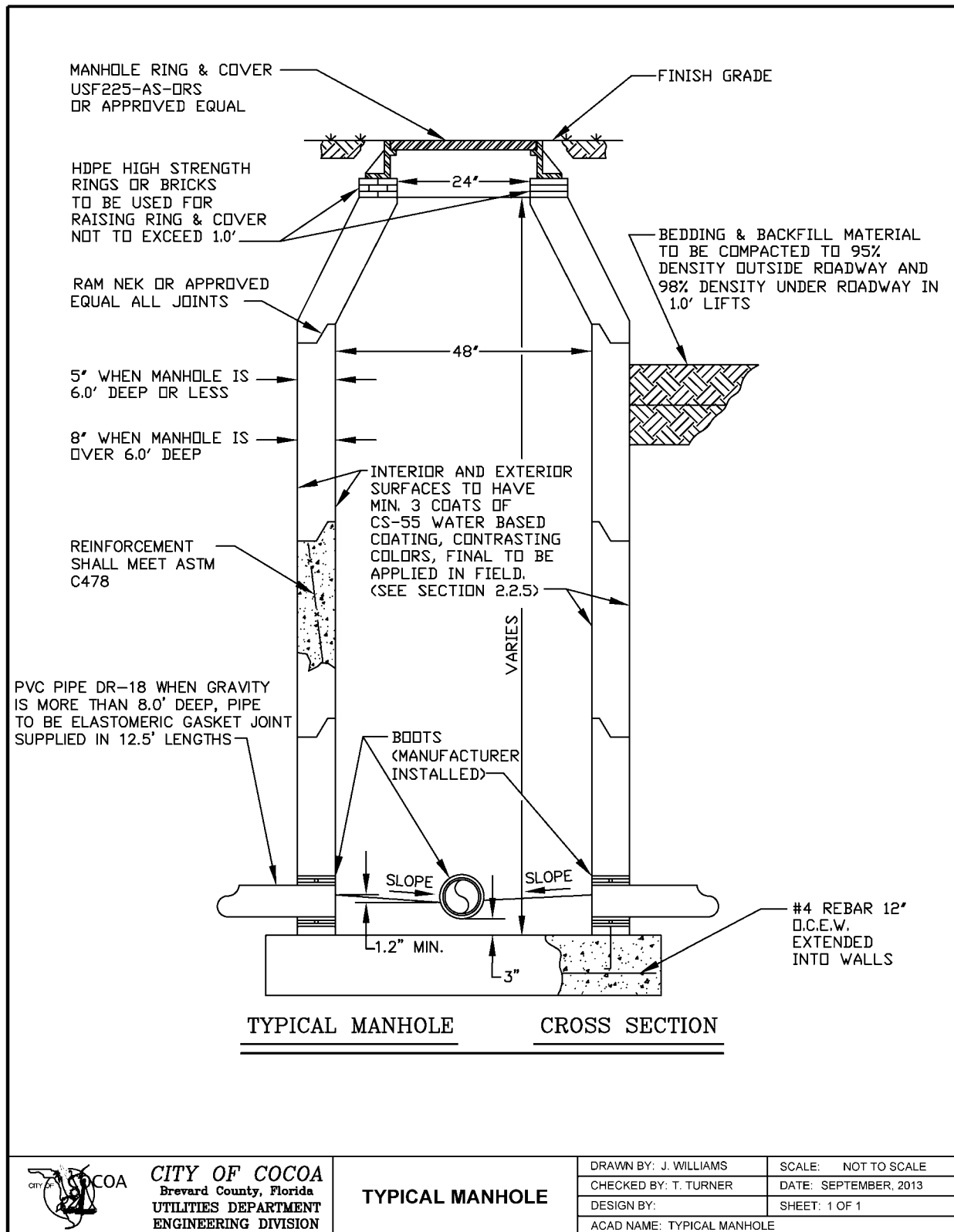


CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

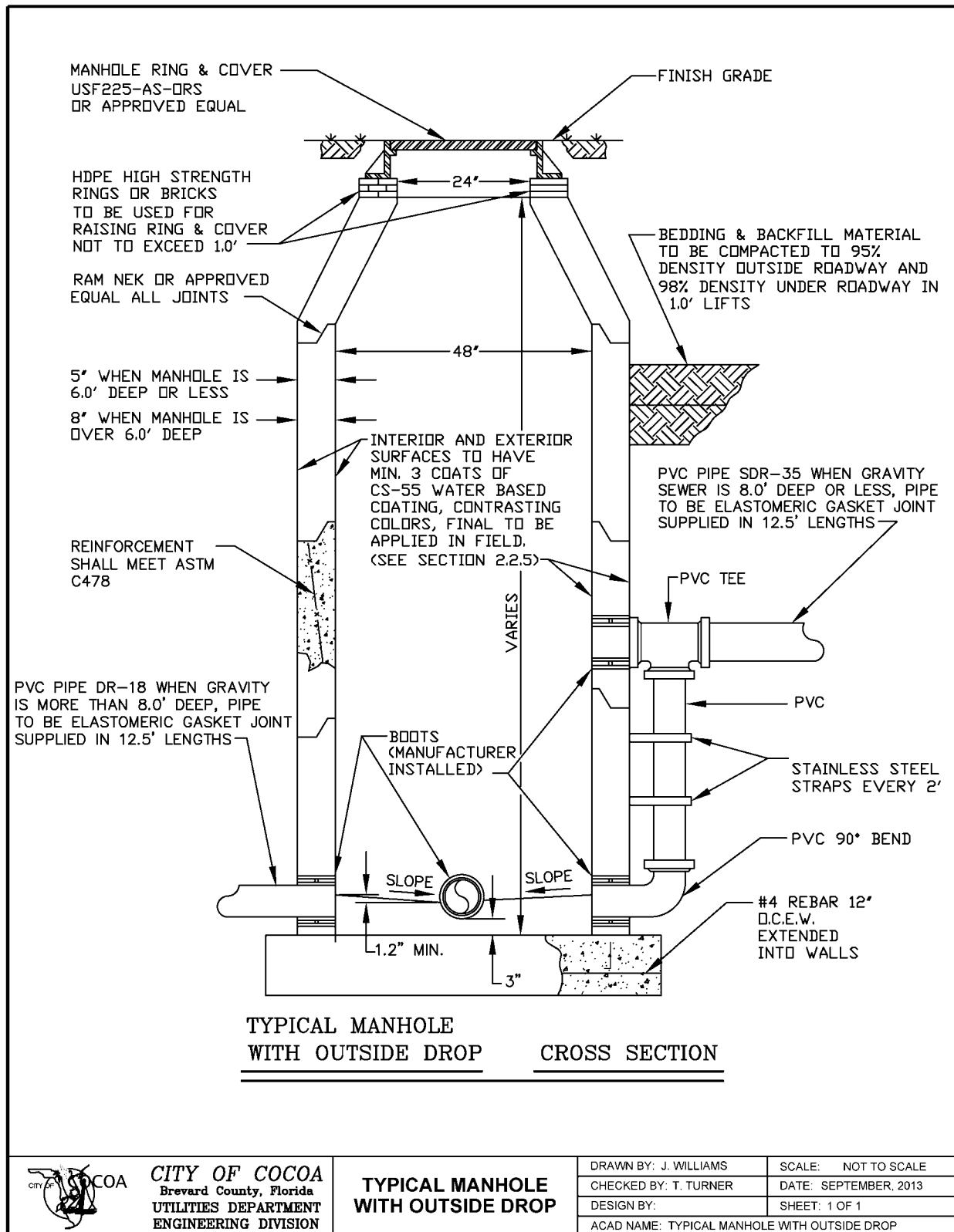
VALVE INSERT FOR A.C. PIPE

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: VALVE INSERT	

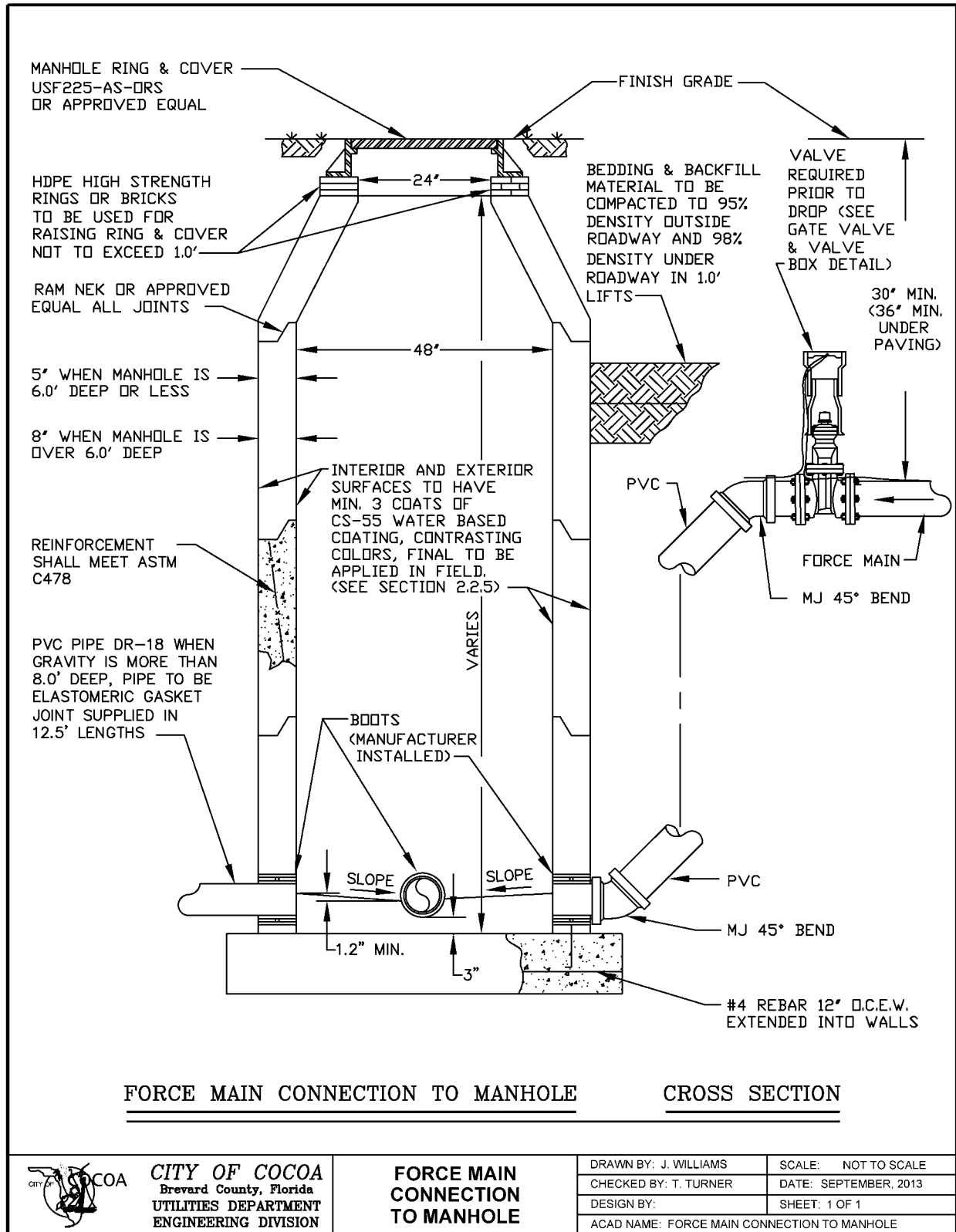
APPENDIX B APPROVED DRAWINGS AND DETAILS



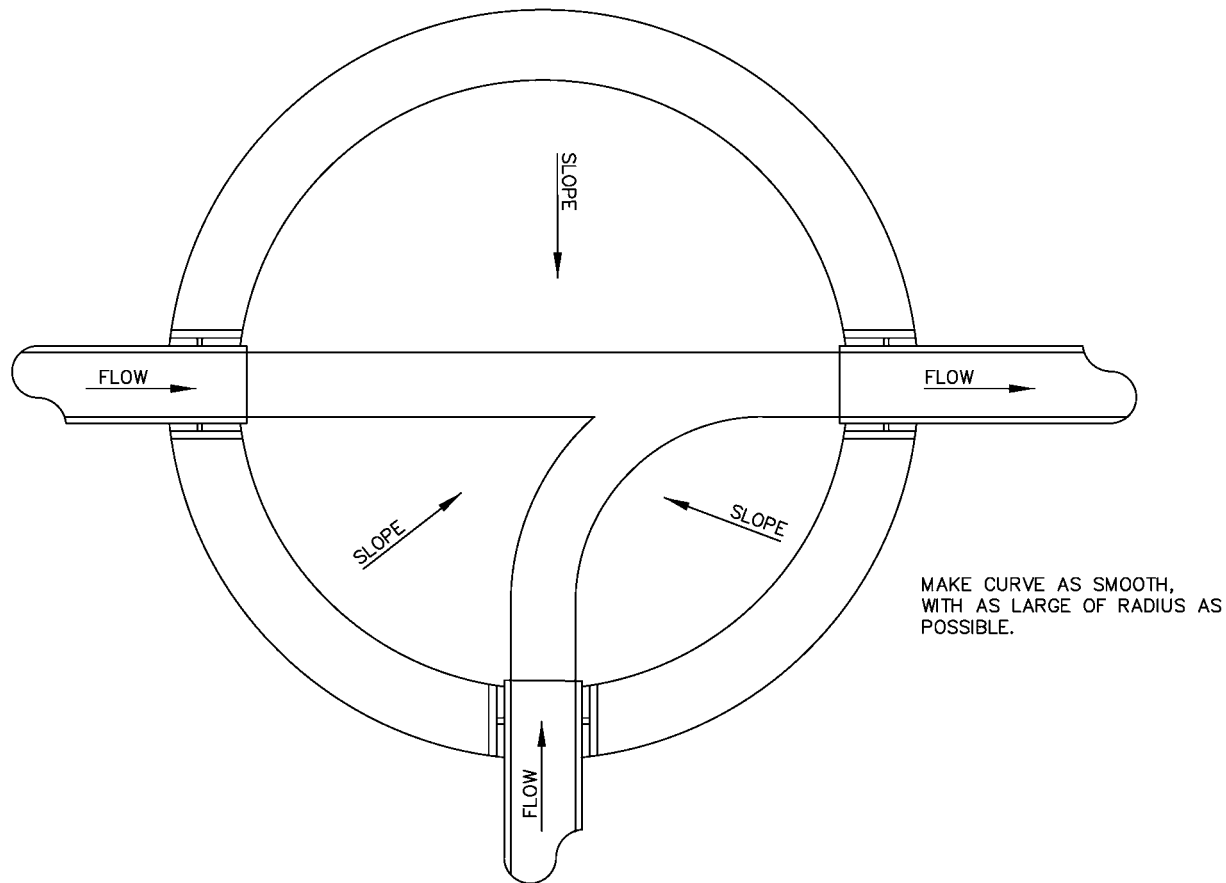
APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS



APPENDIX B APPROVED DRAWINGS AND DETAILS



MANHOLE INVERT PLAN



CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

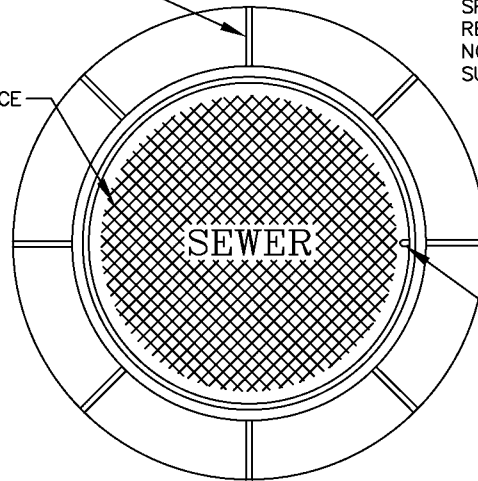
MANHOLE INVERT

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: MANHOLE INVERT	

APPENDIX B APPROVED DRAWINGS AND DETAILS

1/2" RIBS (TYP.)

NON-SKID SURFACE



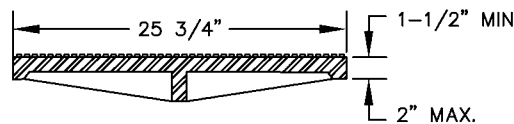
MANHOLE RINGS & COVERS TO BE CAST IRON WITH BEARING SURFACES TO BE MACHINED, TRAFFIC LOAD BEARING IN ACCORDANCE WITH FEDERAL SPECIFICATIONS RR-F-621-C OR LATEST REVISION, MIN. WEIGHT 430 LBS., WITH NON-PENETRATING PICKHOLE & NON-SKID SURFACE, WITH O-RING SEAL.

ORDER NO. : USF 225-AS-ORS RING & COVER SERIES OR APPROVED EQUAL

NON-PENETRATING PICKHOLE

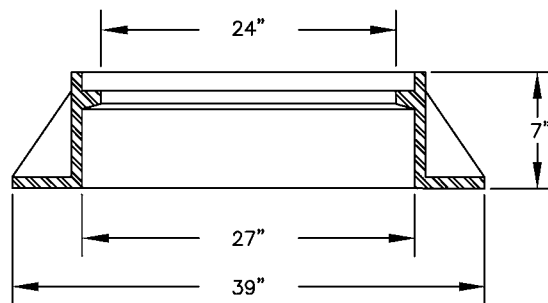
MANHOLE RING AND COVER

PLAN



MANHOLE COVER

CROSS SECTION



MANHOLE RING

CROSS SECTION

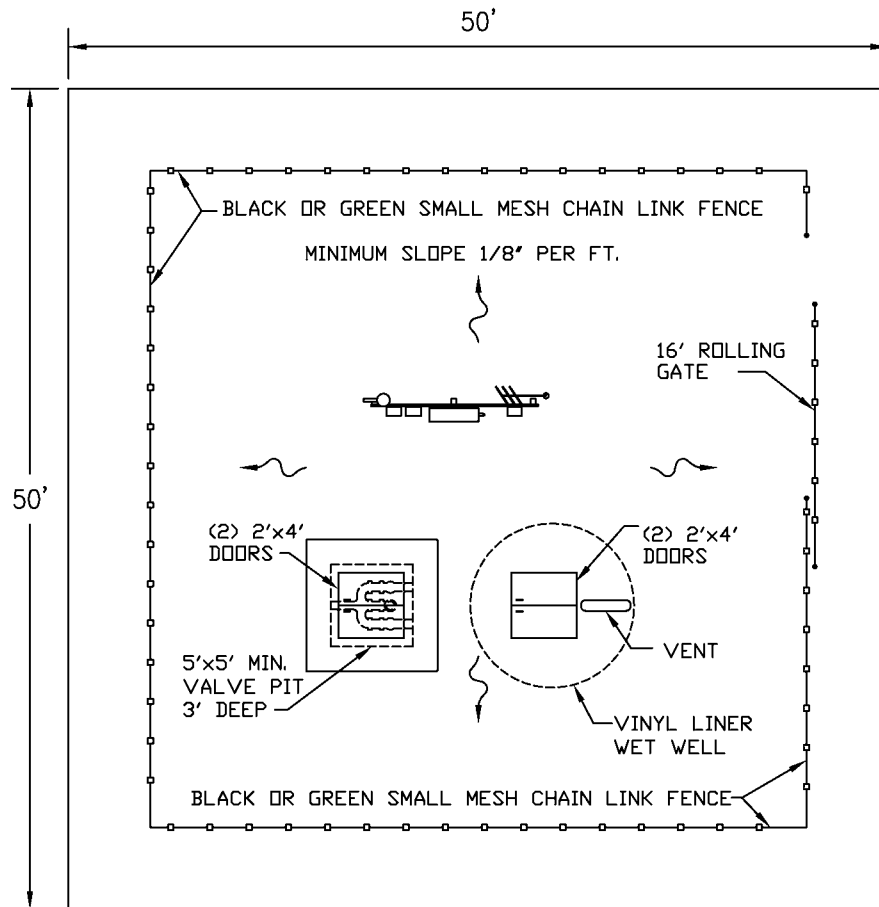


CITY OF COCOA
Brevard County, Florida
UTILITIES DEPARTMENT
ENGINEERING DIVISION

**MANHOLE RING
AND COVER**

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: MANHOLE RING AND COVER	

APPENDIX B APPROVED DRAWINGS AND DETAILS

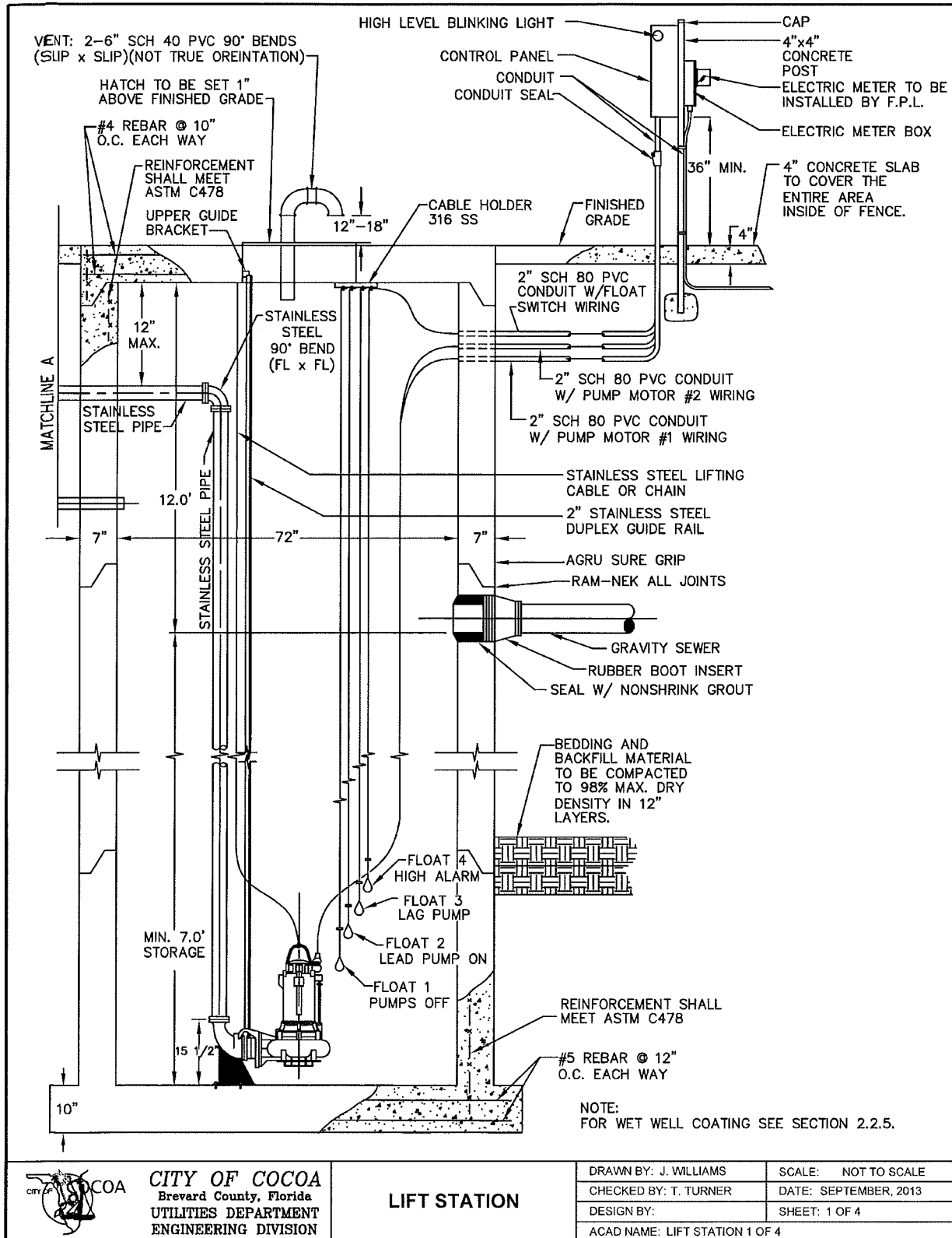


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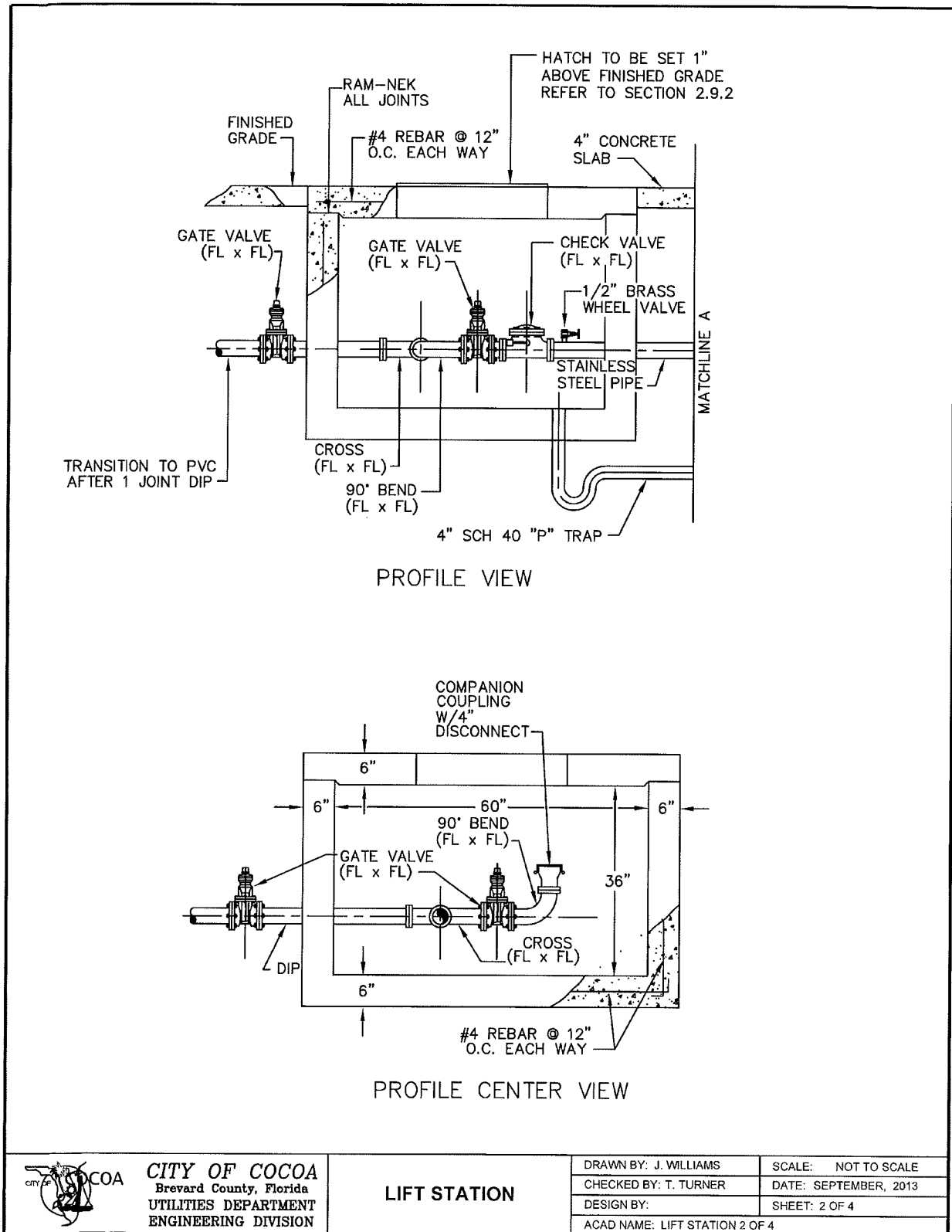
LIFT STATION SITE PLAN

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 1 OF 1
ACAD NAME: LIFT STATION SITE PLAN	

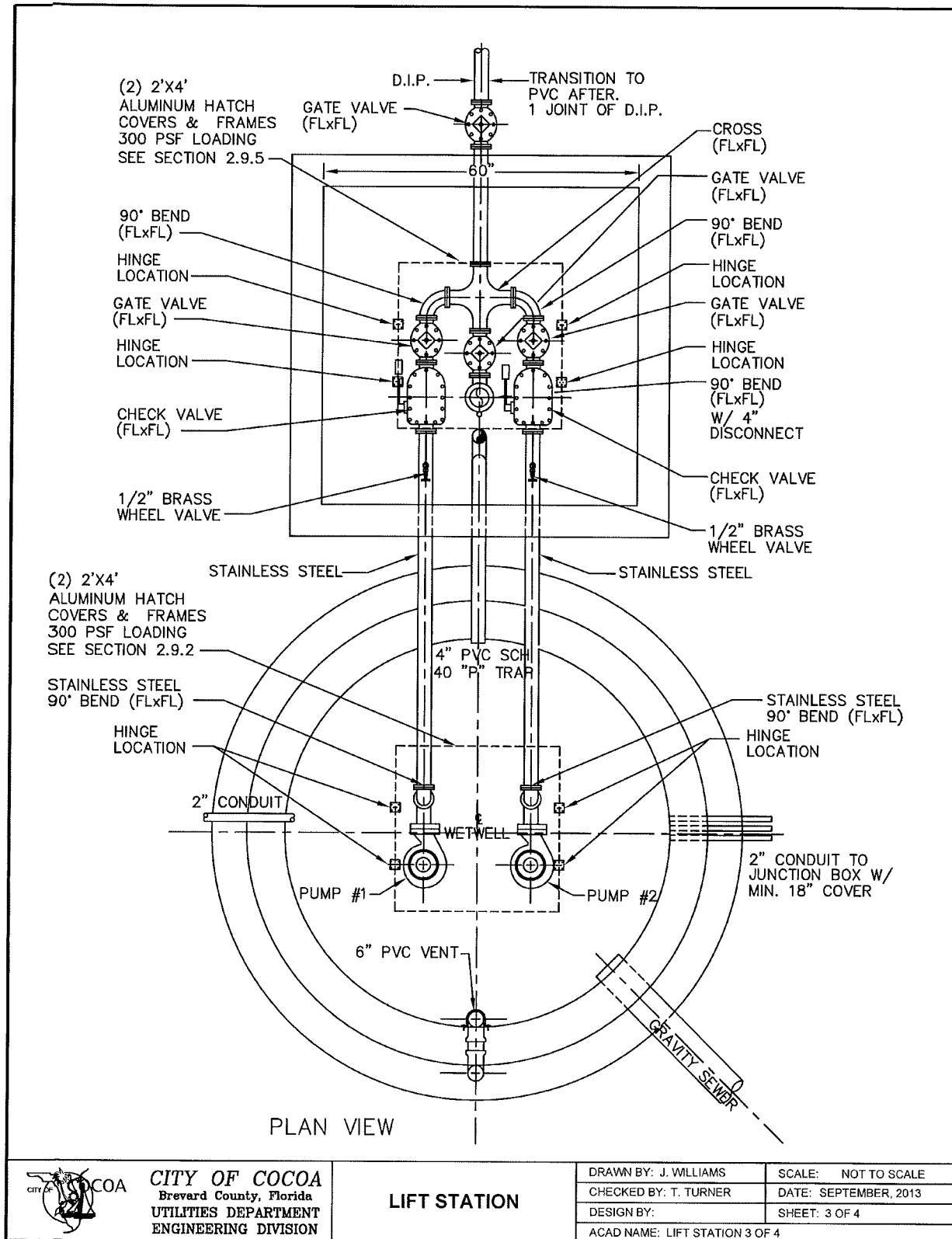
APPENDIX B APPROVED DRAWINGS AND DETAILS



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LIFT STATION ELECTRICAL REQUIREMENTS

- NEMA 4 OR 4x ENCLOSURE - STAINLESS STEEL SIZE 36"x 48"x 12" MIN.
- MAIN CIRCUIT BREAKER -(GENERAL ELECTRIC, WESTINGHOUSE, SQUARE D)
- BRANCH CIRCUIT BREAKER FOR EACH PUMP (GENERAL ELECTRIC, WESTINGHOUSE, SQUARE D) ADJUSTABLE TRIP.
- 20 AMP, 1 POLE CIRCUIT BREAKER FOR 115 VOLT DUPLEX CONVENIENCE RECEPTACLE (GIF)
- MERCURY FLOAT CONTROLS
- HIGH LEVEL ALARM (FLASHING LIGHT)
- ALTERNATOR (FURNAS)
- 120 VOLT CONTROL VOLTAGE
- ALLEN BRADLEY MOTOR STARTERS BUL. 509
- 3 LEG OVERLOAD PROTECTION
- LOW VOLTAGE MOTOR START
- DELAY START ON 2nd PUMP STARTUP
- HOUR METERS NO RESET
- THERMAL OVERLOAD IN PUMP MOTOR (W/ WARNING LIGHT)
- MOISTURE PROBE IN PUMP MOTOR (W/ WARNING LIGHT)
- PUMPS TO BE INSTALLED W/ GUIDE RAIL (STAINLESS STEEL)
- HAND OFF AUTO SWITCH FOR EACH PUMP
- STAINLESS STEEL 316 CABLE OR CHAIN FOR PUMP (FOR LIFTING)
- PHASE FAILURE RELAY
- LIGHTNING ARRESTOR, OUTSIDE BACK OF DISCONNECT BOX
- CONDUIT FROM WETWELL TO CONTROL PANEL MUST BE VAPOR TIGHT (BY USE OF CONDUIT SEAL)
- THREE CONDUIT RUNS FROM CONTROL PANEL TO WETWELL
- COPPER CLAD GROUND ROD 60' MIN.

FENCE SPECIFICATIONS:

- 1) FABRIC 9-GA, HOT DIPPED GALVANIZED BLACK OR GREEN SMALL MESH.
- 2) CORNER POSTS AND GATE POSTS TO BE 3" O.D., SCHEDULE 40x 9'-0"
- 3) LINE POSTS ON 10' CENTERS TO BE 2" O.D., SCHEDULE 40x 8'-0"
- 4) TOP RAIL TO BE 1-5/8" O.D., SCHEDULE 40
- 5) 16'-0" ROLLING GATE TO BE CONSTRUCTED OF 1-5/8" O.D., SCHEDULE 40 TUBE AND TO BE EQUIPPED WITH CENTER LOCKING DROP RODS AND DIAGONAL TRUSS RODS.

NOTES:

- 1) PUMPS TO BE FURNISHED WITH HIGH PRESSURE DISCHARGE COUPLING, STAINLESS STEEL SLIDERAIL SYSTEM, SEAL FAILURE AND THERMAL OVERLOAD INDICATORS.
- 2) ALL PIPES, INVERTS AND HATCHES TO BE THE SIZE AND KIND SPECIFIED ON THE SET OF APPROVED CONSTRUCTION PLANS.
- 3) D.I.P. TO BE CLASS 54 MIN. THICKNESS.
- 4) ALL HARDWARE INSIDE WETWELL TO BE 316 STAINLESS STEEL.

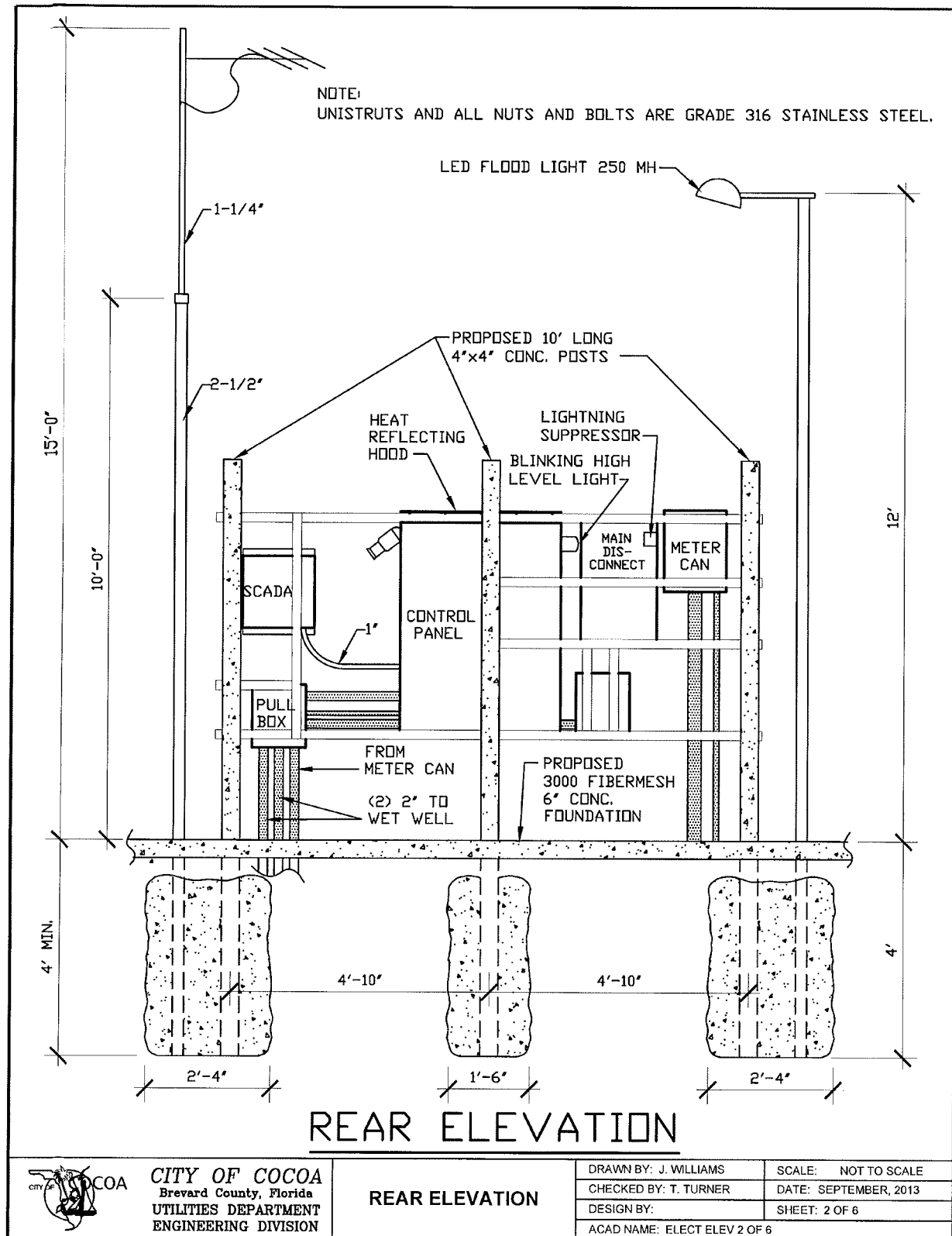


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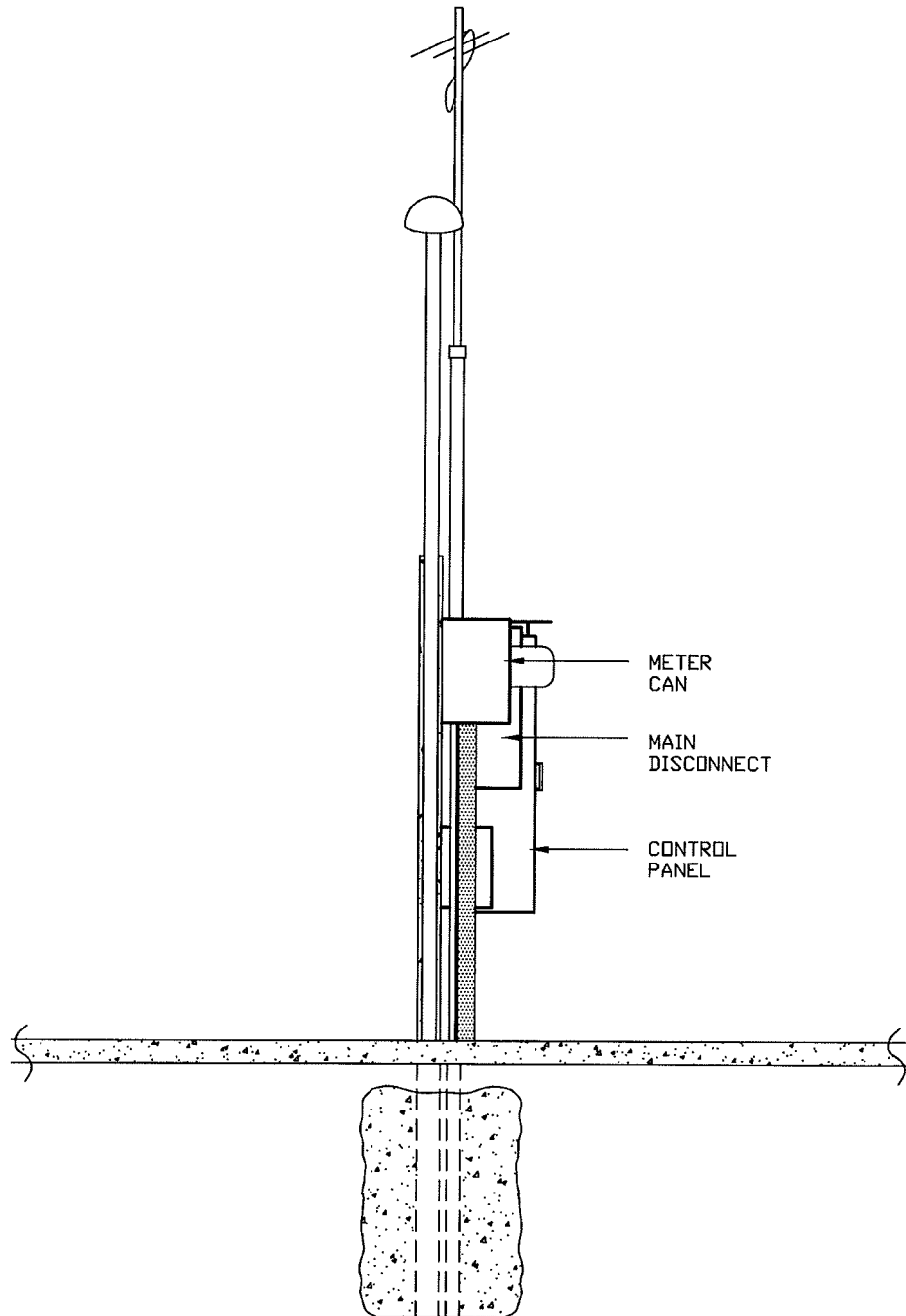
LIFT STATION

DRAWN BY: J. WILLIAMS	SCALE: NOT TO SCALE
CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 4 OF 4
ACAD NAME: LIFT STATION 4 OF 4	

APPENDIX B APPROVED DRAWINGS AND DETAILS



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LEFT SIDE ELEVATION

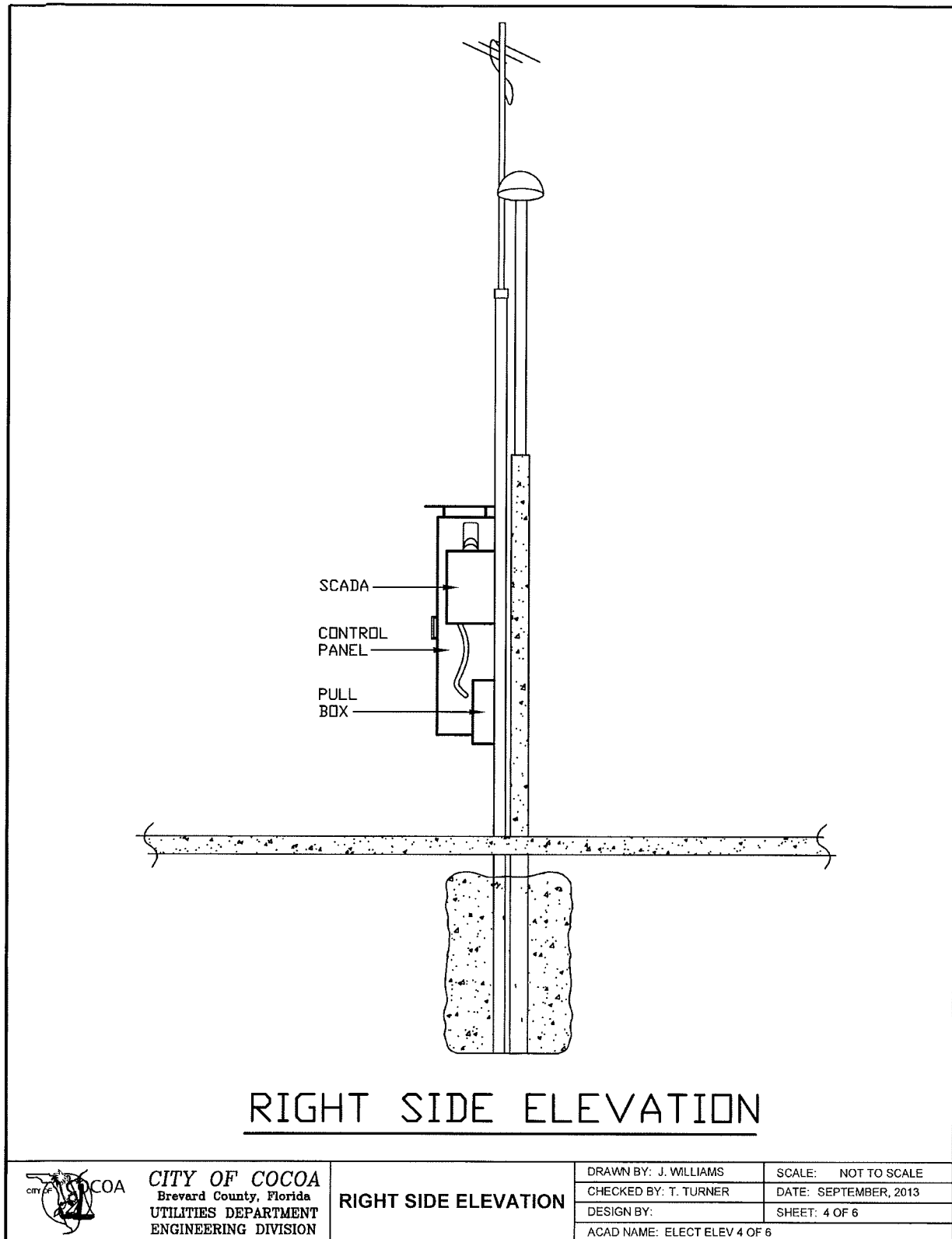


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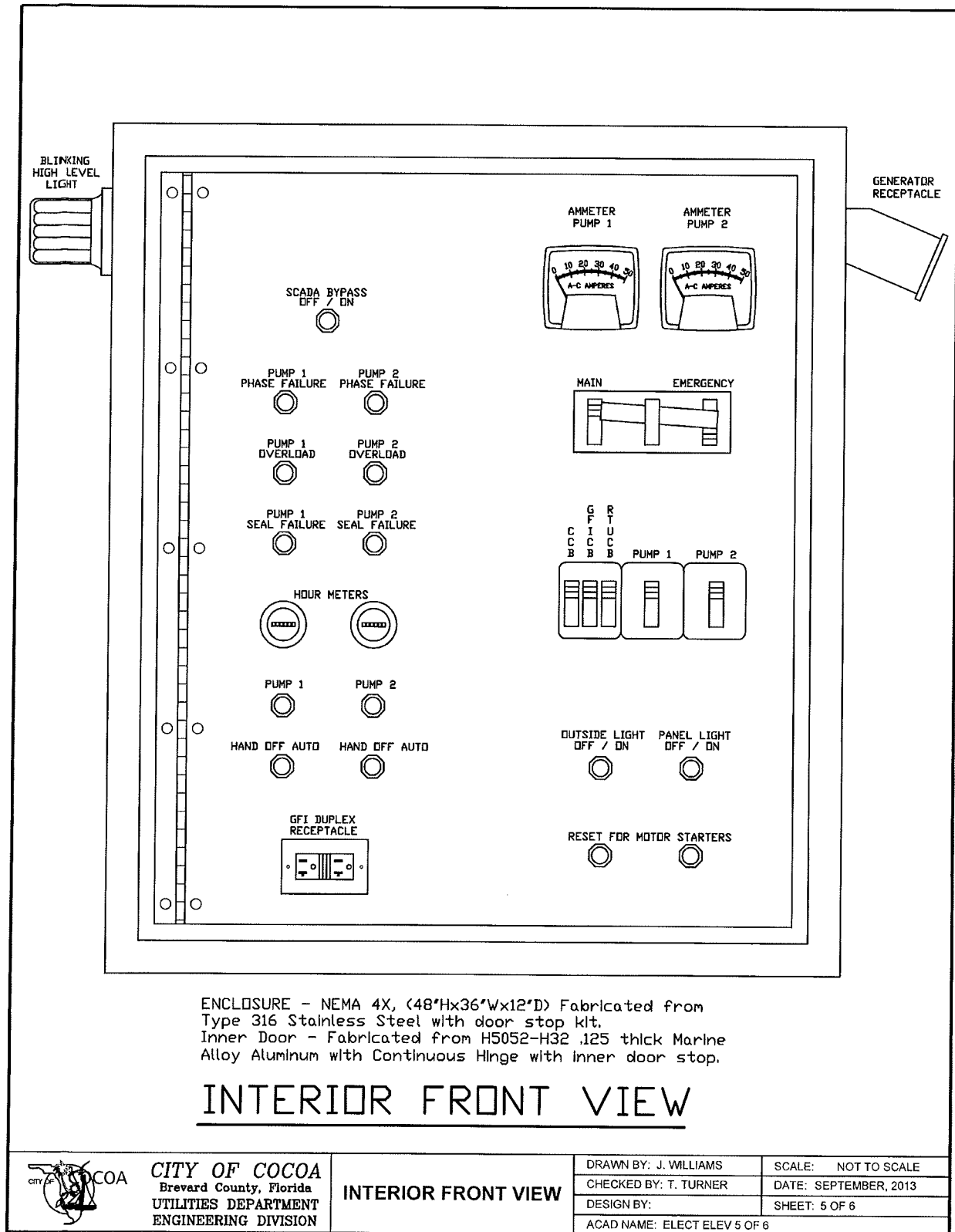
LEFT SIDE ELEVATION

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DESIGN BY:	SHEET: 3 OF 6
ACAD NAME: ELECT ELEV 3 OF 6	

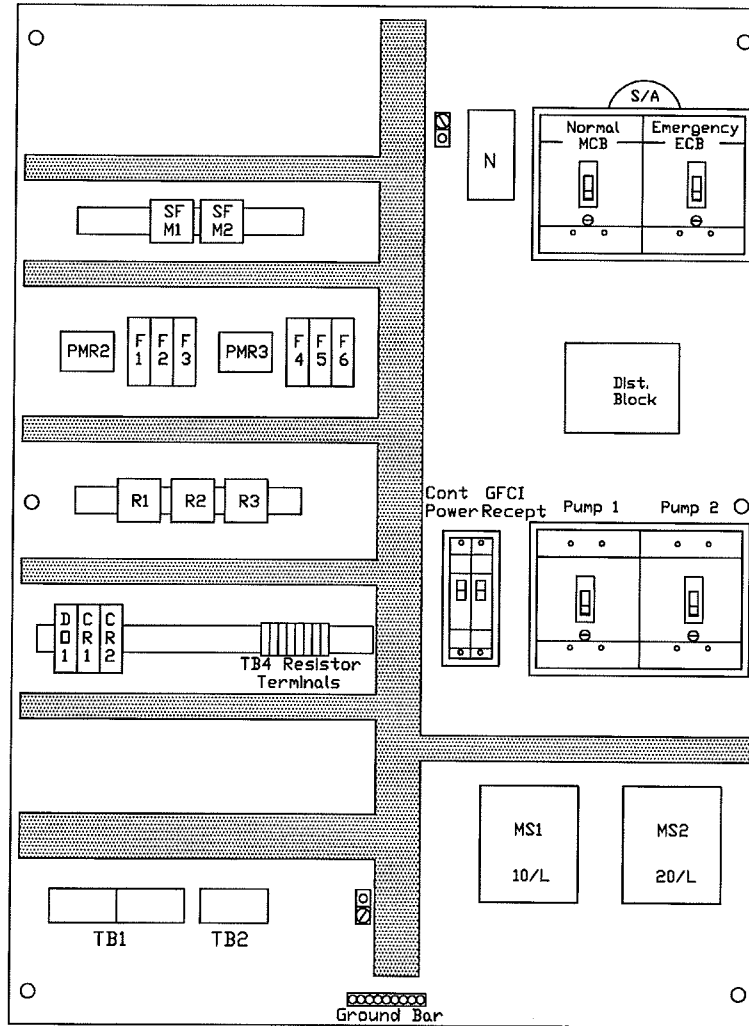
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INTERIOR BACK PANEL

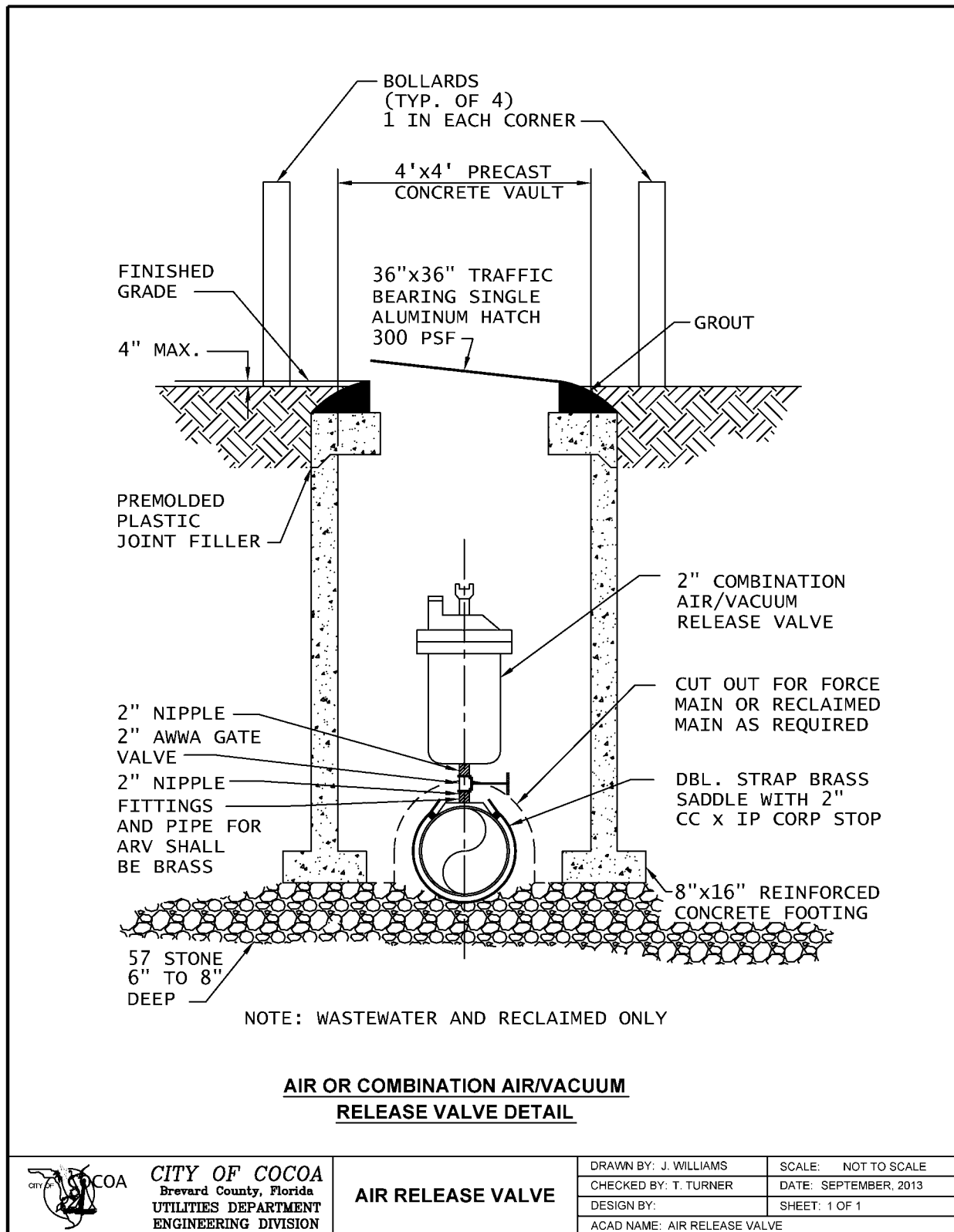


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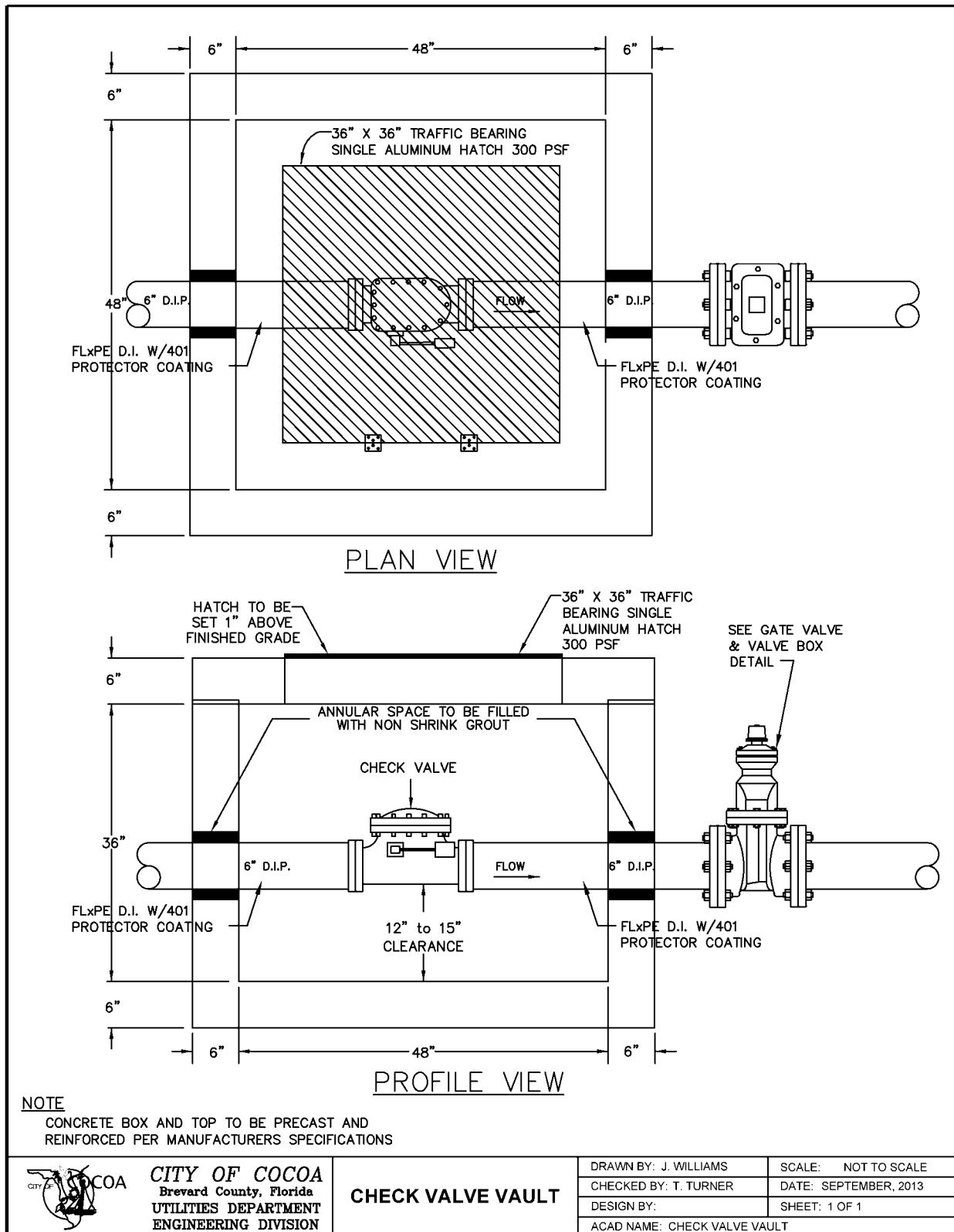
INTERIOR BACK PANEL

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CHECKED BY: T. TURNER	DATE: SEPTEMBER, 2013
DESIGN BY:	SHEET: 6 OF 6
ACAD NAME: ELECT ELEV 6 OF 6	

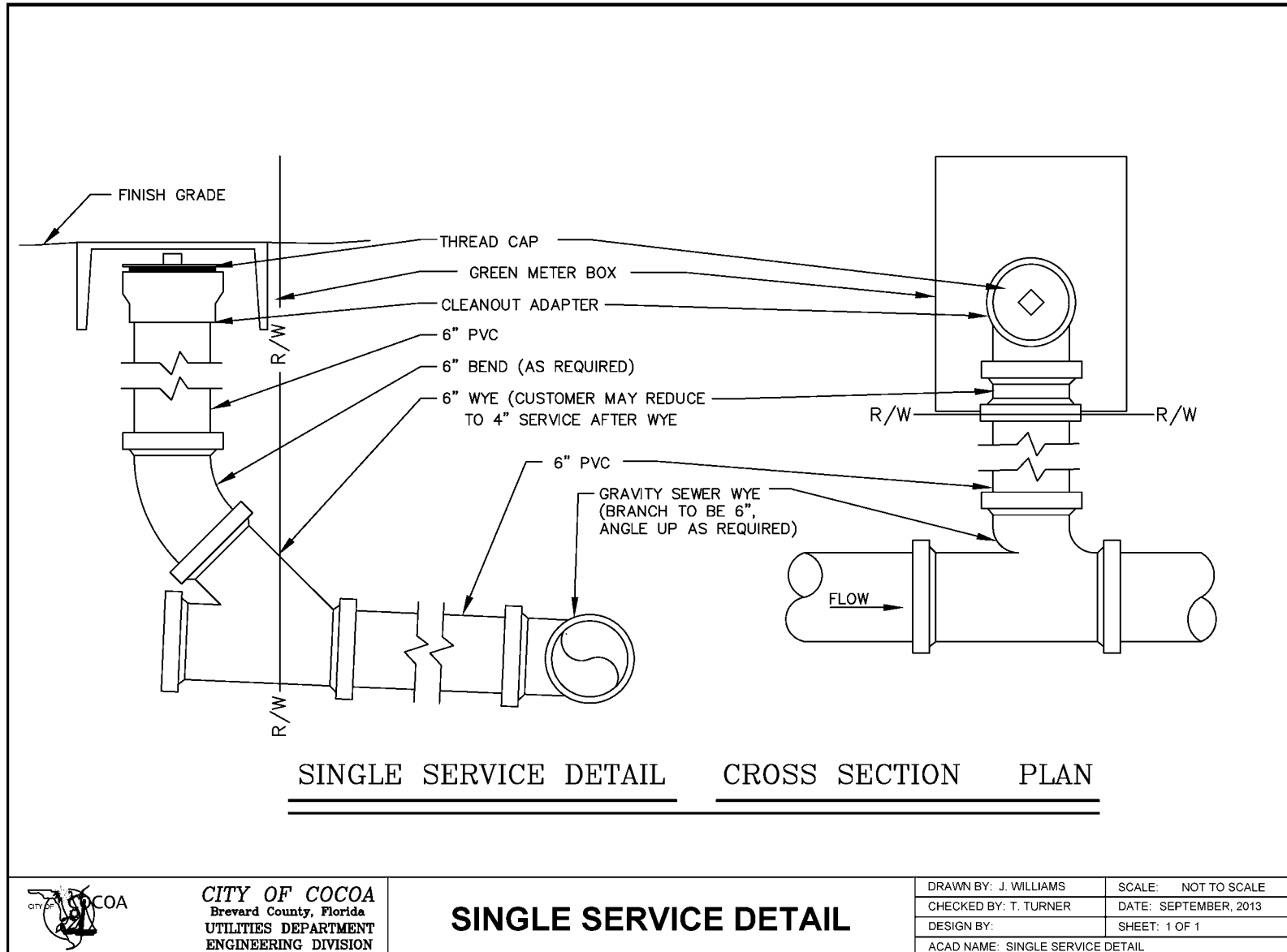
APPENDIX B APPROVED DRAWINGS AND DETAILS



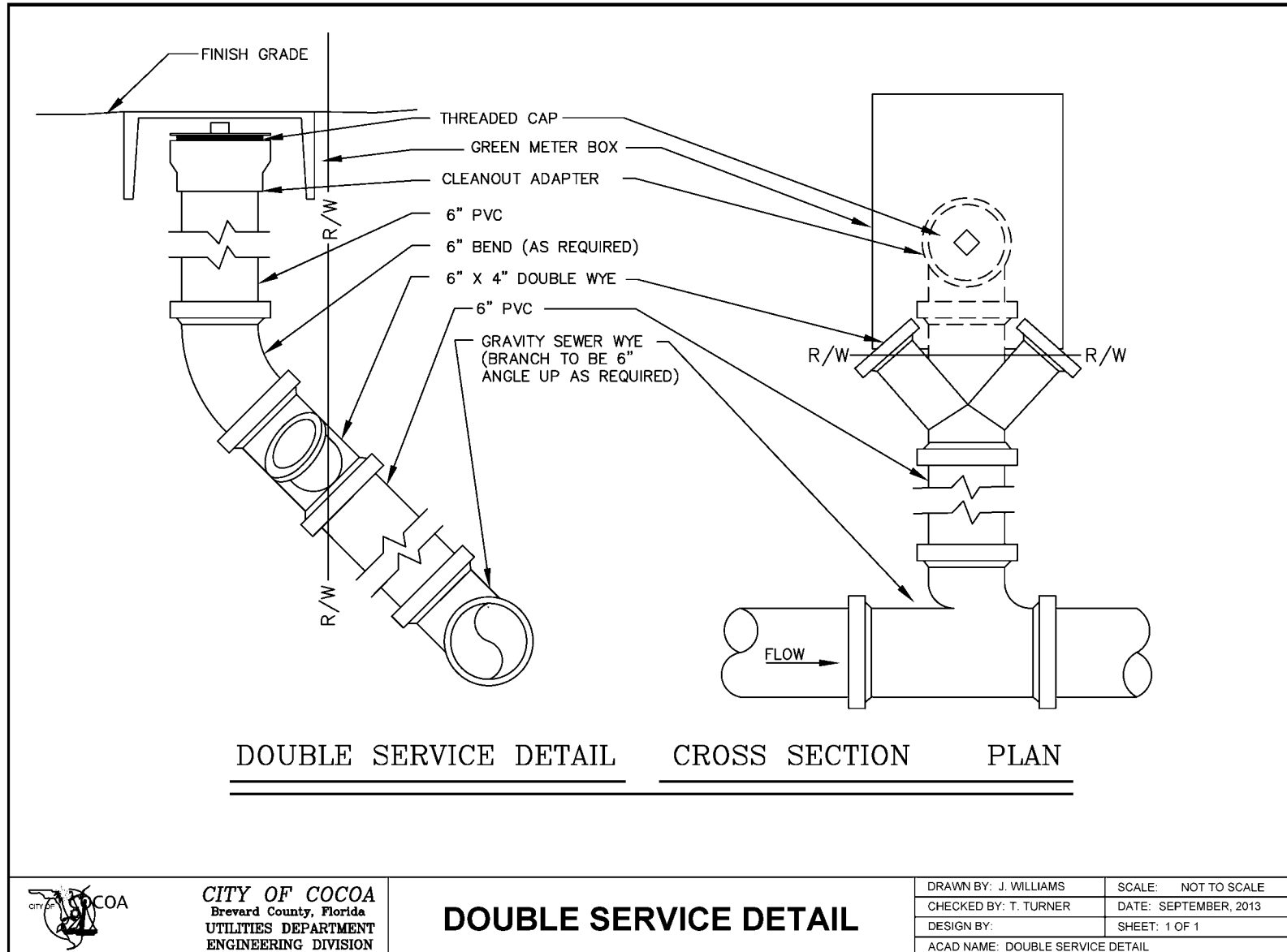
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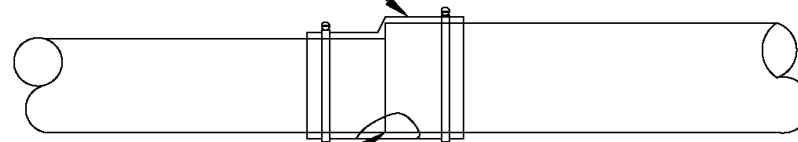


APPENDIX B APPROVED DRAWINGS AND DETAILS

SIZE (I.D.)	SDR-35(O.D.)	DR-18(O.D.)	D.I.P.(O.D.)
8"	8.4"	9.05"	9.05"
10"	10.5"	11.10"	11.10"
12"	12.5"	13.2"	13.2"

TRANSITION COUPLING WITH
STAINLESS STEEL STRAPS
& BOLTS

WHEN O.D. IS THE SAME BETWEEN
PVC & D.I.P. A TRANSITION COUPLING
IS NOT REQUIRED.



FLOW LINE TO
REMAIN CONSTANT

SEE APPENDIX A
APPROVED MATERIALS

TRANSITION COUPLING

DETAIL

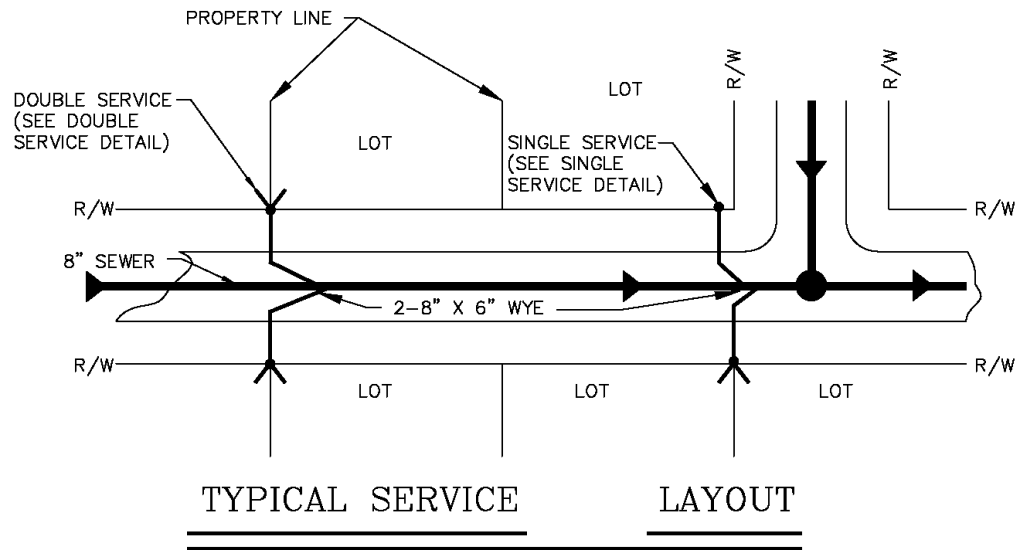


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TRANSITION COUPLING

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ACAD NAME: TRANSITION COUPLING	

APPENDIX B APPROVED DRAWINGS AND DETAILS



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TYPICAL SERVICE

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ACAD NAME: TYPICAL SERVICE	