PROJECT MANUAL

International Drive Utility Improvements
from Westwood Blvd. South to Westwood Blvd. North

ORANGE COUNTY UTILITIES DEPARTMENT
9150 CURRY FORD ROAD
ORLANDO, FLORIDA 32825

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Engineer's Project No. 071020

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SECTION 01001
GENERAL REQUIREMENTS

1.01 WORK UNDER THIS CONTRACT

In conformance with the requirements of Notice and Service of the General Conditions, all notices or other papers required to be delivered by the Contractor to the Owner shall be delivered to the office of the Owner's Engineer, Woolpert, Inc., 5323 Millenia Lakes Boulevard, Suite 220, Orlando, Florida 32839.

This project consists of the construction of a new reclaimed water main, new water main, gravity sanitary sewer and other conflict resolution between proposed drainage piping, structures and existing utilities. Detailed information is presented in Table 01001-A Scope of Work.

A. WORK TO BE DONE

1. The Contractor shall furnish all labor, materials, equipment, tools services and incidentals to complete all work required by these specifications and as shown on the Drawings, at a rate of progress, which will ensure completion of the Work within the Contract Time stipulated.

2. All materials, equipment, skills, tools and labor which is reasonably and properly inferable and necessary for the proper completion of the Work in a substantial manner and in compliance with the requirements stated or implied by these Specifications or Drawings shall be furnished and installed by the Contractor without additional compensation, whether specifically indicated in the Contract Documents or not.

3. The Contractor shall perform the work complete, in place, and ready for continuous service, and shall include repairs, testing, permits, clean up, replacements, and restoration required as a result of damages caused during this construction.

4. The Contractor shall comply with all City, County, State, Federal, and other codes, which are applicable to the proposed construction work.

5. All newly constructed work shall be carefully protected from injury in any way. No wheeling, walking, or placing of heavy loads on it shall be allowed and all portions damaged shall be reconstructed by the Contractor at his own expense.

6. Description of Work to be done: See Table 01001-A.

B. DRAWINGS AND PROJECT MANUAL

1. The Work shall be performed in accordance with the Drawings and Specifications prepared by Woolpert, Inc., 5323 Millenia Lakes Boulevard, Suite 220, Orlando, Florida 32839. All work and materials shall conform to the latest Orange County Manual of

Standards and Specifications. Refer to Appendix D, dated February 11, 2011 for the list of approved products.

2. The Contractor shall verify all dimensions, quantities and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications or other data received from the Engineer, and shall notify same, in writing, of all errors, omissions, conflicts and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory Work, faulty construction or improper operation resulting there from, or from rectifying such conditions at his own expense.

3. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quantity of materials and equipment included in the Work to be done under this Contract.

4. Intent

    a. All Work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified either in the Drawings or in the Specifications, but involved in carrying out their implied 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.
    b. Items of material, equipment, machinery, and the like may be specified on the Drawings and not in the Specifications. The Contractor in accordance with the specification on the Drawings shall provide such items.
    c. 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 or 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. Interpretation of these Specifications shall be made upon that basis.
    d. Reference to the following standards of any technical society, organization or body shall be construed to mean the latest standard, code or specification or tentative specification adopted and published at the date of advertisement for bids, even though reference has been made to an earlier standard. Such reference is hereby made a part of the Contract the same as if herein repeated in full and in the event of any conflict between any of these specifications, standard codes or tentative specifications and the Contract Documents, the most stringent shall govern.

AA	Aluminum Association
AASHTO or AASHO	American Association of State Highway and Transportation Officials
ABPA	Acoustical and Board Products Association
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Association
AGA	American Gas Association
AISI	American Iron and Steel Institute
AMCA	American Moving and Conditioning Association
ANSI	American National Standards Institute
API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ASA	American Standards Association (now ANSI)
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSCBC	American Standard Safety Code for Building Construction
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWBP	American Wood Preservers Board
AWS	American Welding Society
AWWA	American Water Works Association
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard
DOT Spec	Standard Specification for Road and Bridge Construction Florida Department of Transportation
AGMA	American Gear Manufacturer's Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
FS	Federal Standards
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NEC	National Electrical Code
NECA	National Electrical Contractor's Association
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NPT	National Pipe Threads
NSF	National Science Foundation
OSHA	U.S. Department of Labor, Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PS	United States Products Standards
SAE	Society of Automotive Engineers
SDI	Steel Decks Institute
SJI	Steel Joists Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Structural Steel Painting Council
UL	Underwriter's Laboratories, Inc.
UASI or USAS	United States of America Standards Institute (now ANSI)

5. When obtaining data and information from the Drawings, conflicts, errors, and discrepancies shall be resolved from the documents given the following order of precedence:

    a. Agreement
    b. Change Orders
    c. Addenda
    d. Supplementary Conditions
    e. Instructions to Bidders
    f. General Conditions
    g. Specifications
    h. Drawings
    i. Invitation for Bids
    j. Bid
    k. Bonds
    l. Insurance Certificates
    m. Insurance Endorsements
    n. Affidavits

        1) Dimensions
        2) Full size Drawings
        3) Large scale Drawings
        4) Small scale Drawing

When measurements are affected by conditions already established or where items are to be fitted into constructed conditions, it shall be the CONTRACTOR'S responsibility to verify all such dimensions at the site and the actual job dimensions shall take precedence over scale and figure dimensions on the Drawings.

C. WORK UNDER OTHER CONTRACTS

1. During progress of Work under this Contract, it may be necessary for other contractors and persons employed by the Owner to Work in or about the project. The Owner reserves the right to put such other contractors to work and to afford such access to the Site of the Work to be performed hereunder at such times, as the Owner deems proper.

2. The Engineer's control of the coordination and sequence of the Work to be performed under various contracts shall permit him to direct the operations of two contractors at junctions in their Work so as to minimize disturbance to the respective operations and minimize conflicts as to responsibility for placement and maintenance of plugs, caps, or bulk-heads at such locations.

3. If this Contract requires a portion of the Work to be tied into work done under other Contract(s), it will be necessary for this Contractor to plan his work and cooperate with other contractors insofar as possible to prevent any interference and delay.

4. At pipe connections between work construction by separate contractors or subcontractors, it shall be the responsibility of the first contractor reaching such a location to place and maintain watertight plugs, caps or bulkheads in his Work. It shall be the responsibility of the second contractor reaching such a location to dewater the prior work, if such is required, make his connection thereto and place and maintain the necessary watertight plugs or bulkheads at the entrances of his work to the existing pipeline or structure so as to prevent any water, sand or other material and debris from entering the Work completed under other contracts.

5. The Contractor shall not impede or interfere with the work of such other contractors engaged in or about the Work and shall so arrange and conduct his work that such other contractors may complete their work at the earliest date possible.

D. HOURS OF WORK & CONTRACTOR'S PAYMENT TO OWNER FOR OVERTIME WORK

Except in the event of special construction, no work shall be done between the hours of 7:00 p.m. and 7:00 a.m., or on Saturdays, Sundays and Orange County Holidays. If the proposed and efficient prosecution of the Work requires operations during the aforementioned hours of on Saturdays or Sundays, the Owner's permission shall be required to be obtained two (2) days before starting such items of the Work.

Normal work hours for the County's inspector(s) are defined as any 8-hour period between the hours of 7:00 a.m. and 7:00 p.m. on the weekdays of Monday through Friday. Any County Inspector(s) work beyond the aforementioned normal work hours shall be requested in writing 48-hours in advance. All overtime and weekend work compensation to the County's Inspector(s) for working beyond the normal working hours are considered overtime compensation and shall be paid for by the Contractor at the overtime pay rate of $51.00 per hour. This overtime pay rate is subject to adjustment by the County. The Contractor agrees that the County shall deduct charges for work outside normal work hours and for overtime pay from payments due the Contractor.

E. WEATHER

During inclement weather, all work that might be damaged or rendered inferior by such weather conditions shall be suspended. The orders and decisions of the Engineer as to suspensions shall be final and binding. During suspension of the Work from any cause, the Work shall be suitably covered and protected so as to preserve it from injury by the weather or otherwise; and, if the Engineer will so direct, the rubbish and surplus materials shall be removed.

F. PROTECTION AND RESTORATION

1. The Contractor shall be responsible for the preservation of all public and private property, and shall use every means of protection necessary to prevent damage thereto.

If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done. The contractor shall make good the damage in a manner acceptable to the Engineer.

2. Protection of Trees and Shrubs

    a. Protect with boxes or other barricades.
    b. Do not place excavated material so as to injure trees or shrubs
    c. Install pipelines in short tunnels between and under root systems
    d. Support trees to prevent root disturbance during nearby excavation.

3. Tree and Limb Removal

    a. Tree limbs, which interfere with equipment operation and are designated for pruning, shall be neatly trimmed and the tree cut coated with tree paint. Professional arborists shall do any required tree pruning.
    b. The Owner/Engineer may order the Contractor, for the convenience of the Owner, to remove trees along the line or trench excavation. The Contractor shall obtain any permits required for removal of trees. Ordered tree removal shall be paid for under the appropriate Contract Items.

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

5. Lawn Areas - All lawn areas disturbed by construction shall be replaced with like kind to a condition similar or equal to that existing before construction. Where sod is to be removed, it shall be carefully removed, and the same resodded, or the area where sod has been removed shall be restored with new sod in the manner described in the applicable section.

6. Fences - Any fence, or part thereof, that is damaged or removed during the course of the work shall be replaced or repaired by the Contractor, and shall be left in as good a condition as before the starting of the work.

7. Where fencing, walls, shrubbery, grass strips or area must be removed or destroyed incident to the construction operation, the Contractor shall, after completion of the work, replace or restore to the original condition all such destroyed or damaged landscaping and improvements.

The cost of all labor, materials, equipment, and work for restoration shall be deemed included in the appropriate Contract Item or items, or if no specific item is provided therefore, as part of the overhead cost of the Work, and no additional payment will be made therefore.

G. ADJACENT LANDS AND IMPROVEMENTS

1. Contractor shall be entirely responsible and liable for all damage or injury because of his operations to all other adjacent public and private property, landscaping, trees, fences, structures of any kind and appurtenances thereto met with during the progress of the Work.
2. The Contractor shall not enter or occupy private land outside of the project site or right-of-way, except by written permission of the appropriate owners. Contractors shall provide Owner a copy of such written permission.

1.02 LABOR

A. Supervision - The Contractor shall keep the Contract under his own control and it shall be his responsibility to see that the Work is properly supervised and carried on faithfully and efficiently. The Contractor shall supervise the Work personally or shall have a competent, English speaking superintendent or representative, who shall be on the site of the project at all working hours, and who shall have full authority by the Contractor to direct the performance of the Work and arrange for all necessary materials, equipment, and labor immediately.

B. Jurisdictional Disputes - It shall be the responsibility of the Contractor to pay all costs that may be required to perform any of the Work shown on the Drawings or specified herein to avoid any work stoppages due to jurisdictional disputes. The basis for subletting work in question, if any, shall conform to precedent agreements and decisions on record with the Building and Construction Trades Department, AFL-CIO, dated June 1973, including any amendments thereto.

C. Apprenticeship - The Contractor shall comply with all of the requirements of Section 446, Florida Statutes, for all contracts in excess of $25,000 excluding roadway, highway or bridge contracts and the Contractor agrees to insert in any subcontract under this Contract the requirements of this Article.

1.03 MATERIALS AND EQUIPMENT

A. MANUFACTURER

1. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request and at the Engineer's option, that the manufacturer or subcontractor communicate directly with the Engineer. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.

2. All workmanship and materials shall be of the highest quality. The equipment shall be the product of manufacturers who are experienced and skilled in the field with an established record of research and development. No equipment will be considered

unless the manufacturer has designed and manufactured equipment of comparable type and size and has demonstrated sufficient experience in such design and manufacture.

3. All materials and equipment furnished by the Contractor shall be subject to the inspection, review and acceptance of the Engineer. No material shall be delivered to the work without prior approval of the Engineer.

4. All apparatus, mechanisms, equipment, machinery, and manufactured articles for incorporation into the Project shall be the new (most current production at time of bid) and unused standard products of recognized reputable manufacturers.

5. Manufactured and fabricated products

    a. Design, fabricate and assemble in accord with the best engineering and shop practices.
    b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
    c. Any two or more pieces of material or equipment of the same kind, type or classification, and being used for identical types of service, shall be made by the same manufacturer.
    d. Products shall be suitable for service conditions as specified and as stated by manufacturer.
    e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
    f. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

6. Product Standards: Equipment and appurtenances shall be designed in conformity with ANSI (formerly ASA), ASME, IEEE, NEMA, OSHA, AGMA, and other generally accepted applicable standards. They shall be of rugged construction and of sufficient strength to withstand all stresses that may occur during fabrication, testing, transportation, installation, and all conditions or operations. All bearings and moving parts shall be adequately protected against wear by bushings or other approved means. Provisions shall be made for adequate lubrication with readily accessible devices.

7. Equipment Clearances

    a. All equipment shall fit the allotted space and shall leave reasonable access room for inspection, servicing, and repairs.
    b. Ample clearance shall be provided for inspection and adjustment.
    c. All equipment shall be installed in such a manner as to provide access for routine maintenance including lubrication.
    d. The Contractor at no additional cost shall provide greater space and room required by substituted equipment to the Owner.

8. Safety Requirements

a. All machinery and equipment shall be safeguarded in accordance with the safety codes of the ANSI, OSHA, and local industrial codes. Such guards or shields shall not interfere with lubrication of equipment.
b. The Contractor shall provide for each V-belt drive or rotating shaft a protective guard that shall be securely bolted to the floor or apparatus. The guard shall completely enclose drives and pulleys.
c. Belt guards for fans shall be arranged so as not to restrict the airflow into the fan inlet.
d. In addition to the components specified and shown on the Drawings and necessary for the specified performance, the Contractor shall incorporate in the design and show on the shop drawings all the safety features required by the current codes and regulations, including but not limited to those of the Occupational Safety and Health Act, and Amendments thereto.

9. Vibration

a. All rotating mechanical equipment (unless other specified or shown on the Drawings) shall be mounted on vibration isolators to isolate the equipment from the structure.
b. Isolators shall produce uniform loading and deflections, regardless of equipment weight distribution, and shall be the product of a manufacturer regularly engaged in the production of such items and who publishes engineering and selection data.
c. Vibration of rotating equipment shall not exceed the recommended limits of the respective manufacturing standards (i.e., pump vibration; National Hydraulic Institute Standards). Vibrations that exceed manufacturers, industrial standards or those specified shall be reduced to acceptable levels at no additional cost to the Owner.

10. Noise

a. Unless otherwise specified, all installed equipment shall not produce noise levels greater than 85 dBA when measured 3 feet from the noise source, nor greater than the recommended limits of the respective manufacturers or industrial standards.
b. Equipment which exceeds these noise level limitations shall be removed from the project and replaced with acceptable equipment or may be modified by the Contractor using methods which do not interfere with the normal operation and maintenance of the equipment.

B. SUBSTITUTIONS

1. The substitution requirements of this Section are in addition to the requirements of the General Conditions and Supplementary Conditions.

2. When a particular product is specified or called for, it is intended and shall be understood that the proposal tendered by the Bidder includes those products in his Bid. Should the Bidder desire to provide alternate products equal to those specified, the Bidder shall furnish information as described in the Contract Documents. The alternate product or products submitted by the Bidder shall meet the requirements of the specifications and must be in all respects equal to the products specified by name herein.

3. The intent of these specifications is to provide the Owner with a quality facility without discouraging competitive bidding. For products specified only by reference standards, performance and descriptive methods, without naming manufacturer's products, the Contractor may provide the products of any manufacturer complying with the Contract Documents, subject to the review of product data by the Engineer as specified herein. For products specified by naming a manufacturer's product followed by the words "or equal", the Contractor may provide any of the named products. He may substitute a product by another manufacturer as an equal only after review by the Engineer as specified herein.

4. In all cases, any product provided must comply with all of the specified requirements.

C. DELIVERY AND STORAGE

1. General

   a. The Contractor shall be responsible for all material, equipment and supplies sold and delivered to the Owner under this Contract until final inspection of the Work and acceptance thereof by the Owner.
   b. All materials and equipment to be incorporated in the Work shall be handled and stored by the Contractor before, during and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage or any kind whatsoever to the material or equipment.
   c. All materials, which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the site of the Work, and the Contractor shall receive no compensation for the damaged material or its removal.
   d. In the event any such material, equipment and supplies are lost, stolen, damaged or destroyed prior to final inspection and acceptance, the Contractor shall replace same without additional cost to the Owner.

2. Delivery - the Contractor Shall

   a. Materials shall be delivered in ample quantities to insure the most speedy and uninterrupted progress of the Work to complete the Work within the allotted time.
   b. Coordinate deliveries in order to avoid delay in, or impediment of, the progress of the Work of any related Contractor.
   c. Deliveries to the site shall not be scheduled more than one month prior to installation without written authorization from the Engineer.

d. Arrange deliveries of products in accordance with construction schedules coordinated to avoid conflict with work and conditions at the site.
e. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
f. Immediately on delivery, inspect shipments with the Owner's field representative to assure compliance with requirements of Contract Documents and approved submittals, and that products are properly protected and undamaged.
g. Provide equipment and personnel to handle products by methods recommended by the manufacturer to prevent soiling or damage to products or packaging.
h. Submit operation and maintenance data to the Engineer for review prior to shipment of equipment.

3. Storage

a. The Contractor shall be responsible for securing a location for on-site storage of all material and equipment necessary for completion of this project. The location and storage layout shall be submitted to the Owner/Engineer at the preconstruction conference.
b. All material delivered to the job site shall be protected from dirt, dust, dampness, water, and any other condition detrimental to the life of the material from the date of delivery to the time of installation of the material and acceptance by the Owner.
c. Products are to be stored in accord with manufacturer's instructions, with seals and labels intact and legible.
d. When required or recommended by the manufacturer, the Contractor shall furnish a covered, weather protected storage structure providing a clean, dry, noncorrosive environment for all mechanical equipment, valves, architectural items, electrical and instrumentation equipment, and special equipment to be incorporated into this project.
e. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions and free from damage or deterioration.
f. Manufacturer's storage instructions shall be carefully studied by the Contractor and reviewed with the Engineer by him. These instructions shall be carefully followed and a written record of this kept by the Contractor.
g. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding". Electric motors provided with heaters shall be temporarily wired for continuous heating during storage. Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.
h. Mechanical equipment to be used in the Work, if stored for longer than ninety (90) days, shall have the bearings cleaned, flushed and lubricated prior to testing and start-up, at no extra cost to the Owner.
i. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment during start-up and certify that its condition has not been detrimentally affected by the long storage period. Such start-up certification by the

manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed and tested. If such a certification is not given, the equipment shall be judged defective. It shall be removed and replaced at the Contractor's expense.

j. Specific Material Storage Requirements
   1) Loose Granular Materials: Store in a well-drained area on solid surfaces to prevent mixing with foreign matter.
   2) Cement, Sand and Lime: Stored under a roof and off the ground and kept completely dry at all times.
   3) Brick, Block and Similar Masonry Products: Handle and store in a manner to reduce breakage, chipping, cracking and spilling to a minimum.
   4) Precast Concrete Beams: Handle and Store in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking.
   5) All structural and miscellaneous steel and reinforcing steel: Store off the ground or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical.

4. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contractor's Contract. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, engineering and any other costs associated with making the necessary corrections. In any event, equipment and materials not properly stored will not be included in a payment estimate.

D. MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

1. Comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to all parties involved in the installation, including two copies for the Engineer's use. Maintain one set of complete instructions at the job site during installation and until completion.

2. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements. Should job conditions or specified requirements conflict with the manufacturer's instructions, consult with Engineer for further instructions. Do not proceed with Work without clear instructions.

3. Perform Work in strict accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

4. The Contractor shall have on hand sufficient proper equipment and machinery of ample capacity to facilitate the installation of the Work and to handle all emergencies normally encountered in Work of this character.

5. Equipment shall be installed in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Plans, unless directed otherwise by the Engineer during installation.

6. All equipment shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.

7. The Contractor shall furnish, install and protect all necessary anchor and attachment bolts and all other appurtenances needed for the installation of the devices included in the equipment specified. Anchor bolts shall be as approved by the Engineer and made of ample size and strength for the purposes intended. The manufacturer shall furnish substantial templates and working drawings for installation.

E. OPERATING AND MAINTENANCE DATA

1. The Contractor shall furnish two (2) sets of preliminary manufacturers' operation and maintenance materials and manuals for review by the Engineer in the same manner as shop drawing submittals. The Contractor shall furnish five (5) sets of final equipment manufacturer's operation and maintenance materials and manuals for use by the Owner, after incorporating Engineers' review comments.

2. Each manufacturer shall provide a recommended maintenance schedule guide for each item of equipment. Each manual shall include lubrication instructions for the equipment; the lubrication instruction shall include a list of recommended lubricants, with cross references, for each recommended type of lubricant. The manuals are intended to be used as a guide for routine maintenance and should include tasks necessary for properly maintaining the equipment.

F. MANUFACTURER'S SERVICE

This material shall be furnished directly to the Engineer upon review and acceptance of shop drawings for the equipment and prior to all the equipment being installed and its final acceptance by the Engineer.

1. Where service by the manufacturer is specified to be furnished as part of the cost of the item of equipment, the Work shall be at the Contractor's expense.

2. The services provided shall be by a qualified manufacturer's service representative to check the completed installation, place the equipment in operation, and instruct the Owner's operators in the operation and maintenance procedures. Such services are to be for period of time and for the number of trips specified. A working day is defined as a normal 8-hour working day on the job and does not include travel time.

3. The services shall further demonstrate to the Engineer's complete satisfaction that the equipment will satisfactorily perform the functions for which is has been installed. See also Article 1.13; Start-up.

G. INSPECTION AND TESTING

1. General

   a. If, in the testing of any material or equipment, it is ascertained by the Engineer that the material or equipment does not comply with the Contract, the Contractor shall be notified thereof, and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the Work and replace it with acceptable material, without cost to the Owner.
   b. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.

2. Cost

   a. Owner shall employ and pay for the services of an independent testing laboratory to perform testing specifically indicated on the Contract Documents or specified in the Specifications and may at any other time elect to have materials and equipment tested for conformity with the Contract Documents.
   b. The cost of field leakage and pressure tests and shop tests of materials and equipment specifically called for in the Contract Documents shall be borne by the Contractor, and such costs shall be deemed included in the Contract price.
   c. Notify Owner employed-laboratory sufficiently (a minimum of 48 hours) in advance of operations to allow for laboratory assignment of personnel and scheduling of tests. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred.
   d. The Contractor shall pay for all Work required to uncover, remove, replace, retest, etc any Work not tested due to the Contractor's failure to provide the minimum 48 hours advance notice or due to failed tests. Contractor shall also provide compensation for the Owner/Engineer’s personnel for required re-testing due to failed or rescheduled testing.

3. Shop Testing

   a. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function or special requirements are specified shall be tested in the shop of the manufacturer in a manner, which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. No such equipment shall be shipped to the Work until the Engineer notifies the Contractor, in writing, that the results of such tests are acceptable.
   b. Five copies of the manufacturer's actual shop test data and interpreted results thereof, accompanied by a certificate of authenticity notarized and signed by a responsible

official of the manufacturing company, shall be furnished to the Engineer as a prerequisite for the acceptance of any equipment. The cost of shop tests (excluding cost of Owner's representative) and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor and shall be included in the Contract price.

c. The Contractor shall give notice in writing to the Owner sufficiently in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, the Owner shall arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials; or he will notify the Contractor that the inspection will be made at a point other than the point of manufacture; or he will notify the Contractor that inspection will be waived.

d. When inspection is waived or when the Engineer so requires, the Contractor shall furnish to him authoritative evidence in the form of Certificates of Manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents. These certificates shall be notarized and shall include five (5) copies of the results of physical tests and chemical analysis, where necessary, that have been made directly on the product or on similar products of the manufacturer.

e. The Contractor must comply with these provisions before shipping any material. Such inspections by the Owner shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

4. Field Testing

a. The Owner shall employ and pay for services of an independent testing laboratory to perform testing specifically indicated in the Contract Documents. The Contractor shall pay for all failed testing. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the Work of the Contract.

b. The Owner may at any time during the progress of the Work request additional testing beyond that which is specified in the Contract. This testing will be at the Owner's expense. The Contractor shall assist the testing laboratory personnel in all ways to facilitate access to the location of the material or equipment to be tested.

c. Contractor shall:
    1) Cooperate with laboratory personnel, provide access to the Project.
    2) Secure and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.
    3) Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes, which require control by the testing laboratory.

5. Demonstration Tests

Upon completion of the Work and prior to final payment, all equipment and piping installed under this Contract shall be subjected to acceptance or demonstration tests as specified or required to provide compliance with the Contract Documents. The Contractor shall furnish all labor, fuel, energy, water and all other equipment necessary for the demonstration tests at no additional cost to the Owner. See Article 1.13 - Start-up.

6. Final Inspection

Prior to preparation of the final payment application, a final inspection will be performed by the Owner and the Engineer to determine if the Work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents. See Article 1.14 - Closeout.

7. Inspection by Existing Utility Owners

The Contractor shall pay for all inspections during the progress of the Work required and provided by the owner of all existing public utilities paralleling or crossing the Work, as shown on the Drawings. All such inspection fees shall be deemed included in the appropriate Contract Item or items, or if no specific item is provided therefore, as part of the overhead cost of the Work, and no additional payment will be made therefore.

8. Inspection by Other Agencies

The Florida Department of Transportation, the Florida Department of Environmental Regulation, and other authorized governmental agencies shall have free access to the site for inspecting materials and Work, and the Contractor shall afford them all necessary facilities and assistance for doing so. Any instructions to the Contractor resulting from these inspections shall be given through the Owner. These rights of inspections shall not be construed to create any contractual relationship between the Contractor and these agencies.

H. WARRANTIES AND BONDS

1. The Contractor shall submit warranties and bonds as specified in the General Conditions and as specified herein. Co-execute submittals when so specified.

2. For all major pieces of equipment, the Contractor shall submit a warranty from the equipment manufacturer. "Major" equipment is defined as a device having a 1.0 HP or larger motor or which lists for more than $1,000.00. The manufacturer's warranty period shall be concurrent with the Contractor's for one (1) year, unless otherwise specified, commencing at the time of final acceptance by the Owner.

The Contractor shall warrant all equipment in the Contractor's one-year warranty period even though certificates of warranty may not be required.

3. In the event that the equipment manufacturer or supplier is unwilling to provide a one-year warranty commencing at the time of the Owner acceptance, the Contractor shall obtain from the manufacturer a two (2) year warranty commencing at the time of equipment delivery to the job site. This two-year warranty from the manufacturer shall not relieve the Contractor of the one-year warranty starting at the time of Owner acceptance of the equipment.

4. If an individual specification section requires a particular warranty more stringent than that required by this Section or the General Conditions, the more stringent requirements shall govern for the applicable portion of the Work.

5. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors, and bind into a commercial quality standard three (3) ring binder; submit five (5) copies of the warranties and bonds to the Engineer for review and transmittal to the Owner.

6. The warranties and bonds shall include

    a. Equipment or product description
    b. Manufacturer's name, principal, address and telephone number
    c. Contractor, name of responsible principal, address and telephone number.
    d. Local supplier's or representatives name and address
    e. Scope of warranty or bond
    f. Proper procedure in case of failure
    g. Instances which might affect the validity of warranty or bond
    h. Date of beginning of warranty, bond or service and maintenance contract
    i. Duration of warranty, bond or service maintenance contract

I. TOOLS AND ACCESSORIES

1. The Contractor shall furnish with each type, kind or size of equipment, one complete set of suitably marked high-grade special tools and accessories, which may be needed to adjust, operate, maintain or repair the equipment (including special grease guns or other lubricating tools).

2. Such tools and accessories shall be furnished in approved painted steel tool cases, properly labeled and equipped with good grade cylinder locks and duplicate keys no later than upon start-up.

3. Each piece of equipment shall be provided with a substantial stainless steel nameplate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight and principal rating data.

J. SPARE PARTS

Spare parts may be specified for certain equipment in the pertinent sections of the Specifications. The Contractor shall collect and store all spare parts during construction and shall surrender such to the Owner in original boxes or containers upon final inspection. In addition, the Contractor shall furnish to the Owner an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier, and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivered cost.

K. GREASE, OIL AND FUEL

1. All grease, oil and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied.

2. The Contractor shall be responsible for changing the oil in all drives and intermediate drives of each mechanical equipment after initial break-in of the equipment, which in no event shall be any longer than three weeks of continuous operation.

L. HAULING AND CONSTRUCTION OPERATIONS

The Contractor shall conduct access, hauling, filling and storage operations on-site as specified herein and as shown on the Contract Drawings.

1. Borrow Material: All borrow material shall be obtained off-site by the Contractor.

2. Excess Suitable Material: Under no circumstances shall surplus suitable material be disposed of in wetland areas as defined by the FDEP or USACOE. The Contractor shall be responsible for proper disposal of excess suitable material.

3. Unsuitable Material: All unsuitable material shall become the property and responsibility of the Contractor. The Contractor shall properly dispose of all such unsuitable materials off-site in accordance with local, State and Federal Regulations.

M. USE OF CHEMICALS

All chemicals used during the project construction furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or other classification, must show approval of the Environmental Protection Agency, National Safety Foundation or the U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.

N. QUALITY ASSURANCE

In order to establish a standard of quality and to demonstrate the proficiency of workmen or to facilitate the choice among several textures, types, finishes and surfaces, the Contractor shall provide such samples of workmanship or finish as may be required, or requested by the Owner. The materials and equipment used on the Work shall correspond to the samples or other data approved as a quality standard for the Work.

1.04 PROJECT SITE AND ACCESS

A. RIGHT-OF-WAY AND EASEMENTS

1. The use of public streets and alleys shall be such as to provide a minimum of inconvenience to the public and to other traffic. The Contractor shall remove any earth or other excavated material spilled from trucks and the streets cleaned to the satisfaction of the Owner.

2. The Contractor shall not enter or occupy private land outside of easements, except by written permission of the property owner.

B. EXISTING FACILITIES

The Work shall be so conducted to maintain existing facilities in operation insofar as is possible. Requirements and schedules of operations for maintaining existing facilities in service during construction are described in Table 01001-B, Existing Facilities to Remain in Operation, if applicable.

C. ACCESS

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

2. Access to businesses located adjacent to the project site must be maintained at all times. Contractor may prearrange the closing of business access with the business owner. Such prearranged access closing shall not exceed two (2) hours. Property drainage and grading shall be restored and all construction debris removed within 48 hours of backfilling trench.

3. Contractor agrees that representatives of the Owner and any governmental agents will have access to the Work wherever it is in preparation or progress and that the Contractor shall provide facilities for such access and inspection.

1.05 PERMITS

The Owner has obtained permits related to this Work prior to advertising and are specifically listed in Table 1001- B. The Owner will also obtain permits, which relate to the completed facilities.

Upon Notice of Award, the Contractor shall immediately apply for all other applicable permits to construct the Work from the appropriate governmental agency or agencies. No Work shall commence until all applicable permits have been obtained and copies delivered to the Owner/Engineer. The costs for obtaining these permits shall be borne by the Contractor.

The Contractor shall strictly adhere to the specific requirements of the governmental unit(s) or agency (ies) having jurisdiction over the Work. Whenever there is a difference in the requirements of a jurisdictional body and these Specifications, the more stringent shall apply.

1.06 UTILITIES

A. UTILITY CONSTRUCTION

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto, whether owned or controlled by governmental bodies or privately owned by individuals, firms or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage or water. Other public or private property that may be affected by the Work shall be deemed included hereunder.

2. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons, and damage to property. The Contractor shall, at his own expense, provide suitable safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required.

3. The length of open trench will be controlled by the particular surrounding conditions, but shall always be confined to no more than 300 LF of open trench at any given time and no open trench at the end of the day to remain open overnight. If any excavation becomes a hazard, or if it excessively restricts traffic at any point, the Owner/Engineer may require special construction procedures such a further limiting the length of open trench, prohibiting stacking excavated materials in the street, and temporary restoration of roadways, driveways, and walkways to be accomplished each day.

B. EXISTING UTILITIES

1. The locations of all existing underground piping, structures and utilities have been taken from information received from the respective owner. The locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping, conduit, and cables to be encountered.

2. The Contractor shall, at all times in performance of the Work, employ accepted methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage or destruction of existing public utility installations and structures. The Contractor shall also, at all times in the performance of the Work, avoid unnecessary interference with, or interruption of, public utility services; and shall cooperate fully with the owners thereof to that end.

3. Pipelines shall be located substantially as indicated on the Drawings, but the Owner/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. When the location of piping is dimensioned on the Drawings, it shall be installed in that location; when the location of piping is shown on a scaled drawing, without dimensions, the piping shall be installed in the scaled location unless the Owner/Engineer approves an alternate location for the piping. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required. The Engineer may require detailed pipe laying drawings and schedules for project control.

4. The Contractor shall exercise care in any excavation to locate all existing piping and utilities. All utilities, which do not interfere with the completed Work, shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the Owner/Engineer. Any existing facilities, which require operation to facilitate repairs, shall be performed only by the owner of the respective utility.

5. It is the responsibility of the Contractor to ensure that all utility or other poles, the stability of which may be endangered by the proximity of excavation, be temporarily stayed and/or shored in position while Work proceeds in the vicinity of the pole and that the utility or other companies concerned be given reasonable advance notice of any such excavation by the Contractor.

C. NOTICES

1. The Contractor will inform all governmental utility departments and other owners of public utilities that may be affected by the Work in writing within two weeks after the execution of the Contract or Contracts covering the Work. Such notice will be sent out in general, and directed to the attention of the governmental utility departments and other owners of public utilities for such installations and structures as may be affected by the Work.

2. The Contractor shall also comply with Florida Statute 553.851 regarding notification of existing gas and oil pipeline company owners. Evidence of such notice shall be furnished to the Owner/Engineer within two weeks after the execution of the Contract.

3. It shall be the Contractor's responsibility to contact utility companies at least 48 hours in advance of breaking ground in any area or on any unit of the Work so maintenance personnel can locate and protect facilities, if required by the utility company.

D. EXPLORATORY EXCAVATIONS

Exploratory excavations shall be conducted by the Contractor to locate any underground pipelines or structures in advance of the construction. Test pits shall be excavated in areas of potential conflicts between existing and proposed facilities and at piping connections to existing facilities a minimum of 48 hours or 1000 feet in advance of Work. If there is a potential conflict, the Contractor is to notify the Engineer immediately. Information on the obstruction to be furnished by the Contractor shall include: Location, Elevation, Utility Type, Material and Size. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the Engineer.

E. UTILITY CROSSINGS

It is intended that wherever existing utilities must be crossed, deflection of the pipe within specified limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated on the Drawings. However, when in the opinion of the Owner/Engineer this procedure is not feasible, he may direct the use of fittings for a utility crossing or conflict transition as detailed on the Drawings.

F. RELOCATIONS

1. Relocations shown on the Drawings

   a. Public utility installations or structures, including but not limited to light poles, signs, fences, piping, conduits and drains that interfere with the positioning of the Work which are shown on the Drawings to be removed, relocated, replaced or rebuilt by the Contractor shall be considered as part of the general cost of doing the Work and shall be included in the prices bid for the various contract items. No separate payment shall be made therefore.

2. Relocations not shown on the Drawings

   a. Where utility installations or structures are encountered during the course of the Work, and <u>are not</u> indicated on the Drawings or in the Specifications, and when, in the opinion of the Owner/Engineer, removal, relocation, replacement or rebuilding is necessary to complete the Work under this contract; shall be accomplished by the utility having jurisdiction, or such Work may be ordered, in writing by the Owner/Engineer, for the Contractor to accomplish.
   b. If such Work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required. If such

Work is approved by Owner/Engineer and accomplished by the Contractor, it will be paid for as a Change Order.

3. All existing utility castings, including valve boxes, junction boxes, manholes, hand holes, pull boxes, inlets and similar structures in the areas of construction that are to remain in service and in areas of trench restoration and pavement replacement, shall be adjusted by the Contractor to bring them flush with the surface of the finished Work.

4. All existing utility systems that conflict with the construction of the Work herein, which can be temporarily removed and replaced, shall be accomplished at the expense of the Contractor. Work shall be done by the utility unless the utility approves in writing that the Work may be done by the Contractor.

1.07 RELATED CONSTRUCTION REQUIREMENTS

A. TRAFFIC MAINTENANCE

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

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

3. At the request of any jurisdictional agency, the Contractor shall prepare a Traffic Control Plan prior to commencing any Work on the site and submit to the Engineer. The Traffic Control Plan shall detail procedures and protective measures for protection and control of traffic affected by the Work consistent with the following applicable standards:

   a. Standard Specifications for Road and Bridge Construction, 1991 including all subsequent supplements issued by the Florida Department of Transportation, (FDOT Spec.).
   b. Manual of Traffic Control and Safe Practices for Street and Highway construction, Maintenance and Utility Operations, FDOT.
   c. Right-of-Way Utilization Regulations, Orange County, Florida, latest edition.

   All references to the respective agency in the above referenced standards shall be construed to also include the Owner for this Work.

4. Before closing any thoroughfare, the Contractor shall give written notice to and, if necessary, obtain a permit or permits from the duly constituted public authority having

jurisdiction over the thoroughfare. Notice shall be given no less than 72 hours in advance of the time when it may be necessary in the process of construction to close such thoroughfare, or as may be otherwise provided in the approved Traffic Control Plan.

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

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

7. If required by duly constituted public authority, the Contractor shall, at his own expense, construct bridges or other temporary crossing structures over trenches so as not to unduly restrict traffic. Such structures shall be of adequate strength and proper construction and shall be maintained by the Contractor in such a manner as not to constitute an undue traffic hazard. Private driveways shall not be closed except when and where necessary, and then only upon due advance notice to the Owner/Engineer and for the shortest practicable period of time consistent with efficient and expeditious construction. The Contractor shall be liable for any damages to persons or property resulting from his work.

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

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

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

B. BARRIER AND LIGHTS

The Contractor shall exercise extreme care in the conduct of the Work to protect health and safety of the workmen and the public. The Contractor shall provide all protective measures and devices necessary, in conformance with applicable local, state and federal regulations regarding their need and use. Vehicles and equipment within ten (10) feet of roadway shall have safety strobe lights. Protective measures shall include but are not limited to barricades, warning lights/flashers and safety ropes.

C. DEWATERING, FLOTATION

The Contractor, with his own equipment, shall do all pumping necessary to dewater any part of the Work area during construction operations to insure dry working conditions. The Contractor shall be completely responsible for any tanks, wet wells or similar structures that may become buoyant during the construction and modification operations due to the ground water or floods and before the structure is put into operation. The proposed final structures have been designed against buoyancy; however, the Contractor may employ methods, means and techniques during the various stages of construction (or other conditions) which may affect the buoyancy of structures. Should there be any possibility of buoyancy of a structure; the Contractor shall take the necessary steps to prevent its buoyancy either by increasing the structure's weight, by filling it with approved material or other acceptable methods. Damage to any structures due to floating or flooding shall be repaired or the structures replaced at the Contractor's expense.

D. DUST, NOISE AND EROSION CONTROL

1. The Contractor shall prevent dust nuisance from his operations or from traffic by the use of water and deliquescent salts.

2. Noise Suppression

The Contractor shall eliminate noise to as great an extent as practical at all times. Air compressing plants shall be equipped with silencers and the exhaust of all gasoline motors or other power equipment shall be provided with mufflers. Near hospitals and schools, special care shall be used to avoid noise or other nuisances. The Contractor shall strictly observe all local regulations and ordinances covering noise control.

Sound levels measured by the Owner's personnel shall not exceed 45 dBA after 8 p.m. or 55 dBA 8 a.m. to 8 p.m. This sound level shall be measured at the exterior of the nearest exterior wall of the nearest residence or building. Levels at the equipment shall not exceed 85 dBA at any time. Sound levels in excess of these values are sufficient cause to have the Work halted until equipment can be quieted to these levels. Work stoppage by the Owner/Engineer for excessive noise shall <u>not</u> relieve the Contractor of other contractual responsibilities stipulated in the Contract Documents including, but not limited to Contract Price and time.

3. Erosion and Sedimentation Control

    a. Temporary erosion controls include, but are not limited to, grassing, mulching, netting, watering and reseeding on-site surfaces and soil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the Owner/Engineer, FDEP and any other agency having jurisdiction.
    b. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces, which will ensure that sedimentation pollution, will be either eliminated or maintained within acceptable limits as established by the Owner/Engineer, FDEP and any other agency having jurisdiction.
    c. The construction of temporary erosion and sedimentation control facilities shall be in accordance with the technical provision of section 104-6.4 of the 1991 Edition, FDOT Standard Specifications for Road and Bridge Construction.
    d. Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

E. CONSTRUCTION FIELD ENGINEERING

2. Professional Engineer: The Contractor shall provide the services of a Registered Professional Engineer currently licensed in the State of Florida for the following specific services as applicable to the Work:

    a. Inspections, testing, witnessing requiring a licensed professional engineer;
    b. Design of temporary shoring, bridging, scaffolding or other temporary construction; and
    c. Other requirements as specified herein.

3. Registered Land Surveyor: The Contractor shall retain the services of a registered land surveyor licensed in the State of Florida for the following specific services as applicable to the Work:

    a. Identify existing rights-of-ways and property lines along or adjacent to the Work;
    b. Locate existing utilities and structures as may be affected by the Work.
    c. Locate control points prior to starting the Work;
    d. Replace control points or reference points that may be lost or destroyed.

4. Contractor shall protect control points prior to starting the Work and shall preserve all permanent reference points during construction. Report to the Owner/Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
   The Contractor shall bear the cost of re-establishing project control points if disturbed, and bear the entire expense of rectifying Work improperly installed due to not

maintaining or protecting or to removing without authorization such established points, stakes and marks.

5. Submittals

   a. Certificate signed by a Registered Surveyor certifying that elevations and locations of improvements are in conformance, or non-conformance, with Contract Documents.
   b. Documentation to verify accuracy of field engineering work when requested by the Engineer.

F. LINES AND GRADES

1. All Work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings, or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

2. The Contractor shall, at his own expense, establish all working or construction lines and grades as required from the project control points set by the Owner/Engineer, and shall be solely responsible for the accuracy thereof.

3. Water, force and reclaimed water mains shall follow the minimum cover over the top of the pipe as specified on the Orange County Utilities – Standards and Construction Specifications Manual. Cover shall vary to provide long uniform gradient or slope to pipe to minimize air pockets and air release valves. The stationing shown on the Drawings for air and vacuum release valve assemblies are approximate and the Contractor shall field adjust these locations to locate these valves at the highest point in the pipeline installed. The Owner/Engineer must approve all locations.

4. To insure a uniform gradient for gravity pipe and pressure pipe, all lines shall be installed using the following control techniques as a minimum:

   a. Gravity Lines: continuous control, using laser beam technology.
   b. Pressure Lines: control stakes set at 50 ft intervals using surveyor's level instrument.

G. CUTTING AND PATCHING

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

2. Preparation

   a. Inspect the existing conditions of the project, including elements subject to damage and/or movement during cutting and patching.

b. Provide adequate temporary support to assure the structural integrity of all facilities during completion of the Work.

3. Performance

a. Execute cutting and demolition by methods that will prevent damage to other existing facilities and will provide proper surfaces to receive installation of equipment and repair.
b. Excavation and backfilling shall be performed in a manner, which will prevent settlement and/or damage to existing facilities.
c. All pipes, sleeves, ducts, conduits and other penetration through surfaces shall be made airtight.
d. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.

H. TEMPORARY CONSTRUCTION

1. Temporary Fences: If, during the course of the Work, it is necessary to remove or disturb any fencing, the Contractor shall, at his own expense, provide a suitable temporary fence, which shall be maintained until the permanent fence, is replaced. The Engineer will be solely responsible for the determination of the necessity for providing a temporary fence and the type of temporary fence to be used.

2. Responsibility for Temporary Structures: In accepting the Contract, the Contractor assumes full responsibility for the sufficiency and safety of all temporary structures or work and for any damage which may result from their failure or their improper construction, maintenance or operation and will indemnify and save harmless the Owner from all claims, suits or actions and damages or costs of every description arising by reason of failure to comply with the above provisions.

I. TEMPORARY FACILITIES

1. Contractor shall furnish, install and maintain temporary facilities required for construction, and shall remove them upon completion of the Work. All facilities shall comply with the respective federal, state and local codes and regulations and with utility company requirements.

2. Materials for temporary facilities may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

3. Temporary Utilities

a. Temporary Electricity and Lighting: The Contractor shall make all arrangements with the local utility company, provide service required for power and lighting, install circuit and branch wiring, install distribution boxes located so that power and

lighting is available at field office site throughout the construction period, and provide adequate artificial lighting for all areas of work when natural light is not adequate for work and for areas accessible to the public.

b. Temporary Heat and Ventilation

   1) The Contractor shall provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate the progress of the Work, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage due to temperature or humidity. Portable heaters shall be standard U.L. approved units complete with controls.
   2) The Contractor shall provide adequate force ventilation of enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases.

c. Temporary Telephone Service: The Contractor shall make all arrangements with the local and long distance telephone service companies and provide direct line telephone services at the construction site for the use of personnel.

d. Temporary Water

   1) The Contractor shall provide water for construction and testing purposes, shall install branch piping with taps located so that water is available throughout the construction by the use of hoses, and shall protect piping and fittings against freezing as applicable to the work site.
   2) The Contractor may use the existing water supply systems for testing, flushing, and construction water only at the direction of the utility Owner/Engineer. The Contractor shall pay for all water used in performing the above functions in accordance with the utility owner's established water rate schedules. The Contractor shall install at each connection to a public water supply a backflow preventer and all other appurtenances required by the Owner/Engineer, codes and regulations. Contractor shall be required to meter all water used.

e. Temporary Sanitary Facilities: The Contractor shall provide sanitary facilities in compliance with laws and regulations.

f. Payment for Utilities: The Contractor shall make all necessary applications and arrangements and pay all fees and charges for electrical energy for power and light, gas energy, water and sanitary service, and telephone service required for the construction and testing of the Work under this Contract during its entire progress. He shall provide and pay for all temporary piping, valves, wiring, switches, connections, and meters. All non-project related telephone, toll charges shall be paid by the party who places the call.

4. Temporary Offices and Buildings

   a. Furnish, install and maintain the following offices or buildings for the Owner and the Contractor during the entire construction period:

1) Contractor's field office
2) Owner's field office
3) Storage or work sheds for construction

b. Arrange to provide a suitable location for all temporary structures, buildings or storage sheds. During the preconstruction meeting, submit for approval a sketch of each temporary building and shed and a location map within the project site indicating building/shed layout, temporary drainage and utilities, access, and parking.

c. Construction: At Contractor's option, portable or mobile buildings may be used, but must be structurally sound, weather tight, with floors raised aboveground and appropriately insulated for occupancy and storage requirements. Mobile buildings, when used, must be provided with steps and landings at the entrance door and hurricane tie-downs.

d. Prohibited Use

1) Permanent facilities shall not be used for field office or for storage unless otherwise approved by the Owner.
2) Temporary or permanent facilities shall not be used for living quarters.

e. Owner's Field Office: (Provide at site within 15 days after Notice to Proceed). **No Construction until field office is in full operation.**

1) The specific requirements for the Owner's field office is specified in Table 01001-D (unless otherwise noted).
2) The Contractor shall make all provisions and pay all installations and other costs for the Owner's construction office. The Contractor shall pay all monthly charges for the various services provided for the Owner's office throughout the construction period.

f. Maintenance and Cleaning

1) Furnish, replace, and replenish light bulbs, fluorescent tubes, toilet paper, paper towels, soap, bottled water, and other things required to maintain offices in a clean condition.
2) Wash floor and clean washroom fixtures at least once each week. Wash windows when needed or when requested by Owner. Sweep floor and dust furnishings daily.
3) Maintain office in first class condition for the duration of the project and for 30 days after final completion.

g. Removal

1) Remove temporary field offices, contents, and services at a time when no longer needed.
2) Remove foundations and debris; grade site to required elevations and clean the areas.

5. First Aid Station

The Contractor shall keep on the site, at each location where Work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times.

J. PRE-CONSTRUCTION PHOTOGRAPHS

1. The Contractor shall engage the services of a professional videographer to record pre-construction conditions no more than 45 days and no less than five days prior to construction. The videographer shall be a commercially known firm skilled and regularly engaged in the business of continuous preconstruction color audio-visual tape documentation. The videographer shall not be an employee of the Contractor or in anyway associated with the Contractor. No construction shall begin prior to the review and approval of the respective videotapes by the Owner and Engineer. All videotapes and written records shall become the property of the Owner.

a. Video Recording

1) Type: E.I.A. standard video with minimum horizontal resolution of 525 lines, 60 fields.
2) Screen Display: time of day, month, day and year.
3) Coverage: record all existing surface features located within the area affected by construction featuring existing improvements and vegetation and existence of any faults, defects or fractures thereto.
4) Each video tape shall be permanently labeled and provided with a log of the video's content indexed by Video Unit Counter Numbers with corresponding subject data (street name, direction, engineering station numbers and date).
5) Recording shall be performed on bright sunny days using a stable continuity of coverage at a rate not exceeding five miles per hour, with camera not mounted more than 10 feet above ground.

b. Audio Recording

1) Single voice narrative recording corresponding and simultaneous with the video recording.
2) Provide commentary to assist viewer orientation including street name, side, direction of travel, house addresses, and engineering station numbers.

K. CONSTRUCTION PHOTOGRAPHS

1. The Contractor shall employ a competent photographer regularly engaged in the business to take construction record photographs periodically during the course of the Work.

   a. Prints: date imprinted 8-inch x 10-inch high resolution glossy single weight color print paper; four (4) sets to be provided to the Owner with each respective Application for Payment and distributed by the Owner as follows:

      1) Owner (1 set)
      2) Engineer (1 set)
      3) Contractor (1 set)
      4) Project Record Data (1 set stored by Contractor on site)

   b. Required Photographs and Views: Provide two (2) views each at the completion of the following stages of construction for each structure.

      1) Site clearing
      2) Excavation
      3) Foundation
      4) Framing
      5) Enclosure
      6) Pipeline laying prior to backfilling
      7) Site restoration and landscaping
      8) Installation of equipment and facilities. Additionally, four (4) views (N,S,E,W) of the overall project site shall be provided on a monthly basis as directed by the Owner or RPR
      9) The Contractor may substitute color aerial photography upon prior approval by the Owner.

   c. Required Photographs and Views: Provide minimum three (3) views each at the following locations for pipelines:

      1) Utility conflicts/relocations
      2) Exploratory excavations
      3) Boring and jacking
      4) Stream or canal crossing
      5) Typical valve installation
      6) Typical air release
      7) Typical hydrant assembly
      8) Photographs will generally be taken for top view, upstream and downstream prior to backfilling.

   d. Negatives: Shall be maintained by the photographer for two years after final completion and then shall convey the negatives to the Owner.

   e. Photo Identification (data permanently printed on back):

1) Name of Project
2) Name of Structure
3) Orientation of View
4) Date & Time of Exposure
5) Name and address of photographer
6) Film numbered identification of exposure

L. CLEANING

1. During Construction

a. During construction of the Work, the Contractor shall, at all times, keep the site of the Work and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the Owner/Engineer, such material, debris, or rubbish constitutes a nuisance or is objectionable.
b. Provide on-site containers for the collection of waste materials, debris and rubbish and remove such from the site periodically by disposal at a legal disposal area away from the site.
c. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces. Use only those cleaning materials and methods recommended by the manufacturer of the surface material to be cleaned. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.
d. The Contractor shall remove from the site all surplus materials and temporary structures when no longer necessary to the Work at the direction of the Owner/Engineer.

2. Final Cleaning

a. At the conclusion of the Work, all equipment, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and he shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances. Employ skilled workmen for final cleaning. Thoroughly clean all installed equipment and materials to a bright, clean, polished and new appearing condition. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
b. The Work shall be left in a condition as shown on the Drawings and the remainder of the site shall be restored to a condition equal or better than what existed before the Work.

c. Prior to final completion, or Owner occupancy, Contractor shall conduct an inspection of interior and exterior surfaces, and all work areas to verify that the entire Work is clean. The Owner will determine if the final cleaning is acceptable.

M. DAILY REPORTS

1. The Contractor shall submit to the Owner/Engineer's Representative daily reports of construction activities including non-work days. The reports shall be complete in detail and shall include the following information:

   a. Days from Notice to Proceed; Days remaining to substantial and final completion
   b. Weather Information;
   c. Work activities with reference to the BCM schedule activity numbers (including manpower, equipment and daily production quantities for each individual activity);
   d. Major deliveries;
   e. Visitors to site;
   f. Test records;
   g. New problems, and;
   h. Other pertinent information.

2. A similar report shall be submitted for/by each Subcontractor.

3. The report(s) shall be submitted to the Resident Project Representative's Field Office within two (2) days of the respective report date. The CONTRACTOR's Superintendent or Project Manager shall sign each report. Pay request will not be processed unless daily reports are current.

   If a report is incomplete, in error, or contains misinformation, the Resident Project Representative shall return a copy of the report to the CONTRACTOR's Superintendent or Project Manager with corrections noted. When chronic errors or omissions occur, the CONTRACTOR shall correct the procedures by which the reports are produced.

N. PROJECT SIGNS (NOT APPLICABLE)

Two (2) project signs shall be furnished and installed on the project site by the Contractor at locations determined by the Owner. The Contractor may be required to relocate these identifying project signs during the progress of the Work. Each sign shall be approximately 4 x 8 feet in size, and shall contain the project name, and names of the Owner or governing council, Engineer and Contractor. Wood shall be pressure treated and fasteners galvanized.

1.08 CONSTRUCTION NOT PERMITTED

A. USE OF EXPLOSIVES

No blasting shall be done except upon approval by the Owner/Engineer and the governmental agency or political subdivision having jurisdiction. When the use of

explosives is approved by the Owner/Engineer as necessary for the execution of the Work, the Contractor shall use the utmost care so as not to endanger life or property, and assume responsibility for any such damage resulting from his blasting operations, and whenever directed, the number and size of the charges shall be reduced. All explosives shall be stored in a secure manner and all such storage places shall be marked clearly, "DANGEROUS EXPLOSIVES" and shall be in care of competent watchmen. The Contractor at his expense shall obtain all permits required for the use of explosives. All requirements of the governmental agency issuing permit shall be observed.

B. BURNING

Do not burn combustible materials. Remove all cleared material from the Work site and dispose of in accordance with all local laws, codes, and ordinances. At the Contractor's option, chipping operations may be substituted when the tree species and soundness is appropriate for such use.

C. EXCAVATED SUITABLE MATERIAL HAULED OFF-SITE

All suitable topsoil and excavated material shall remain stockpiled at the Owner/Engineer's direction.

1.09 PROJECT MEETINGS

A. GENERAL

1. The Contractor shall attend all meetings to ascertain that work is expedited consistent with the Contract Documents and construction schedules.

2. Representatives of the Owner, Engineer, contractors, subcontractors, suppliers and utility owners attending meeting shall be qualified and authorized to act on behalf of the entity each represents.

3. The Owner/Engineer will schedule and administer the preconstruction meeting, periodic progress meetings, and specially called meetings throughout the progress of the work (i.e., prepare agenda for meetings, make physical arrangements for meetings and, preside at meetings, prepare meeting minutes). A copy of the minutes of each progress meeting will be available within five (5) days after the meeting.

4. Contractor shall record the Preconstruction Meeting and each progress meeting in their entirety, and shall provide the Engineer a regular cassette copy of such recording, having good quality and clarity.

B. PRECONSTRUCTION MEETING

1. A preconstruction meeting shall be held no later than twenty (20) days after date of Notice of Award and before the date of Notice to Proceed at a central site, convenient for all parties, designated by the Owner.

2. Attendance

   a. Resident Project Representative (RPR)
   b. Owner's Representative
   c. Engineer and his professional consultants
   d. Contractor and his superintendent
   e. Major subcontractors
   f. Major suppliers
   g. Utilities
   h. Others as appropriate

2. Suggested Agenda: This meeting is intended to introduce the various key personnel from each organization and to discuss the requirements of the Contract Documents as to how they specifically pertain to this Project and Work. The Engineer will prepare a "Preconstruction Booklet" for this meeting outlining specific construction administration procedures, general construction requirements and other special considerations. The Contractor shall provide information as requested by the Engineer in the development of the Preconstruction Booklet.

C. PROGRESS MEETINGS

1. Progress meetings will be held every thirty (30) days or less with the first meeting thirty (30) days after the Preconstruction Meeting or thirty (30) days or less after the date of Notice to Proceed.

2. Progress meeting dates and time shall be scheduled at the Preconstruction Meeting for the entire duration of the Work on a monthly calendar basis. All progress meetings shall be held at the project field office of Contractor.

3. Attendance

   a. Resident Project Representative (RPR)
   b. Owner's Representative
   c. Engineer/prof. consultants as needed
   d. Contractor
   e. Subcontractors as appropriate to agenda
   f. Suppliers as appropriate to the agenda
   g. Others as appropriate

5. Suggested Agenda: A general agenda for Progress Meetings will be provided to the Contractor at the Preconstruction Meeting.

6. The Contractor shall study previous meeting minutes and current agenda items in order to be prepared to discuss pertinent topics such as deliveries of materials and equipment, progress of the Work, etc.

7. The Contractor is to provide a current shop drawing log at each progress meeting, as well as evidence of the completion of Project Record Drawings concurrent with Work progress.

1.10 CONSTRUCTION PROGRESS SCHEDULE

A. GENERAL – PRELIMINARY SCHEDULES

Submit three (3) copies of the following preliminary schedules at least seven (7) calendar days before the preconstruction conference:

1. Preliminary construction schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2. Preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing and processing such submittal;

3. Preliminary schedule of values for all of the Work, which will include quantities and prices of items aggregating the Contract Price and will subdivide the Work into component pars in sufficient detail to serve as the basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

Within seven (7) calendar days after the preconstruction conference, the preliminary schedules will either be approved or returned for revisions. Do not begin work, except mobilization and traffic control, without approved preliminary schedules.

B. GENERAL - CONSTRUCTION SCHEDULE

The Bar Chart Method (BCM) shall be used to develop the construction schedule for the total contract Work. The construction schedule shall be developed using the BCM utilizing Primavera or Microsoft Project Computer Software or equal (compatible with IBM computers and DOS operating system). Preface each construction schedule as follows:

1. Project Name
2. Contract Number
3. Contractor
4. Original contract time allowed or completion date
5. Type of construction schedule (initial or update)
6. Effective date of the schedule

7. Percent work complete
8. Percent time used

Submit three (3) copies of the construction schedule and one electronic copy of the schedule on Compact Disk within 30 calendar days after the Notice To Proceed is issued. Allow 14 calendar days after receipt for approval of the construction schedule or a return for revisions.

Do not show conflicts with any scheduled activities and order of work requirements in the contract.

Show completion of the Work within the Contract Time.

C. BAR CHART METHOD (BCM)

The BCM construction schedule shall consist of a progress bar chart and a written narrative.

1. Progress Bar Chart - The following applies to the initial submission and all updates:

   a. Use a time scale to graphically show the percentage of work scheduled for completion during the contract time.
   b. Define and relate activities to the contract pay items.
   c. Show all activities in the order the work will be performed, including submittals, approvals, fabrication and delivery.
   d. Show all critical (major) activities that are controlling factors in the completion of the work.
   e. Show the time required for each activity and its relationship in time to other activities.
   f. Show the total expected time to complete all work.
   g. Provide enough space for each activity to permit two (2) additional plots parallel to the original time span plot. Use one (1) space for revision of the planned time span, and one (1) for showing actual time span achieved.

2. Written Narrative - The following applies to the written narrative:

   a. Estimate starting and completion dates of each activity.
   b. Describe work to be done within each activity including the type and quantity of equipment, labor, and material to be used.
   c. Describe the location on the project where each activity occurs.
   d. Describe planned production rates by pay item quantities (e.g., cubic yards of excavation per day/week).
   e. Describe workdays per week, holidays, number of shifts per day, and number of hours per shift.
   f. Estimate any periods during which an activity is idle or partially idle. Show the beginning and end dates for reduced production or idle time.
   g. Describe expected and critical delivery dates for equipment or material that can affect timely completion of the project.

h. Describe critical completion dates for maintaining the construction schedule.
i. Identify the vendor, supplier, or subcontractor to perform the activity. State all assumptions made in the scheduling of the subcontractor's or supplier's work.

D. SCHEDULE UPDATES

Review the construction schedule to verify finish dates of completed activities, remaining duration of uncompleted activities, and any proposed logic and/or time estimate revisions. Keep the Owner/Engineer informed of the current construction schedule.

Submit three (3) copies of an updated construction schedule and one electronic copy of the updated construction schedule on a Compact Disk with each month's Application for Payment or when:

1. A delay occurs in the completion of a critical (major) activity.

2. A delay occurs causing a change in a critical activity for BCM schedules.

3. The actual prosecution of the work is different from that represented on the current construction schedule.

4. There is an addition, deletion, or revision of activities required by a contract modification.

E. CONTRACTOR'S RESPONSIBILITY; CONTRACTOR SHALL

1. Determine the sequence of activities for the orderly progression of the Work.

2. Determine appropriate time estimates of the detailed construction activities.

3. Determine the means, methods, techniques and procedures to be employed in the prosecution of the Work in compliance with the Contract Documents.

4. Monitor the Construction Schedule in a timely manner.

5. Accurately update and revise the Construction Schedule as project conditions and the Contract Documents may require.

6. Consult with his Subconsultant(s) in the preparation and submittal process of the Construction Schedule.

7. Allow for his cooperation with the operation of the Owner and the work of other separate Continuing contractors, as applicable.

8. Use the schedule to report progress and for determining delays in achieving the project completion date(s).

F. WORK PLAN

The Contractor shall submit to the Owner's Engineer a weekly work plan on the required form identifying controlling work items expected to be underway during the upcoming weekly period.

1. Objective and Definition: The objective of the work plan (FDOT Form 700-010-15, Construction 07/94) shall be to identify those major controlling work items, which if not worked on during the planned period, would delay project completion as set by the Contractor's approved construction progress schedule(s). Critical (major) activities as detailed in the Contractor's approved construction progress schedule are considered controlling items of work. Approval of the work plan is by the Owner's Engineer.

2. Responsibility: The Contractor shall be responsible for identifying and executing work items necessary to insure project completion according to the work schedule. The Contractor will insure the work proposed complies with all sequencing or other requirements established in the contract special provisions, plans or the standard specifications.

3. Work Plan Meeting: The Contractor's work plan identifying controlling work items expected to be underway during the upcoming weekly period shall be submitted at and discussed during scheduled weekly construction progress meetings with the Owner's on-site representative.

1.11 SHOP DRAWINGS, WORKING DRAWINGS AND SAMPLES

A. GENERAL

The Contractor shall submit to the Engineer for review and acceptance, if any, such working drawings, shop drawings, test reports and data on materials and equipment, and material samples as are specified elsewhere in the specifications and in the Contract Drawings.

B. SHOP DRAWINGS

The term “Shop Drawings” shall be construed to mean Contractor’s plans for material and equipment, which becomes an integral part of the Project. Shop Drawings shall consist of fabrication, erection and setting drawings and schedule drawings, manufacturer’s scale drawings, wiring and control diagrams, material and equipment lists, catalog data sheets, cuts, performance curves, diagrams, materials of construction and similar descriptive material.

1. Shop drawings shall be prepared in a manner and sufficient detail to enable the engineer to determine compliance with all stated specifications requirements.

2. Drawings and schedules shall be checked and coordinated with the work of all trades involved before they are submitted for review by the Engineer and shall bear the Contractor's stamp of review and acceptance as evidence of such checking and coordination.

3. If drawings show variation from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in his letter of transmittal. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the Contractor fails to describe such variations, he shall not be relieved of the responsibility for executing the work in accordance with the Contract, even though such drawings have been reviewed.

C. WORKING DRAWINGS

The term "Working Drawings" shall be construed to mean the Contractor's plan for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities, groundwater control systems, forming and false work for underpinning and for such other work as may be required for construction but does not become an integral permanent part of the Project.

1. Working Drawings shall be submitted to the Engineer where required by the Contract Documents or requested by the Engineer, and shall be submitted al least thirty (30) calendar days (unless otherwise specified by the Engineer) in advance of their being required for the work.

2. Working Drawings shall be prepared, signed, and sealed by a registered professional engineer currently licensed to practice in the State of Florida. Working Drawing submittals are required to verify compliance with this provision. The Engineer will not check designs prepared by the Contractor's professional engineer. The Contractor and the Contractor's engineer assume all risks of error; the Owner/Engineer shall have no responsibility therefore.

D. SAMPLES

1. Samples shall be delivered to the Engineer as specified or directed. The Contractor shall prepay all shipping charges on samples.

2. Review and acceptance of a sample shall be only for the characteristics or use named in such acceptance and shall not be construed to change or modify any Contract requirements. Materials or equipment for which samples are required shall not be used in work until accepted by the Engineer. Materials and equipment incorporated in Work shall match the accepted samples.

3. Accepted samples not destroyed in testing shall be sent to the site of the Work. Accepted samples of the hardware in good condition sill be marked for identification and may be used in the work. Samples, which failed testing or were not accepted, will

be returned to the Contractor at his expense, and if so requested at the time of submission.

E. CONTRACTOR'S RESPONSIBILITY

The Contractor shall:

1. Check all drawings, data and samples prepared by or for him before submitting them to the Engineer for review;

2. Stamp each data submittal with "Contractor's Stamp" indicating that they have been checked. Shop drawings submitted to the Engineer without the "Contractor's Stamp" will be returned for non-conformance with this requirement;

3. Determine and verify field measurements and construction criteria;

4. Determine and verify specific catalog numbers and similar data (other catalog or manufacturer's data not pertinent to the submittal shall be crossed or marked out).

5. Determine and verify general conformance with Contract Documents.

6. Not begin any work covered by a shop drawing returned for correction until a revision or correction thereof has been reviewed, accepted and returned to the Contractor by the Engineer. The Contractor shall be responsible for and bear all costs for damages which may result from the ordering of any material or from proceeding with any part of the work prior to the review and approval by the Engineer of the necessary shop drawings;

7. Carry out the construction in accordance with the Engineer accepted shop drawings and shall make no further changes therein except upon written instruction from the Engineer;

8. Submit to the Engineer all shop drawings, samples and schedules sufficiently in advance of construction requirements to provide no less than thirty (30) calendar days for checking, and appropriate action;

9. List exceptions to the specifications taken by the Contractor in the letter of Shop Drawing Transmittal to the Engineer.

F. ENGINEER'S RESPONSIBILITY

The Engineer will:

1. Review shop drawings, data, and samples submitted by the Contractor to interpret the work depicted on such submittal to be in general conformance with the design concept and in general compliance with the Contract Document requirements. The Engineer's review and acceptance, if any, constitutes a limited, conditional or qualified permission

to use such materials, equipment or methods and does not constitute an acceptance of dimensions, quantities, details of the material, equipment, device or item submitted.

2. Review and return shop drawing submittals within 30 calendar days of receipt.

3. Reject and return shop drawings to the Contractor without action or review with the following applicable notation:

   a."Contractor's Stamp required - Incomplete Review by Contractor", or
   b."Submittal Not Required by Contract Documents", or
   c."Submittal Incomplete - See Section _____", or
   d."Contract Variation Not Noted in Transmittal".

G. SUBMITTAL PROCEDURES

1. Preliminary Shop Drawing Data: Within 20 days after the Award of the Contract or before the Preconstruction Meeting, the Contractor shall submit to the Engineer a complete listing of manufacturers for all items for which shop drawings are to be submitted.

2. Shop Drawing Submittal Schedule: Within 30 days after the Notice to Proceed, the Contractor shall submit to the Engineer a complete schedule of shop drawing submittals fixing the respective dates for submission, the beginning of manufacture, testing, and installation of materials, supplies and equipment, noting those submittals critical to the progress schedule.

3. Submittal Log: An accurate updated log of submittals maintained by the Contractor and subject to review by the Owner/Engineer at each scheduled progress meeting.

4. When reviewed by the Engineer, each of the shop drawings will be identified as having received such review, being so stamped and dated. Shop drawings stamped "REJECTED" will be returned to the Contractor for correction and resubmittal with the required correction indicated on the shop drawing or listed on a "Shop Drawing Review Comment Sheet".

5. If submitted drawings or schedules show a departure or variation from the Contract Requirements which the 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.

6. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or specifications, the Contractor shall give written notice thereof to the Engineer. This does not constitute a change order until approved by the Owner.

7. Re-submittals will be handled in the same manner as first submittals. On re-submittals, the Contractor shall direct specific attention on the transmittal and on resubmitted shop drawings to revisions other than the corrections requested by the Engineer on previous submissions. The Contractor shall make any corrections required by the Engineer.

8. The Engineer will review a submittal/re-submittal a maximum of two (2) times after which the cost of review will be borne by the Contractor at the Engineer's standard hourly rate.

9. No partial submittals will be reviewed. Submittals not complete will be returned to the Contractor, and will be considered "Rejected" until properly resubmitted. Unless otherwise specifically permitted by the Engineer, all submittals shall be grouped containing all associated items for:

   a. Systems
   b. Processes
   c. As indicated in specific specification sections.

10. Contractor shall submit a minimum of five (5) sets, plus additional sets as required by his subcontractors, of each shop drawing submittal for review. The Engineer will distribute shop drawings as follows for the indicated action taken:

SHOP DRAWING SUBMITTAL DISTRIBUTION

Representative Party	Accepted (A) Accepted as Noted (AN)			Not Accepted (NA)		
	Submittal Transmittal	Shop Drawing	Review Comment Sheet	Submittal Transmittal	Shop Drawing	Review Comment Sheet
Engineer	Original	File Copy	1 Copy	Original	File Copy	1 Copy
Contractor (see Note 1)	1 Copy	1 Copy Each Submittal	1 Copy	1 Copy	All Copies Except Engrs. File Copy	1 Copy
Owner	2 Copies	2 Copies Each Submittal	2 Copies	1 Copy	None	1 Copy
Resid. Proj. Rep. (RPR)	1 Copy	1 Copy Each Submittal	1 Copy	1 Copy	None	1 Copy
Project Record Data (see Note 2)	1 Copy	1 Copy Each Submittal	1 Copy	1 Copy	None	1 Copy

NOTES:
1. Contractor shall distribute additional copies to subcontractors as required.
2. Stored by Contractor to be furnished to Owner upon closeout.

11. All shop drawing submittals shall be accompanied with a transmittal letter providing the following information:

    a. Project Title and Contract Number
    b. Date
    c. Contractor's name and address
    d. The number of each shop drawing, project data, and sample submitted.
    e. Notification of Deviations from Contract Documents
    f. Submittal Log Number conforming to specification section numbers

        1) Submit each specification section separately.
        2) Identify each shop drawing item required under respective specification section.
        3) Identify resubmittals using specification section followed by A (first resubmittal), B (second resubmittal) ... etc.

1.12 PROJECT RECORD DOCUMENTS (Also see Section 01720 – Project Record Documents)

A. The Contractor shall maintain at the site, for the Owner, one record copy of the following to be submitted to the Engineer for the Owner at Project Closeout:

    1. Conformed Drawings
    2. Conformed Specifications
    3. Addenda Information
    4. Change Orders and other modifications to the Contract
    5. Construction Progress Schedules
    6. Field Orders
    7. Contractor's Requests for Additional information
    8. Approved Shop Drawings
    9. Field Test Records
    10. Project Record Drawings certified by Professional Land and Surveyor registered in the State of Florida

B. Store Record Documents and samples in Contractor's field office apart from documents used for construction. Do not use record document for construction purposes. Label each document "PROJECT RECORD" in neat large printed letters. File documents and samples in accordance with CSI/CSC format.

C. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

1.13 START-UP

A. GENERAL

As soon as conditions permit, the Contractor shall furnish all labor, fuel, energy, lubrication, water, and all other materials, equipment, tools, and instruments necessary for the following acceptance tests (Start-up Check-Out and Demonstration and Testings). Prior to these acceptance tests, the Contractor shall conduct preliminary testing of equipment and, if the preliminary field test disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, then Contractor shall, prior to Start-up Demonstration and Testing, make all changes, adjustments and replacements required. The furnishing Contractor shall assist in the preliminary field tests as applicable.

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

2. Demonstrate to the Engineer that all temporary jumpers and/or bypasses have been removed and that all of the components are operating under their own controls as designed.

B. START-UP CHECK-OUT CERTIFICATION (Potable and Reclaimed Water)

Start-up of water main shall include the following steps:

Potable and Reclaim Mains	Wastewater Force Main
Filling pipe.	Filling pipe.
Pressure testing pipe.	Pressure testing pipe.
Flushing pipe.	Flushing pipe.
Disinfection of pipe.	Submittal by Owner of test results to FDEP.
Flushing of chlorine solution from pipe.	FDEP's acceptance.
Bacteriological test.	Pipeline may be placed in service.
Submittal by Owner of test results to FDEP.	
FDEP's acceptance.	
Pipeline may be placed in service.	

1. Water Supply: The Contractor shall obtain and pay for (by metered charges) an adequate amount of water from the utility owner for filling, flushing and testing of mains.

2. Filling Pipe - Jumper Connection.

   a. Filling of all newly, constructed water mains shall take place through a temporary jumper connection between an existing water main and the new main incorporating an approved construction water meter and an approved AWWA double check backflow prevention device. Contractor shall furnish and maintain the temporary jumper connection including the construction water meter and the backflow prevention device and be able to show documented proof that such devices have been tested and are in good working order at time of installation. (Reference Utility's Cross-Connection Control Manual for testing procedures.)

b. The point of meter installation shall have prior approval from the utility owner and may include but not necessarily be limited to; existing fire hydrants, existing blow-offs, restrained valve at terminating end of existing water main or wet tap on existing water main. The Contractor shall notify the utility owner prior to flushing and/or filling to allow the utility owner to observe flushing and/or filling operation.
c. Jumper connection shall be 2 inches minimum in size. Piping material between originating point and the water meter shall be threaded brass, threaded galvanized steel pipe, or DR 9 poly.
d. Tie-in valve (main line) shall remain closed at all times except as described later in this section.

3. Flushing of Pipes

a. Flushing of pipes shall be in accordance with Sections 02660, 02661 and 02662 of these Specifications. The pressure in the existing water system shall be monitored and maintained during flushing and at no time should the pressure in the existing water system be allowed to drop below 50 psi.
b. For pipes 8" or smaller diameter, flushing shall be achieved through the jumper connection.
c. For pipes greater than 8" diameter, the connection for flushing will be made in the field as directed by the RPR as required. All main line valves shall be operated by the utility Owner or RPR only.
d. The Contractor shall supply and install pressure gauges to monitor system pressure during flushing operations.

4. Disinfection of Water Mains: Disinfection of water mains shall be in accordance with Divisions 2 and 16 of these Specifications and in accordance with AWWA 651-92 and Florida DEP Standards.

5. Bacteriological Testing

a. Bacteriological testing shall be in accordance with Divisions 2 and 15 of the Specifications.
b. Two (2) consecutive passing test results are required for each pipe segment tested. If a pipe segment fails to provide two (2) consecutively passing tests, then the pipe segment shall be disinfected again and retested until two (2) consecutive passing test results are obtained.
c. Test results shall be submitted to the Owner/Engineer for forwarding to FDEP.

6. Final Acceptance: After release by FDEP and approval by the utility Owner/Engineer, the Contractor shall connect pipes to the existing water mains.

C. START-UP DEMONSTRATION AND TESTING CERTIFICATION

1. After all Work components have been constructed, field tested and the start-up CHECK-OUT completed in accordance with the manufacturer requirements, perform Start-up DEMONSTRATION AND TESTING in the presence of the Engineer and the Owner.

2. The intent of the start-up demonstration and testing is for the Contractor to demonstrate to the Owner and Engineer that the Work will function as a complete and operable system under normal as well as emergency operating conditions and is ready for acceptance. The demonstration shall be conducted upon completion of all systems at a date to be agreed upon in writing by the Owner or his representative.

3. Start-up DEMONSTRATION AND TESTING will be conducted using potable water supplied by the utility owner at locations approved by Owner. The Contractor shall supply and install properly operating backflow preventer(s) as specified under Subsection 1.13.B of this Section.

4. Start-up DEMONSTRATION AND TESTING shall be conducted continuously for (3) three consecutive days. The Work must operate successfully during this testing period in the manner intended. If the Work does not operate successfully, or if the start-up is interrupted, the problems shall be corrected and the test shall start over from day one. The party causing the interruption shall be subject to the assessment of actual damages due to delay.

5. During the start-up demonstration period, operate the Work, instruct designated operating personnel in the function and operation of the Work and cause various operational circumstances to occur. As a minimum these circumstances shall include average and peak daily flows, random equipment failures, surcharges and bypasses. Demonstrate the essential feature of the equipment and its relationship to other equipment.

6. Acceptability of the Work's performance shall be based on the Work performing as specified, under these actual and simulated operating conditions as defined in the Contract Documents.

7. Certificate of Completed Demonstration: Submit five (5) copies of Certificate of Completed Demonstration, signed by the Contractor, Subcontractor and Owner and insert one copy in each Operation and Maintenance Manual.

D. FAILURE OF TESTS

1. Any defects in the materials and equipment or their failure to meet the tests, guarantees or requirements of the Contract Documents shall be promptly corrected by the Contractor by replacements, improvements, or otherwise at no cost to the Owner. The decision of the Engineer as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive.

2. If the Contractor fails to make these corrections or if the improved materials and equipment, when tested, shall again fail to meet the guarantees or specified requirements, the Owner, notwithstanding partial payment for work, and materials and equipment, may reject the nonconforming materials and equipment and may order the Contractor to remove them from the site at his own expense.

3. If the Owner rejects any materials and equipment, then the Contractor shall replace the rejected materials and equipment within a reasonable time. If he fails to do so, the Owner may, after the expiration of a period of thirty (30) calendar days after giving him notice in writing, proceed to replace such rejected materials and equipment. The cost thereof shall be deducted from any compensation due or which may become due the Contractor under his Contract.

1.14 CONTRACT CLOSEOUT

A. SUBSTANTIAL COMPLETION

1. When the Contractor considers the Work as substantially complete, he shall submit to the Engineer a written notice stating so and requesting the Engineer to make an inspection to determine the status of completion. This request shall be accompanied by a list of items to be completed or corrected.

2. Should the Engineer determine that the work is not substantially complete; the Engineer will promptly notify the Contractor in writing, given the reasons therefore. The Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Engineer for re-inspection.

3. When the Engineer finds that the work is substantially complete, he will prepare and deliver to the Owner, a tentative Certificate of Substantial Completion with a tentative list of items to be completed or corrected prior to final payment. After consideration of any objections made by the Owner, the Engineer will execute and deliver to the Owner and the Contractor a final Certificate of Substantial Completion with a revised tentative list of items to be completed or corrected.

B. FINAL INSPECTION

1. When the Contractor considers the Work complete, he shall submit written certification that:

   a. Contract Documents have been reviewed.
   b. Work has been inspected for compliance with Contract Documents.
   c. Work has been completed in accordance with Contract Documents.
   d. Equipment and systems have been tested in the presence of the Owner's Representative and are operational.
   e. Work is completed and ready for final inspection.

2. The Engineer will make a final inspection to verify the status of completion after receipt of such certification.

3. Should the Engineer consider that the Work is incomplete or defective, he will promptly notify the Contractor in writing, listing the incomplete and defective work, to the best of his knowledge at that time. If the Engineer has inadvertently omitted any items from the list it shall not relieve the Contractor from his obligations shown on the Drawings and specified in the Project Manual. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to the Engineer that the Work is complete.

4. When the Engineer finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

5. Should the Engineer perform re-inspection due to failure of the work to comply with the claims of status of completion made by the Contractor, the Owner will deduct the amount of any compensation or costs paid for additional inspections or tests from the final payment to the Contractor.

C. CONTRACTOR'S CLOSE-OUT SUBMITTALS TO ENGINEER

1. Evidence of compliance with requirement of governing authorities.
2. Project Record Documents
3. Operating and Maintenance Data
4. Warranties and Bonds (required for the Correctional Period and Maintenance Period).
5. Spare Parts and Maintenance Materials
6. Supplier and Subcontractor Final Waiver and Release of Lien(s), and Contractor's, Supplier's and Subcontractor's Final Affidavit(s). (Required information shall conform to Chapter 713 of the Florida Statutes, Supplement 1996.)
7. Final Application for Payment, including "Consent of Surety to Final Payment", "Final Statement of Accounting" and final Change Order, if required. The final Statement of Accounts shall reflect the following adjustments to the Contract Price:

    a. Previous Change Orders
    b. Allowances
    c. Unit prices
    d. Deductions for uncorrected work
    e. Penalties and bonuses
    f. Deductions for liquidated damages
    g. Deductions for re-inspection payments
    h. Other adjustments
    i. Release of Liens

8. The Engineer will prepare a final Change Order, reflecting accepted adjustments to the Contract Price, which were not previously made by Change Orders. The Contractor

shall meet all close-out requirements as specified in the General Conditions (Part F) of these specifications.

TABLE 01001-A
SCOPE OF WORK

PROJECT TITLE International Drive Utility Improvements

(from Westwood Blvd. South to Westwood Blvd. North)

OWNER: Orange County Utilities Department

This project consists of the resolution of utility conflicts, and improvements to the potable water, reclaimed water and wastewater systems within the International Drive right of way as affected by the OCPW roadway improvements project. The following pipe construction is proposed:

- Construction of approximately 1,360 LF of 24"and 50 LF of 12" DIP potable water main, 1 – 16" and 10 - 24" conflict transitions (including line stops) and other related potable water system components.

- Construction of approximately 7,950 LF of 24" DIP reclaimed water main. Tapping sleeve and valve connections and other related reclaimed water system components.

- Construction of approximately 210 LF of 12" PVC sanitary sewer , 1 new sanitary manhole, CIPP lining of approximately 1,370 LF of 18" and 3,320 LF of 15" sanitary sewer main and rehabilitation of 2 existing manholes. Construction of approximately 550 LF of 12" PVC force main 4 - 12" conflict transitions (including line stops) and other related wastewater system components.

Work shall also include open cutting of roads and removal and replacement of asphalt pavement, curbing, sidewalks and landscaping required as a result of the new pipe installations.

Construction shall include all necessary fittings, reducers, bends, tees, wyes, caps, plugs, restraining devices, locator plates, locate wire, polyethylene encasement, where required, butterfly valves, gate valves and air release valves as called out in construction drawings, furnishing all labor, materials and equipment and required to construct the pipelines including clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, flushing, testing, disinfection, restoration and cleanup.

Construction shall also include Maintenance of Traffic and dewatering.

All work shall be done in accordance with Orange County Standards and Construction Specifications for wastewater and reclaimed water main construction and Appendix D, dated February 11, 2011, and as specified in the Project Manual for a complete and acceptable project.

TABLE 01001-B
EXISTING FACILITIES TO REMAIN IN OPERATION

- Orange County Water Distribution System
- Orange County Wastewater Collection System
- Orange County Reclaimed Water Distribution System
- All other utilities which occupy subject rights-of-way

TABLE 01001-C
PERMITS OBTAINED BY OWNER

- Florida Department of Environmental Protection – Notification/Application for Constructing a Domestic Wastewater Collection/Transmission System
- Florida Department of Environmental Protection – Notice of Intent to Use the General Permit for Construction of Water Main Extensions for PWSs

TABLE 01001-D
OWNER/ENGINEER'S FIELD OFFICE

Furnish, equip, and maintain an office trailer for the sole use of the Owner, with secure entrance doors and one (1) key per occupant. Provide entrance/exit steps at all exterior doors.

1. Area: five hundred (500) square feet minimum, with minimum dimensions twelve (12) feet.
   a. Divide trailer into two (2) office areas with meeting area between and provide partitioned washroom, coat closet, and storage closet.
   b. Obtain prior approval of Engineer of floor plan. Each room shall have doors with integral locks, keyed alike.
2. Windows:
   a. Minimum: three (3), with a minimum total area of ten (10%) percent of floor area.
   b. Operable sash and insect screens.
   c. Locate to provide view of construction areas.
   d. Provide operable Venetian blinds for all windows.
3. Furniture:
   a. Two (2) standard size desks, three (3') foot by five (5') foot with desk chair, and three (3) drawers.
   b. One (1) drafting table: thirty-nine (39") inches x seventy-two (72") inches x thirty-six (36") inches high with one (1) equipment drawer.
   c. Two (2) three (3') foot x six (6') foot folding tables with six (6) folding chairs.
   d. One (1) metal, double-door storage cabinet.
   e. One (1) plan rack to hold a minimum of six (6) sets of project drawings each.
   f. One (1) standard four-drawer legal size metal filing cabinet with locks and keys (one (1) key per occupant).
   g. Six (6) linear feet of bookshelves per desk (min. four (4)-foot. high).
   h. Two (2) swivel armchairs.
   i. Two (2) straight chairs.
   j. One (1) drafting table stool
   k. One (1) wastebasket per desk and table.
   l. One (1) tack board, thirty-six (36") inches x thirty (30") inches.
   m. Coat rack and hooks
   n. Outside thermometers
   o. Xerox machine, Model 3107 or equivalent, with reduction capability
   p. One (1) telephone with answering machine
   q. One (1) plain paper facsimile (fax) machine with separate phone line.
   r. One (1) portable cellular telephone and local service, two (2) batteries with charger (max $100/month)
   s. One (1) state of the art computer with 17" monitor. Internet service will be supplied with computer (DSL or equivalent service)
4. Services (in both office):
   a. Lighting: fifty (50') foot candles at desk top height
   b. Exterior lighting at entrance door
   c. Automatic heating and mechanical cooling equipment sufficient to maintain comfort conditions.
   d. Minimum of four (4) 110-volt duplex electrical convenience outlets, at least one (1) on each wall.
   e. Electric distribution panel; two (2) circuits minimum, 110 volt; 60 hertz service
   f. Equip washroom with flush toilet, washbasin with two (2) faucets, medicine cabinet with supplies, toilet tissue holder, ten (10) gallon capacity automatic electric water heater, and paper towel holder.
   g. One (1) electric bottle water cooler with hot water tap, with accessory refrigerator.
   h. Telephone: Two (2) direct line instruments with local access and one (1) cellular phone.
   i. Provide potable water service to all trailer fixtures.
   j. Provide a single waste discharge to sanitary disposal system.
   k. Cleaning Service.

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

A. Unit Price Contracts: The quantities of work to be done and materials to be furnished under a unit price contract, as given in the Bid Form, are to be considered as approximate only and are to be used solely for the comparison of Bids received and determining an initial Contract Price. The Owner/Engineer does not expressly or by implication represent that the actual quantities involved will correspond exactly herewith; nor shall the Contractor plead misunderstanding or deception because of such estimate or quantities or of the character, location or other conditions pertaining to the Work. Payment to the Contractor will be made only for the actual quantities of work performed or material furnished in accordance with the Drawings and other Contract Documents, and it is understood that the quantities may be increased or diminished as provided in the General Conditions without in any way invalidating any of the unit prices bid.

B. Lump Sum Contracts: The quantities of work to be done and materials to be furnished, including all labor, equipment and incidentals required to complete the Work, are specified in Divisions 1 through 16 of the Contract Specifications and shown in the Contract Drawings. Payment to the Contractor of the lump sum price bid for the Work will be made and shall fully compensate the Contractor for the construction of the Work, completed and ready for continuous operation and use, in the manner contemplated by the Contract Documents.

C. Unit Price and Lump Sum Contracts:

1. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quantity of materials and equipment included in work to be done under this Contract.

2. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required.

3. All contracts shall be subject to 10% minimum retainer as defined in the General Conditions and the Agreement.

1.02 ALLOWANCES

A. The Contractor shall include in the Total Bid Amount all cash allowances stated hereinafter. Items covered by these allowances shall be supplied for such amounts and by such persons as the Owner/Engineer may direct.

B. The amount of the allowance shall be adjusted accordingly by Change Order to recognize the actual cost incurred by the Contractor. The Contractor shall submit appropriate documentation to validate the actual cost of the item.

C. Cash allowances for the purposes of bidding shall be in the following amounts and shall be so reflected in the Bid Form for the designated item.

1.03 SCHEDULE OF VALUES

A. Scope of Work

1. Submit to the Engineer a Schedule of Values within twenty (20) days after the Notice to Proceed.

2. A Schedule of Values shall be submitted for both lump sum and unit price contracts and the sum of the values in the schedule shall equal the Total Bid amount.

3. The Schedule of Values shall establish the actual value of the component parts of the Work and, unless objected to by the Engineer, shall be used as the basis for the Contractor's Applications for Payment.

B. Form and Content

1. Type the schedule on the Engineer's 8-1/2 x 11-inch standard form. Contractor's standard forms and computer printout will be considered for approval by the Engineer upon Contractor's request.

2. The values listed shall be the installed values of the component parts of the Work, including material, labor, overhead and profit, and all other costs associated with the installed value of each item.

C. Unit Price Contracts: For unit price contracts, the Bid Schedule shall be used as the basis for the Schedule of Values. The Contractor shall resubmit the Bid Schedule in the format described herein, and may, at his option, divide the items in the Bid Schedule into sub-items to provide a more detailed basis of payment.

D. Lump Sum Contracts: For lump sum contracts, the cost of the Work shall be separated into major items and sub-items as outlined below:

1. General Requirements (Division 1 Specification Sections)

a. Mobilization, Demobilization, Bonds and Permits

b. Shop Drawing Preparation /Submittal

c. Field Engineering and Exploratory Excavation

d. Record Drawing Preparation

e. All other costs associated with Division 1 of the Specifications

2. Site Work: The cost of the site work, with the exception of earthwork for structures and underground piping, shall be separated by task, with estimated quantities where applicable.

3. Structures: The cost of each structure shall be given separately, and each structure, at a minimum, shall be further separated into the following sub-items: earthwork, concrete forming, concrete reinforcement, concrete, equipment, piping and appurtenances (to a point 5 feet outside of the structure), miscellaneous metals, electrical work (to a point 5 feet outside of the structure) and finishes.

4. Yard Piping: The cost of yard piping shall be separated by pipe size and type, valves and appurtenances. The Contractor's estimated quantities and unit prices shall be included for each sub-item.

5. Electrical Work: The cost of electrical work outside of the structures shall be separated, at a minimum, into the following sub-items: Conduit, wire, duct bank, pull boxes, and yard lighting.

E. The Owner reserves the right to delete any item included in the Schedule of Values and decrease the Contract Price by the scheduled amount for the item deleted.

1.04 APPLICATIONS FOR PAYMENT

A. Applications for Payment shall be submitted by the Contractor to the R.P.R. in accordance with the schedule established by the General Conditions and Agreement between the Owner and the Contractor.

B. Format:

1. Submit applications typed on forms provided by the Owner. The Contractor shall prepare itemized continuation sheets using the accepted Schedule of Values and attach them to the Application. Each item shall have an assigned dollar value for the current pay period, and a cumulative value for the project to date. Change Orders executed prior to the date of submission shall be listed at the end of the continuation sheets and shall be totaled separately.

2. The following items shall be included with each copy of the application for payment:

a. Progress Schedule

b. Stored Material Log

c. Partial Release of Liens (for payment for stored material) and Sub Contractors

d. Consent of Surety

e. Invoices for Stored Material

f. Up to date as-built drawings, red lines and coordinates.

3. The Contractor shall certify, for each current pay request, that all previous payments received from the Owner, under his Contract, have been applied by the Contractor to discharge in full all obligations of the Contractor in connection with Work covered by prior applications for payment, and all materials and equipment incorporated into the Work are free and clear of all liens, claims, security interest and encumbrances. Contractor shall attach to each application for payment like affidavits by all Subcontractors and Suppliers. Contractor shall also attach a "Consent of Surety" to each application for payment. Additionally, a "Partial Release of Lien" from each subcontractor and supplier shall be attached to each application for payment.

4. Submit seven (7) copies of each application to the R.P.R. Each copy shall include original signatures. The R.P.R. shall review the application and verify quantities of installed work and stored materials. Upon his approval, he shall submit the application to the Owner for payment.

C. Work not installed in accordance with the requirements of the Contract Documents or materials not conforming to the Contract Documents will not be approved by the R.P.R. or Owner for payment.

D. The Application for Final Payment shall be prepared in accordance with Article 1.14 of the General Requirements - Contract Closeout.

1.05 MEASUREMENT AND PAYMENT

A. Methods of Payment

1. Unit Price Contracts/Items: Payment will be made for actual quantities of work properly installed as approved by the Owner/Engineer unless otherwise indicated herein.

2. Lump Sum Contracts/Items: Payment will be made for each individual item on a percentage of completion basis as estimated by the Contractor and approved by the Owner/Engineer. Quantities provided in the Schedule of Values are for estimating the completion status for progress payments. Adjustments to costs provided in the accepted Schedule of Values may be made only by Change Order.

B. Methods of Measurement

1. Units of measurement shall be defined in general terms as follows:

a. Linear Feet (LF)

b. Square Feet (SF)

c. Square Yards (SY)

d. Cubic Yards (CY)

e. Each (EA)

f. Sacks (SK)

g. Lump Sum (LS)

2. Unit Price Contracts/Items:

a. Linear Feet (LF) shall be measured along the horizontal length of the centerline of the installed material, unless otherwise specified. Pipe shall be measured along the length of the completed pipeline, regardless of the type of joint required, without deduction for the length of valves or fittings. Pipe included within the limits of lump sum items will not be measured.

b. Square Feet (SF), Square Yards (SY), Cubic Yards (CY), Each (EA) and Sacks (SK) shall be measured as the amount of the unit of measure installed within the limits specified and shown in the Specifications and Drawings. Slope angles and elevations shall be measured using land surveying equipment. Contractor shall provide supporting documentation (i.e. drawings, truck tickets, invoices, etc.) to verify actual installed quantities.

c. No measurement is required for Lump Sum (LS) items.

2. Lump Sum Contracts/Items:

a. The Measurement of Work for lump sum contracts and/or items shall be based on the information provided in the Contract Documents, and compiled through the Contractor's own field verifications, investigations and testing prior to Bidding.

C. The following describes the specific work and methods of measurement for the items listed in the Bid Schedule. Measurement and payment for each Bid Item shall include all labor, materials and equipment required to perform the work included for that respective item to provide a complete and operable installation whether specifically described, mentioned or implied.

Item OCU-1 Mobilization, Demobilization, Bonds and Permits

a. Measurement: Measurement of various items for mobilization, demobilization, bonds and permits will not be made for payment and all items shall be included in the lump sum price. This lump sum price shall not exceed 5% of the summation of total bid prices for all OCU items except OCU-1 and OCU-2.

b. Payment: Payment of 75% of the applicable lump sum price for the item shall be full compensation for the preparatory work and operations in mobilizing for beginning Work on the project including, but not limited to, multiple operations necessary for the movement of personnel, equipment, project signs, supplies and incidentals to the project site, maintenance of traffic and for the establishment of field offices, storage sheds, safety equipment and first aid supplies, sanitary and other facilities, as required by these Specifications, and State and local laws and regulations; and any other preconstruction expense necessary for the start of the Work; the cost of bonds, permits and fees; construction schedules; shop drawings; temporary facilities; lay down/storage area; construction aids; erosion control; work associated with the contractor support during Owner/Engineer reviews and inspection; re-inspections; and any re-work resulting from same. Payment of the remaining 25% of the applicable lump sum price for the item shall be full compensation for finalization of this project including demobilization of personnel, equipment, supplies, and incidentals from the project site; project record documents; contract close-out documents; removal of field offices and storage; final site restoration; and clean-up. The Contractor shall submit invoices substantiating the cost of mobilization with each pay request.

Item OCU-2 Project Record Drawings

a. Measurement: Measurement for Record Drawings will not be made for payment and all items shall be included in the lump sum price. This lump sum price shall be no less than 1% of the summation of total bid prices for all OCU items except OCU-1 and OCU-2. The record drawings must be accepted by the County. This may entail several iterations of review and comments.

b. Payment: Payment of the lump sum price, once the record drawings are completed, reviewed and accepted, shall be full compensation for furnishing all labor, materials, equipment and services necessary to provide the specified record drawings as stated in Section 01720 of this project manual. This item shall include all areas of work encompassed by this project.

Item OCU-3 24” DIP Potable Water Main
Item OCU-4 12” DIP Potable Water Main

a. Measurement: The quantity for payment shall be the actual number of linear feet of potable water main pipe of each size and type satisfactorily furnished and installed, as measured along the length of the centerline of the completed pipeline, regardless of the type joint required, without deduction for the length of valves and fittings.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and constructing the pipeline's complete installation including; clearing and grubbing, excavation, tree removal; dewatering; utility support and protection, grading, sheeting, shoring and bracing, dewatering, backfill, fill grading and compaction over pipe to provide cover and bring to proposed grade, erosion and pollution control, flushing, cleaning, pressure testing, disinfection, landscape & sodding restoration and cleanup. This item also includes all necessary fittings, reducers, bends, tees, wyes, caps, plugs, restraining devices, locator plates, locate wire, polyethylene encasement where required and all other items incidental to the construction of the water main. All costs to furnish and install such items shall be included in the various pipe sizes. Minimum inside diameter pipe size is to be as shown on the plans.

Item OCU-5 24” Gate Valve with Box (Potable Water)
Item OCU-6 12” Gate Valve with Box (Potable Water)

a. Measurement: The quantity for payment shall be the actual number of each size and type valve satisfactorily furnished, installed, and incorporated into the piping system, complete with valve boxes, covers, and concrete collars.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing the valve complete with valve box, cover, valve box extension, operating nut extension, valve wrench, restraining devices, test station box, concrete collar, identification disk (where applicable), bedding material, setting top of valve box to finished grade, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, flushing, testing, disinfection, and complete restoration including but not limited to, sodding, sidewalks, curb and gutter, and pavement.

Item OCU-7 Connection to existing 24” Pipe (Potable Water)
Item OCU-8 Connection to existing 12” Pipe (Potable Water)

a. Measurement: The quantity for payment shall be the actual number of connections satisfactorily installed and incorporated into the water main system, complete with fittings. This item will not include connection to existing pipes when such connection is incorporated into another item (i.e.: Conflict Transition, Tapping Sleeve and Valve, caps, plugs or apparatus for grouting and/or abandonment)

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and complete installation including clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, flushing, cleaning, testing, restoration and cleanup. This item also includes all necessary fittings, reducers, bends, tees, wyes, caps, plugs, restraining devices, locator plates, locate wire, polyethylene encasement where required, removal and replacement/resetting of existing obstructions, and all other items incidental to the connection to the new water main. This work will include coordination with County personnel for temporary valve closures as required for the connections.

Item OCU-9 Offset Air Release Valve Assembly (Potable Water)

a. Measurement: The quantity for payment shall be the actual number of air release valve assemblies of the type specified, satisfactorily furnished and installed for the potable water system.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing the air release valve assembly complete, as shown on the Drawings, including but not limited to tapping saddle, corp stop, piping/tubing, fittings, nipples, 2" gate valve with valve box, concrete collar, #57 stone, 2" air release valve, color coded thermoplastic enclosure, concrete pad, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, testing, temporary restoration, cleanup, and all other items incidental to the installation of the air release valve assembly.

Item OCU-10 2" Blow-Off Valve Assembly (Potable Water)

a. Measurement: The quantity for payment will be the actual number of each size and type valves satisfactorily furnished and installed, complete with meter boxes, covers, fittings, piping and cap

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials, equipment and installing the valve complete with required restraint, valve box, cover, 2" piping and fittings, test station, cap, identification disk (where applicable) and complete restoration including but not limited to, sodding, sidewalks, curb and gutter and pavement sections.

Item OCU-11 Utility Conflict Transition (24” Water Main)
Item OCU-12 Utility Conflict Transition (16” Water Main)

a. Measurement: The quantity for payment will be the actual number of conflict transitions satisfactorily furnished and installed regardless of the depth or configuration required to transition around the proposed conflict.

b. Payment: Payment of the applicable lump sum price shall be full compensation for furnishing all labor, materials and equipment required to install the required concrete thrust collars or mechanical restraint (each side of conflict), install the line stops (each side of conflict), cut and remove existing pipe, install new restrained DI pipe and fittings, connect each end to the existing main, as shown on the drawings. Payment shall include all excavation, backfilling and compaction, dewatering, sheeting and shoring, pipe materials and installation, locate wire, test taps, filling, testing and disinfection for a complete and satisfactory conflict transition. If an air release valve assembly is required to purge potential trapped air, this will be paid for under a separate line item.

Item OCU-13 Remove Existing Water Main and Appurtenances

a. Measurement: The quantity for payment shall be the actual number of linear feet of pipe satisfactorily removed, complete with caps or plugs on segments to remain in service.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and fittings necessary to disconnect the force from facilities to remain in service, plugging existing lines servicing acquired properties, removal of the water main complete including but not limited to excavation, removal and disposal of all pipe, fittings and appurtenances, backfill, compaction, dewatering, and temporary and final restoration of disturbed areas.

Item OCU-14 Abandon Existing Water Main

a. Measurement: Measurement for this item will be the actual number of linear feet of water main satisfactorily filled with grout.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials, equipment and fittings, caps or plugs necessary to grout the existing water main including clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control and cleanup.

Items OCU-15 12” Tapping Sleeve and Valve Assembly (Potable Water)

a. Measurement: The quantity for payment will be the actual number of wet taps satisfactorily furnished and installed complete with tapping sleeve, tapping valve and appurtenances.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing each tapping connection assembly including mechanical joint tapping sleeve, resilient seat tapping gate valve with valve box, restraining devices, tapping coupon retrieval and appurtenances. Payment shall also be full compensation for clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, protection of existing utilities, flushing, testing, temporary restoration and cleanup.

Item OCU-16 24" Line Stop and Restraint (Water Main)
Item OCU-17 16" Line Stop and Restraint (Water Main)
Item OCU-18 12" Line Stop and Restraint (Water Main)

a. Measurement: The quantity for payment shall be the actual number of line stops satisfactorily furnished and installed, and the restraint of the existing water main as may be required for connecting the existing water main with the proposed water mains. This item will not include line stops that are incorporated into another item (i.e.: Conflict Transition)

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing the line stop, restraining the existing water mains, setting top of line stop to finished grade, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, flushing, testing, disinfection, and complete restoration including but not limited to, sodding, sidewalks, curb and gutter, and pavement.

Item OCU-19 Adjustment of Existing Valve Box and Collar (Water Main)

a. Measurement: The quantity for payment will be the actual number of valve boxes satisfactorily adjusted to the proposed finish grade. Any modification, reduction, expansion or relocation of the existing valve box shall be included in the unit price, regardless of the length of riser necessary to make such adjustment, at the direction of the OCU RPR. This item only applies to existing valves requiring adjustment.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials, and equipment, and adjusting the existing valve box, providing the required concrete valve box collar (with the 2" locator wire access tube) and identification marker.

Item OCU-20 24" DIP Reclaimed Water Main

a. Measurement: The quantity for payment shall be the actual number of linear feet of reclaimed water main pipe of each size and type satisfactori-

ly furnished and installed, as measured along the length of the centerline of the completed pipeline, regardless of the type joint required, without deduction for the length of valves and fittings.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and constructing the pipeline's complete installation including; clearing and grubbing, excavation, tree removal; dewatering; utility support and protection, grading, sheeting, shoring and bracing, dewatering, backfill, fill grading and compaction over pipe to provide cover and bring to proposed grade, erosion and pollution control, flushing, cleaning, pressure testing, disinfection, landscape & sodding restoration and cleanup. This item also includes all necessary fittings, reducers, bends, tees, wyes, caps, plugs, restraining devices, locator plates, locate wire, polyethylene encasement where required and all other items incidental to the construction of the reclaimed water main. All costs to furnish and install such items shall be included in the various pipe sizes. Minimum inside diameter pipe size is to be as shown on the plans.

Item OCU-21 24” Gate Valve with Box (Reclaimed Water)
Item OCU-22 18” Gate Valve with Box (Reclaimed Water)
Item OCU-23 12” Gate Valve with Box (Reclaimed Water)

a. Measurement: The quantity for payment shall be the actual number of each size and type valve satisfactorily furnished, installed, and incorporated into the piping system, complete with valve boxes, covers, and concrete collars.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing the valve complete with valve box, cover, valve box extension, operating nut extension, valve wrench, restraining devices, test station box, concrete collar, identification disk (where applicable), bedding material, setting top of valve box to finished grade, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, flushing, testing, disinfection, and complete restoration including but not limited to, sodding, sidewalks, curb and gutter, and pavement.

Item OCU-24 24”x 24” Tapping Sleeve and Valve Assembly (Reclaimed Water)
Item OCU-25 18”x18” Tapping Sleeve and Valve Assembly (Reclaimed Water)
Item OCU-26 12”x12” Tapping Sleeve and Valve Assembly (Reclaimed Water)

b. Measurement: The quantity for payment will be the actual number of wet taps satisfactorily furnished and installed complete with tapping sleeve, tapping valve and appurtenances.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing each

tapping connection assembly including mechanical joint tapping sleeve, resilient seat tapping gate valve, restraining devices, tapping coupon retrieval and appurtenances. Payment shall also be full compensation for the valve box, cover, valve box extension, operating nut extension, valve wrench, restraining devices, test station box, concrete collar, identification disk (where applicable), bedding material, setting top of valve box to finished grade, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, protection of existing utilities, flushing, testing, temporary restoration and cleanup.

Item OCU-27 Remove Existing Steel Casing (Reclaimed Water)

a. Measurement: The quantity for payment shall be the actual number of linear feet of steel casing pipe satisfactorily removed, in order to wet tap the existing 18" DIP carrier pipe within. Removal shall be accomplished without damage to the existing carrier pipe.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and fittings necessary to cut and remove a section of the steel casing pipe and plug each end to remain. Work shall include but not be limited to excavation, removal and disposal of steel casing pipe, plug each end to remain, backfill, compaction, dewatering, and temporary and final restoration of disturbed areas including concrete curbing.

Item OCU-28 Connection to Existing 12" Pipe (Reclaimed Water)
Item OCU-29 Connection to Existing 4" Pipe (Reclaimed Water)

a. Measurement: The quantity for payment shall be the actual number of connections satisfactorily installed and incorporated into the reclaimed water main system, complete with fittings. This item will not include connection to existing pipes when such connection is incorporated into another item (i.e.: Conflict Transition, Tapping Sleeve and Valve, caps, plugs or apparatus for grouting and/or abandonment)

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and complete installation including clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, flushing, cleaning, testing, restoration and cleanup. This item also includes all necessary fittings, reducers, bends, tees, wyes, caps, plugs, restraining devices, locator plates, locate wire, polyethylene encasement where required, removal and replacement/resetting of existing obstructions, and all other items incidental to the connection of the service lines to the new reclaimed water main. This work will include coordination with County personnel for temporary valve closure as required for the connections.

Item OCU-30 Remove Existing Reclaimed Water Main and Appurtenances

a. Measurement: The quantity for payment shall be the actual number of linear feet of pipe satisfactorily removed, complete with caps or plugs on segments to remain in service.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and fittings necessary to disconnect the force from facilities to remain in service, plugging existing lines servicing acquired properties, removal of the reclaimed water main complete including but not limited to excavation, removal and disposal of all pipe, fittings and appurtenances, backfill, compaction, dewatering, and temporary and final restoration of disturbed areas.

Item OCU-31 Offset Air Release Valve Assembly (Reclaimed Water)

a. Measurement: The quantity for payment shall be the actual number of air release valve assemblies of the type specified, satisfactorily furnished and installed for reclaimed water service.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing the air release valve assembly complete, as shown on the Drawings, including but not limited to tapping saddle, corp stop, piping/tubing, fittings, nipples, 2” gate valve with valve box, concrete collar, #57 stone, 2” air release valve, color coded thermoplastic enclosure, concrete pad, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, testing, temporary restoration, cleanup, and all other items incidental to the installation of the air release valve assembly.

Item OCU-32 Offset Air Release Valve Assembly in Vault (Reclaimed Water)

a. Measurement: The quantity for payment shall be the actual number of air release valve assemblies of the type specified, satisfactorily furnished and installed for the reclaimed water main system.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing the air release valve assembly complete, as shown on the Drawings, including but not limited to tapping saddle, corp stop, piping/tubing, fittings, nipples, 2” gate valve with valve box, concrete collar, #57 stone, 2” air release valve, precast concrete vault, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, testing, temporary restoration, cleanup, and all other items incidental to the installation of the air release valve assembly.

Item OCU-33 Adjustment of Existing Valve Box and Collar (Reclaimed Water)

a. Measurement: The quantity for payment will be the actual number of valve boxes satisfactorily adjusted to the proposed finish grade. Any modification, reduction, expansion or relocation of the existing valve box shall be included in the unit price, regardless of the length of riser necessary to make such adjustment, at the direction of the OCU RPR. This item only applies to existing valves requiring adjustment.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials, and equipment, and adjusting the existing valve box, providing the required concrete valve box collar (with the 2" locator wire access tube) and identification marker.

Item OCU-34 4" Line Stop and Restraint (Reclaimed Water Main)
Item OCU-35 12" Line Stop and Restraint (Reclaimed Water Main)

a. Measurement: The quantity for payment shall be the actual number of line stops satisfactorily furnished and installed, and the actual restraint of the existing reclaimed water main as may be required for connecting the existing reclaimed water main with the proposed force mains. This item will not include line stops that are incorporated into another item (i.e.: Conflict Transition)

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing the line stop, restraining the existing reclaim water mains, setting top of line stop to finished grade, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, flushing, testing, disinfection, and complete restoration including but not limited to, sodding, sidewalks, curb and gutter, and pavement

Item OCU-36 12" PVC Force Main

a. Measurement: The quantity for payment shall be the actual number of linear feet of force main pipe of each size and type satisfactorily furnished and installed, as measured along the length of the centerline of the completed pipeline, regardless of the type joint required, without deduction for the length of valves and fittings.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and constructing the pipeline's complete installation including; clearing and grubbing, excavation, tree removal; dewatering; utility support and protection, grading, sheeting, shoring and bracing, dewatering, backfill, fill grading and compaction over pipe to provide cover and bring to proposed grade, erosion and pollution control, flushing, cleaning, pressure testing, landscape & sodding restoration and cleanup. This item also includes all

necessary fittings, reducers, bends, tees, wyes, caps, plugs, restraining devices, locator plates, locate wire, polyethylene encasement where required and all other items incidental to the construction of the force main. All costs to furnish and install such items shall be included in the various pipe sizes. Minimum inside diameter pipe size is to be as shown on the plans.

Items OCU-37 12”x 12” Tapping Sleeve and Valve Assembly (Force Main)

a. Measurement: The quantity for payment will be the actual number of wet taps satisfactorily furnished and installed complete with tapping sleeve, tapping valve and appurtenances.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing each tapping connection assembly including mechanical joint tapping sleeve, resilient seat tapping gate valve installed on its side, mechanical joint plug valve with valve box, restraining devices, tapping coupon retrieval and appurtenances. Payment shall also be full compensation for the valve box, cover, valve box extension, operating nut extension, valve wrench, restraining devices, test station box, concrete collar, identification disk (where applicable), bedding material, setting top of valve box to finished grade, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, protection of existing utilities, flushing, testing, temporary restoration and cleanup.

Item OCU-38 Remove Existing Force Main and Appurtenances

a. Measurement: The quantity for payment shall be the actual number of linear feet of pipe satisfactorily removed, complete with caps or plugs on segments to remain in service.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and fittings necessary to disconnect the force main from facilities to remain in service, plugging existing lines, draining and disposal of the contents, removal of the force main, fittings and appurtenances, complete including but not limited to excavation, removal and disposal of all pipe, fittings and appurtenances, backfill, compaction, dewatering, and temporary and final restoration of disturbed areas.

Item OCU-39 12” Line Stop and Restraint (Force Main)

a. Measurement: The quantity for payment shall be the actual number of line stops and restraint (mechanical or concrete thrust collars) to restrain the existing force main to remain, satisfactorily furnished and installed. This item will not include line stops that are incorporated into another item (i.e.: Conflict Transition)

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment including but not limited to clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, installing concrete thrust collars, installation and removal of the line stop assembly, clearing and backfill, compaction, grading, temporary erosion control, and complete restoration of disturbed areas.

Item OCU-40 Utility Conflict Transition (12" Force Main)

a. Measurement: The quantity for payment will be the actual number of conflict transitions satisfactorily furnished and installed regardless of the depth or configuration required to transition around the proposed conflict.

b. Payment: Payment of the applicable lump sum price shall be full compensation for furnishing all labor, materials and equipment required to install the required concrete thrust collars or mechanical restraint (each side of conflict), install the line stops (each side of conflict), cut and remove existing pipe, install new restrained PVC pipe and DI fittings, connect each end to the existing main, as shown on the drawings. Payment shall include all excavation, backfilling and compaction, dewatering, sheeting and shoring, pipe materials and installation, locate wire, test taps, filling, and testing for a complete and satisfactory conflict transition. If an air release valve assembly is required to purge potential trapped air, this will be paid for under a separate line item.

Item OCU-41 Offset Air Release Valve Assembly (Force Main)

a. Measurement: The quantity for payment shall be the actual number of air release valve assemblies of the type specified, satisfactorily furnished and installed for the force main system.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing the air release valve assembly complete, as shown on the Drawings, including but not limited to tapping saddle, corp stop, piping/tubing, fittings, nipples, 2" gate valve with valve box, concrete collar, #57 stone, 2" air release valve, color coded thermoplastic enclosure, concrete pad, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, testing, temporary restoration, cleanup, and all other items incidental to the installation of the air release valve assembly.

Item OCU-42 Offset Air Release Valve Assembly in Vault (Force Main)

a. Measurement: The quantity for payment shall be the actual number of air release valve assemblies of the type specified, satisfactorily furnished and installed for the force main system.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment and installing the air release valve assembly complete, as shown on the Drawings, including but not limited to tapping saddle, corp stop, piping/tubing, fittings, nipples, 2" gate valve with valve box, concrete collar, #57 stone, 2" air release valve, precast concrete vault, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, testing, temporary restoration, cleanup, and all other items incidental to the installation of the air release valve assembly.

Item OCU-43 Adjustment of Existing Valve Box and Collar (Force Main)

a. Measurement: The quantity for payment will be the actual number of valve boxes satisfactorily adjusted to the proposed finish grade. Any modification, reduction, expansion or relocation of the existing valve box shall be included in the unit price, regardless of the length of riser necessary to make such adjustment, at the direction of the OCU RPR. This item only applies to existing valves requiring adjustment.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials, and equipment, and adjusting the existing valve box, providing the required concrete valve box collar (with the 2" locator wire access tube) and identification marker.

Item OCU-44 Install 12" PVC Gravity Sanitary Sewer

a. Measurement: Measurement for this item will be the actual number of linear feet of each size of gravity sanitary sewer main line satisfactorily furnished and installed including removal and disposal of the existing pipe within the trench limits and installation of the new PVC gravity sewer pipe at the depth and slopes as shown on the drawings.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment, providing a complete gravity sanitary sewer main line replacement including clearing and grubbing, removal of existing asphalt and base courses, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, connection to existing or proposed manholes, flushing, CCTV inspection, testing and cleanup.

Item OCU-45 Line Existing 18-inch Gravity Sanitary Sewer Main
Item OCU-46 Line Existing 15-inch Gravity Sanitary Sewer Main

a. Measurement: The quantity for payment shall be the actual number of linear feet of each size of gravity sewer main satisfactorily lined by CIPP method. Measurement shall be based on the horizontal projection of the centerline of the permanently installed liner between manholes, measured to the nearest foot from inside wall of the manhole to the inside wall of the other manhole and not including the manhole chamber.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment to line the gravity sewer main by cured-in-place pipe (CIPP) method including but not limited to all necessary or required cleaning and preparation of the existing sewer; blocking, plugging and bypass of incoming flows; removal, transportation and disposal of material generated by preparation; CCTV inspection (pre and post); furnishing, installing and curing CIPP pipe liner; testing; reestablishment of existing services (if necessary); cleanup; and all labor, materials, and equipment required to provide a complete and acceptable liner installation.

Item OCU-47 Install New Sanitary Manhole

a. Measurement: Measurement for this item will be the actual number of sanitary manholes satisfactorily furnished and installed including removal and disposal of the existing structure and installation of the new sanitary manhole (cast with the waterproofing admixture). A drop structure shall be installed as required.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials, and equipment, providing a complete sanitary manhole replacement including clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, connection to existing or proposed pipes, vacuum testing, flushing and cleanup.

Item OCU-48 Rehab Existing Manhole (w/Protective Interior Lining)

a. Measurement: Measurement for this item will be the actual number of sanitary manholes satisfactorily rehabilitated based on the depth of pipe or structure being rehabilitated.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials, and equipment, for the rehabilitation of existing sanitary manholes including but not limited to all necessary or required cleaning and preparation of the existing manhole interior surface; blocking, plugging and bypass of incoming flows (if required); removal, transportation and disposal of material generated by preparation; removal and replacement of benching (if required); patching, plugging and preparation of interior walls and corbel; furnish and install interior protective lining; re-establish connections to existing and/or proposed piping; vacuum testing; flushing and cleanup.

Item OCU-49 Core Drill and Connect to Existing Manhole

a. Measurement: The quantity for payment shall be the actual number of Existing Manholes satisfactorily cored drilled and connected to, in accordance with all local, state and federal requirements.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment to core drill the existing sanitary manhole (upper and lower holes), install rubber boots, assemble drop structure and connect the proposed gravity sanitary sewer main. The connection shall include but not be limited to installing any necessary plugs, caps or fittings for by-pass pumping, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, protection of existing utilities, restoration, cleanup and all other items incidental to the core drilling, drop structure and connection to the sanitary manhole. This item shall also include patching/repairing the existing interior and exterior surfaces of the existing manhole.

Item OCU-50 Remove Existing Sanitary Manhole

a. Measurement: The quantity for payment shall be the actual number of Sanitary Manholes satisfactorily removed and disposed of, in accordance with all local, state and federal requirements.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment to completely remove and dispose of all existing Sanitary Manhole. The removal shall include but not be limited to installing any necessary plugs, caps or fittings on the pipes to be abandoned or to remain, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, protection of existing utilities, restoration, cleanup and all other items incidental to the removal of the sanitary manhole.

Item OCU-51 Abandon Existing Gravity Sanitary Sewer Main

a. Measurement: Measurement for this item will be the actual number of linear feet of gravity sewer pipe abandoned and satisfactorily filled with grout.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials, equipment and fittings, caps or plugs necessary to grout the existing gravity sewer main and laterals including clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control and cleanup.

Item OCU-52 Remove Existing Gravity Sanitary Sewer Main

a. Measurement: The quantity for payment shall be the actual number linear feet of gravity sewer pipe satisfactorily removed and disposed of, in accordance with all local, state and federal requirements.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment to completely remove and dispose of all existing wastewater gravity sewer pipe. The removal shall include but not be limited to installing any necessary plugs, caps or fittings, clearing and grubbing, excavation, sheeting, shoring and bracing, dewatering, backfill, compaction, grading, temporary erosion control, protection of existing utilities, restoration, cleanup and all other items incidental to the removal of gravity sewer pipe.

Item OUC-53 Adjust Existing Manhole Ring and Cover (Minor)
Item OUC-54 Adjust Existing Manhole Ring and Cover (Major)

a. Measurement: The quantity for payment will be the actual number of manhole rings and covers satisfactorily adjusted to the proposed finish grade. Modification, reduction, expansion or relocation of the manhole ring and cover accomplished through removal and replacement of the brick (limited to 4 courses) or HDPE adjustment ring (limited to 10") chimney shall be considered MINOR and where the concrete manhole barrel or corbel section must be modified or replaced (due to chimney height limitations) and the entire chimney section must be replaced, this shall be considered MAJOR. All work to make the required adjust to the proposed finished grade shall be included in the respective unit price.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials, and equipment, for adjusting the manhole rings and covers to the proposed finish grade.

Item OCU-55 Asphalt Pavement Removal and Replacement

a. Measurement: The quantity for payment shall be the actual number of square yards of asphalt roadway satisfactorily removed and replaced and/or repaired including subgrade stabilization, base course and asphaltic concrete surface course.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment for saw cutting and removal of the existing surface and base courses and installing and compacting the replacement asphalt roadway.

Item OCU-56 Unsuitable Soil Removal, Disposal and Replacement

a. Measurement: The quantity for payment shall be the actual number of cubic yards of unsuitable soil satisfactorily removed and the corresponding amount of acceptable fill furnished and satisfactorily placed as established on Section 02032.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials and equipment for removing and properly disposing of all unsuitable soils encountered during construction

as dictated by OCU RPR and replacing with clean granular soils as defined and recommended in the geotechnical report in Appendix A.

Item OCU-57 Utility Maintenance of Traffic (Utility M.O.T.)

a. Measurement: Measurement for the Lump Sum item to include all labor, materials and equipment necessary for the construction of the utility work as required by the Maintenance of Traffic Technical Provision (Part H, TP 102) of this construction contract.

c. Payment: Payment of the lump sum item price shall be full compensation for furnishing all labor, materials and equipment necessary to provide safe and effective maintenance of traffic of vehicular and pedestrian traffic including but not limited to preparation and submittal of a complete traffic control plan, temporary lanes, walks or drainage facilities, flagmen, signs, barricades, lights and other protective devices necessary for the construction of the utility work. This item will be paid based on the percentage of the total value of the work performed to date, proportional to the original contract amount for the respective line item. In the event the contractor will utilize a common MOT for the Utility and Roadway work, this pay item shall be the Utility's MOT share.

Item OCU-58 Removal and Replacement of Concrete Sidewalk

a. Measurement: Measurement for this item will be the actual number of square yards of concrete sidewalk satisfactorily removed and replaced including subgrade stabilization, wire reinforcement (where applicable) and concrete.

b. Payment: Payment of the applicable unit price shall be full compensation for furnishing all labor, materials, and equipment for saw cutting and removal of the existing sidewalk and installing the replacement concrete sidewalk.

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SECTION 01516
COLLECTION SYSTEM BYPASS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Work covered by this section consists of providing all temporary bypassing to perform all operations in connection with the flow of wastewater around pipe segment(s) or pump stations. The purpose of bypassing is to prevent wastewater overflows and provide continuous service to all wastewater customers. The Contractor will maintain wastewater flow in the construction area in order to prevent backup and/or overflow and provide reliable wastewater service to the users of the wastewater system at all times.

1.02 SUBMITTALS

A. Prior to implementation of any bypass, the Contractor will submit and receive County acceptance of a bypass plan. The Contractor will submit to the County a comprehensive written plan for approval and acceptance that describes the intended bypass for the maintenance of flows during construction. The Contractor will also provide a sketch showing the location of bypass pumping equipment for each pump station or line segment(s) around which flows are being bypassed. The plan will include proposed tanker(s), pump(s), bypass piping, backup plan and equipment, work schedule, monitoring log for bypass pumping, monitoring plan of the bypass pumping operation, and maintenance of traffic plan.

PART 2 - PRODUCTS

2.01 GENERAL

A. The Contractor will provide and maintain adequate equipment, piping, tankers, and other necessary appurtenances in order to maintain continuous and reliable wastewater service in all wastewater lines as required for construction. The Contractor will have tankers, backup pump(s), piping, and appurtenances ready to deploy immediately.
B. All piping will be designed to withstand at least twice the maximum system pressure or a minimum of 50 psi, whichever is greater.
C. When bypassing a pump station, one back-up pump equal to the primary unit will be provided by the Contractor. Bypass pumps must comply with sound requirements.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall have all materials, equipment and labor necessary to complete the repair, replacement, or rehabilitation on the job site prior to isolating the gravity main segment, manhole, or pump station. The Contractor will demonstrate that the temporary bypass pumping system is in good working order and is sufficiently sized to successfully handle flows by performing a test run for a period of 24 hours prior to beginning the work.

3.02 TRAFFIC CONSIDERATIONS

A. The Contractor shall locate bypass pumping suction and discharge lines so as to not cause undue interference with the use of streets, private driveways, and alleys, to include the possible temporary trenching of piping at critical intersections. Additional traffic maintenance requirements are found in Section 01570 "Maintenance of Traffic".

3.03 BYPASS OPERATION

The County shall accept the bypass plan prior to implementation of the bypass operation. Contractor will plug off and pump down the sewer manhole or line segment in the immediate work area and will maintain the wastewater system so that surcharging does not occur. A successful three (3) day test period shall be performed during normal County workdays (no weekend).

A. Where work requires the line to be blocked after normal working hours and bypass pumping is being used, the Contractor shall be responsible for monitoring the bypass operation 24 hours per day, 7 days per week. Any electronic monitoring in lieu of on-site monitoring must be detailed in the comprehensive written plan and approved by the County.

B. The Contractor shall ensure that no damage will be caused to private property as a result of bypass pumping operations. The Contractor will complete the work as quickly as possible and satisfactorily pass all tests, inspections, repair all deficiencies prior to discontinuing bypassing operations, and returning flow to the sewer manhole or line segment.

C. During bypassing, no wastewater will be leaked, dumped, or spilled in or onto, any area outside of the existing wastewater system.

D. The Contractor shall immediately notify the County should a sanitary sewer overflow occur and take the necessary action to clean up and disinfect the spillage to the satisfaction of the County or other governmental agency. If sewage is spilled onto public or private property, the Contractor will wash down, clean up and disinfect the spillage to the satisfaction of the County and or other governmental agencies.

E. When bypassing a pump station, one (1) back-up pump equal to the primary unit shall be required. Bypass pumps shall have a maximum rating of 55 decibels for sound attenuation.

F. The Contractor shall cease bypass operations and return flows to the new and/or existing sewer when directed by the County. When bypass operations are complete, all bypass piping shall be drained into the wastewater system prior to disassembly.

3.04 CONTRACTOR LIABILITY

A. The Contractor shall be responsible for all required pumping, equipment, piping, and appurtenances to accomplish the bypass and for any and all damage that results directly or indirectly from the bypass pumping equipment, piping and/or appurtenances. The Contractor shall also be liable for all County personnel labor and equipment costs, penalties and fines resulting from sanitary sewer overflows. It is the intent of these specifications to require the Contractor to establish adequate bypass pumping as required regardless of the flow condition.

END OF SECTION

SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The purpose of the Project Record Documents is to provide the County with factual information regarding all aspects of the Work, both concealed and visible, to enable future location, identification and modification of the Work without lengthy and expensive site measurement, investigation or examination.

B. These standards and procedures are for integration of digital engineering CAD drawings and attribute data into the database environments, while maintaining the integrity and positional accuracy of the data. The requirement for digital submittal of approved construction plans is to provide the County GIS with a parcel and utility base for field maintenance and operations.

C. The location of the constructed improvements as depicted in the Contract Drawings is required. To insure the Work was constructed in conformance with the Contract Drawings, the following survey documents are required to be prepared and certified by the Surveyor.
   1. As-Built Asset Attribute Data Table (see Table 01050-2)
   2. Pipe Deflection Table (see Table 01050-3)
   3. Gravity Main Table (see Table 01050-4)
   4. Boundary Survey and Survey Map Report for pump stations and easements with constructed improvements.

1.02 DEFINITIONS

Except where specific definitions are used within a specific section, the following terms, phrases, words and their derivation shall have the meaning given herein when consistent with the context in which they are used. Words used in the present tense include the future tense, words in the plural number include the singular number and words in the singular number include the plural number.

A. As-Built Drawings: Drawings prepared by the Contractor's Surveyor shall depict the actual location of installed utilities for the completed Work in a full size hard copy and an electronic AutoCAD file (dwg) format.

B. Record Documents: All documents as required in subsections 1.04 and 2.02 in this specification section.

C. Boundary Survey: Boundary survey, map and report certified by a Surveyor shall be provided that meets the requirements of Chapter 5J-17 'Minimum Technical Standards', FAC.

D. Surveyor: Contractor’s Surveyor that is licensed by the State of Florida as a Professional Surveyor and Mapper pursuant to Chapter 472, F.S.

E. Survey Map Report: As a minimum the Survey Map Report shall identify any corners that had to be reset, measurements and computations made, pump station and easement boundary issues, locations of constructed improvements outside boundaries, and accuracies obtained.

1.03 QUALITY ASSURANCE

A. Delegate the responsibility for maintenance of the Record Documents to one person on the Contractor’s staff as approved by the County.

B. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of specifications and each sheet of drawings and other documents where such entry is required to show progress and changes properly.

C. Make entries within 24-hours after receipt of information has occurred.

1.04 RECORD DOCUMENTS AT SITE

A. Maintain at the site and always available for County’s use one record copy of:
   1. Construction Contract, Drawings, Specifications, General Conditions, Supplemental Conditions, Bid Proposal, Instruction to Bidders, Addenda, and all other Contract Documents.
   2. Change Orders, Verbal Orders, and other modifications to Contract.
   3. Written instructions by the County as well as correspondence related to Requests for Information (RFIs).
   4. Accepted Shop Drawings, Samples, product data, substitution and "or-equal" requests.
   5. Field test records, inspection certificates, manufacturer certificates and construction photographs.
   6. Progressive As-Built Drawings.
   7. Current Surveyor’s tables for the As-Built Assets Attribute Data, Pipe Deflection Data, and Gravity Main Data.

B. Maintain the documents in an organized, clean, dry, legible condition and completely protected from deterioration and from loss and damage until completion of the Work, transfer of all record data to the final As-built Drawings for submittal to the County.

C. Store As-Built Documents and samples in Contractor's office apart from documents used for construction. Do not use As-Built document for construction purposes. Label each document "AS-BUILT" in neat large printed letters. File documents and samples in accordance with CSI/CSC format.

D. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

PART 2 - PRODUCTS

2.01 AS-BUILT DRAWINGS

A. Maintain the electronic As-Built Drawings to accurately record progress of Work and change orders throughout the duration of the Contract.

B. Date all entries. Enter RFI No., Change Order No., etc. when applicable.

C. Call attention to the entry by highlighting with a "cloud" drawn around the area affected.

D. In the event of overlapping changes, use different colors for entries of the overlapping changes.

E. Design call-outs shall have a thin strike line through the design call-out and all As-Built information must be labeled (or abbreviated "AB") and be shown in a bolder text that is completely legible.

F. Make entries in the pertinent other documents while coordinating with the County for validity.

G. Entries shall consist of graphical representations, plan view and profiles, written comments, dimensions, State Plane Coordinates, details and any other information as required to document field and other changes of the actual Work completed. As a minimum, make entries to also record:
   1. Depths of various elements of foundation in relation to finish floor datum and State Plane Coordinates and elevations.
   2. As-Built Asset Attribute Data Table shall be completed in the Drawings.
   3. When electrical boxes, or underground conduits and plumbing are involved as part of the Work, record true elevations and locations, dimensions between boxes.
   4. Actually installed pipe or other Work materials, class, pressure rating, diameter, size, specifications, etc. Similar information for other encountered underground utilities, not installed by Contractor, their owner and actual location if different than shown in the Contract Documents.
   5. Details, not on original contract Drawings, as needed to show the actual location of the Work completed in a manner that allows the County to find it in the future.
   6. The Contractor shall mark all arrangements of conduits, circuits, piping, ducts and similar items shown schematically on the construction documents and show on the As-Built Drawings the actual horizontal and vertical alignments and locations.
   7. Major architectural and structural changes including relocation of doors, windows, etc. Architectural schedule changes according to Contractor’s records and shop drawings.

2.02 RECORD DOCUMENTS

A. Three (3) hard copy sets and three (3) digital media sets of the final Record Documents and shall include all of the documents described below under this subsection 2.02.

B. The following documents shall be signed and sealed by the Surveyor:
   1. As-Built Asset Attribute Data Table (see Specification Section 01050 "Surveying and Field Engineering", Table 01050-2 for an example).
   2. Boundary Survey of pump station and Survey Map Report
   3. Boundary Survey and Survey Map Report for the location of constructed pipes within any easements and right-of-way. As a minimum the Survey Map Report shall identify or describe the locations where the pipe centerline was constructed within three feet of the easement or right-of-way boundary, where the pipe was constructed outside the easement or right-of-way boundary, any corners that had to be reset, measurements and computations made, pump station boundary issues, and accuracies obtained. Survey map report shall be dated after the Work within the right-of-ways or easements have been completed.
   4. Gravity Main Table (see Specification Section 01050 "Surveying and Field Engineering", Table 01050-4 for an example)
   5. Pipe Deflection Table (see Specification Section 01050 "Surveying and Field Engineering" Table 01050-3 for an example). An electronic blank table will be supplied by the County.

C. Digital sets of the final Record Documents including but not limited to:
   1. Scanned digital copies of the final As-Built Drawings.
   2. Electronic Survey documents electronically sealed by the Surveyor.
   3. Final Record Documents information.
   4. Digital As-Built Drawing in the Engineer's current version of AutoCAD file (dwg) format for the Contract Drawings, updated to match the final Record Drawing information.

D. Pump station site Boundary Survey and Map Report.

E. New Boundary Survey to re-establish easement corners, right-of-way monuments, or pump station site corners with monuments if destroyed by the Work.

F. Scanned Documents: Scan the Survey Documents and other Record Documents reflecting changes from the Bid Documents.

G. The scanned As-Built drawing sets shall be complete and include the title sheet, plan/profile sheets, cross-sections, and details. Each individual sheet contained in the printed set of the As-Built Drawings shall be included in the electronic drawings, with each sheet being converted into an individual tif (tagged image file). The plan sheets shall be scanned in tif format Group 4 at minimum of 400 dpi resolution to maintain legibility of each drawing. Then, the tif images shall be embedded into a single pdf (Adobe Acrobat) file representing the complete plan set. Review all Record Documents to ensure a complete record of the Project.

H. Provide an encompassing digital AutoCAD file that includes all the information of the As-Built Drawings and any other graphical information in the As-Built Drawings. It shall include the overall Work, utility system layout and associated parcel boundaries and easements. Feature point, line and polygon information for new or altered Work and all accompanying geodetic control and survey data shall be included. The surveyor's certified As-Built Asset Attribute Data shall be added to the As-Built Drawings and Surveyor shall electronically seal the data in a comma-delineated ASCII format (txt).

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION MEETING

A. Pre-construction Meeting: It is recommended that the Surveyor attend the Pre-construction meeting. At the pre-construction meeting the Contractor shall be provided with a blank electronic version of the spreadsheet for the tables: Asset Attribute Data and Pipe Deflection. The Contractor's surveyor shall use these tables to input the data and shall not alter the table format or formulas.

3.02 CONSTRUCTION PROGRESS MEETINGS

A. Contractor shall provide progressive Record Documents described below.
   1. Construction Contract, As-Built Drawings, Specifications, General Conditions, Supplemental Conditions, Bid Proposal, Instruction to Bidders, Addenda, and all other Contract Documents.
   2. Specifications and Addenda: Record manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed as well as any changes made by Field Order, Change Order or other.
   3. Change orders, verbal orders, and other modifications to Contract.
   4. Written instructions by the County as well as correspondence related to Requests for Information (RFIs).
   5. Accepted Shop Drawings, samples, product data, substitution and "or-equal" requests.
   6. Field test records, inspection certificates, manufacturer certificates and construction photographs.
   7. As-Built Asset Attribute Data Table: Surveyor shall obtain field measurements of vertical and horizontal dimensions of constructed improvements. The monthly submittal shall include the Surveyor's certified statement regarding the constructed improvements being within the specified accuracies as described in Specification Section 01050 "Surveying and Field Engineering", Table 01050-1 Minimum Survey Accuracies or if not, indicating the variances.
   8. Gravity Main Table: Surveyor shall prepare and update a Gravity Main Table to include as a minimum the pipe segment identification, pipe lengths, manhole inverts and tops, and slopes for gravity mains. Surveyor shall certify the data entered are correct and indicate if the minimum slopes have not been met.

9. Pipe Deflection Table: Surveyor shall input the type of pipe, pipe manufacturer, PVC manufacturer deflection allowance, allowable angle of offset and radius of curvature, laying length of pipe, and coordinates. Surveyor shall certify the data entered are correct and indicate if the deflection allowance, offset or radius of curvature exceeds the manufacturer's recommendations.

3.03 FINAL RECORD DOCUMENTS SUBMITTAL

A. Submit the Final Record Documents within 20 days after Substantial Completion.
   1. Participate in review meetings as required and make required changes and promptly deliver the Final Record Documents to the County.

3.04 STORAGE AND PRESERVATION

A. Store Record Documents and samples at a protected location in the project field office apart from documents used for construction.
   1. Provide files and racks for storage of documents
   2. Provide locked cabinet or secure space for storage of samples.

B. File documents and samples in accordance with CSI format with section numbers matching those in the Contract Documents.

C. In the event of loss of recorded data, use means necessary to again secure the data to the County's approval.
   1. Such means shall include, if necessary in the opinion of the County, removal and replacement of concealing materials.
   2. In such cases, provide replacements of the concealing materials to the standards originally required by the Contract Documents.

END OF SECTION

SECTION 02030

GENERAL SITE REQUIREMENTS

PART 1 - GENERAL

All labor, materials, equipment and testing covered in this section shall be provided by the CONTRACTOR at his sole expense, unless otherwise specially noted.

PART 2 - GRADES, SURVEY LINES, AND PROTECTION OF MONUMENTS

2.01 GRADES

All work shall be constructed in accordance with the lines and grades shown on the plans. The full responsibility for keeping alignment and grade shall rest upon the CONTRACTOR.

Benchmarks and base line controlling points shall be established in the field by the COUNTY prior to beginning work. Reference marks for lines and grades as the work progresses will be located to cause as little inconvenience to the prosecution of the work as possible. The CONTRACTOR shall so place excavation and other materials as to cause no inconvenience in the use of the reference marks provided. CONTRACTOR shall remove any obstructions placed contrary to this provision.

2.02 SURVEYS

The CONTRACTOR shall check such reference marks by means as he may deem necessary and, before using this, shall call the COUNTY's attention to any inaccuracies. The CONTRACTOR shall, at his own expense, establish all working or construction lines and grades as required from the reference marks, and shall be solely responsible for the accuracy thereof. The CONTRACTOR shall, however, be subject to the check and review of the COUNTY.

2.03 MONUMENT PRESERVATION

Property corners and survey monuments shall be preserved using care not to disturb or destroy them. If a property corner or survey monument is disturbed or destroyed during construction, whether by accident, careless work, or required to be disturbed or destroyed by the construction work, said property corner or survey monument shall be restored by a land surveyor registered in the State of Florida. All costs for this work shall be paid for by the CONTRACTOR.

PART 3 - UTILITY COORDINATION

3.01 LOCATION OF UTILITIES

Prior to proceeding with construction, the CONTRACTOR shall comply with all aspects and provisions of the underground facilities protection and damage prevention act.

The CONTRACTOR shall take all reasonable precautions against damage to existing utilities. However, in the event of a break in an existing water main, gas main, sewer or underground cable, the CONTRACTOR shall immediately notify the responsible official of the organization operating the interrupted utility. The CONTRACTOR shall lend all possible assistance in restoring services and shall assume all cost, charges, or claims connected with the interruption and repair of such services.

3.02 DEVIATIONS OCCASIONED BY STRUCTURES OR UTILITIES

Wherever obstructions are encountered during the progress of the work and interfere to such an extent that an alteration in the plans is required, the COUNTY shall have the authority to order a deviation from the line and grade or arrange with the owners of the structures for the removal, relocation or reconstruction of the obstructions. Where gas, water, telephone, electrical, hot water, steam or other existing utilities are an impediment to the construction of the proposed improvement, the COUNTY shall order a change in grade or alignment or shall direct the CONTRACTOR to arrange with the owners of the utilities for their removal. If a change in line or grade of a gravity sewer is necessary, the COUNTY will require the addition of any manholes needed to maintain the integrity of the sewer system.

3.03 TEST PITS

Test pits for the purpose of locating underground pipeline, utilities, 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 COUNTY. The costs for such test pits shall be borne by the CONTRACTOR.

PART 4 - MAINTENANCE OF TRAFFIC AND CLOSING OF STREETS

4.01 GENERAL

In addition to the requirements outlined below, "County Detour Plan Processing Procedure for Non-Emergency Road Closures" as amended shall apply.

4.02 TRAFFIC INTERRUPTIONS

The CONTRACTOR shall carry on the work in a manner, which will cause a minimum of interruption to traffic. Where traffic must cross open trenches, the CONTRACTOR shall provide suitable bridges at street intersections and driveways. The CONTRACTOR shall post suitable signs indicating that a street is closed and necessary detour signs for the proper maintenance of traffic. Prior to closing of any streets, the CONTRACTOR shall notify and obtain the approval of responsible authorities and the COUNTY.

Unless permission to close a street is received in writing from the proper authority (County, City, FDOT, etc.), 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 ways, erect wheel guards or fences, or take other measures for safety satisfactory to the COUNTY.

4.03 TRAFFIC DETOURS

Detours around construction will be subject to the approval of the authority having jurisdiction and the COUNTY. 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. Periods when traffic is being detoured will be strictly controlled by the COUNTY.

It shall be the sole responsibility of the CONTRACTOR to take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist, or police protection provided for traffic while work is in progress. The CONTRACTOR shall be fully responsible for damage or injuries whether or not police protection has been provided.

PART 5 - PROTECTION OF PUBLIC AND PROPERTY

5.01 BARRICADES, GUARDS AND SAFETY PROVISIONS

The CONTRACTOR shall be solely responsible for adhering to the rules and regulation of OSHA and appropriate authorities regarding safety provisions. To protect persons from injury and to avoid property damage, adequate barricades, construction signs, lights and guards as required shall be placed and maintained by the CONTRACTOR at his expense during the progress of the work and until it is safe for traffic to use the roads and streets. All excavation material piles, equipment and materials, which may serve as obstructions to traffic, shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor, as deemed by the COUNTY.

All signage and barricades shall be in accordance with the MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES and the TRAFFIC CONTROL AND SAFE PRACTICES MANUAL.

5.02 PROTECTION OF UTILITY STRUCTURES

Temporary support, adequate protection and maintenance of all underground and surface utility structures including drains, sewers, manholes, hydrants, valves, valve covers, wires, cables, power poles and other miscellaneous utility structures encountered in the progress of the work shall be furnished by the CONTRACTOR at his expense. Any such structures, which may have been disturbed, shall be restored by the CONTRACTOR at his expense upon completion of the work.

5.03 OPEN EXCAVATION

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 with hand

railings and other crossings for accommodating travel by pedestrians and workers. Bridges provided for access to private property during construction shall be removed when no longer required. The length of open trench will be controlled by the particular surrounding conditions, but shall be limited to three hundred feet (300') unless otherwise approved by the COUNTY. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the COUNTY may require special construction procedures such as limiting the length of open trench, fencing, prohibiting excavated material in the street and requiring that the trench shall not remain open overnight. 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. All open trenches and excavation shall be covered at the end of the workday.

5.04 PROTECTION OF TREES AND SHRUBS

All trees and shrubs not shown to be removed on the plans shall be protected by the CONTRACTOR at his expense. No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed by negligence of the CONTRACTOR or his employees shall be replaced by him with new stock of similar size and age at the sole expense of the CONTRACTOR. Where limbs must be trimmed, back to allow construction, scars resulting from limb removal shall be treated with a tree sealant by qualified landscape personnel at the sole expense of the CONTRACTOR.

5.05 PROTECTION OF LAWN AREAS

Lawn areas shall be left in as good or better condition as before starting of the work. Where sod is to be removed, it shall be carefully restored with new sod of the same type.

5.06 RESTORATION OF FENCES

Any fence, or part thereof, that is damaged or removed during the course of the work shall be replaced or repaired by the CONTRACTOR at his expense and shall be left in as good a condition as before the starting of the work. The manner in which the fence is repaired or replaced and the materials used shall be subject to the approval of the COUNTY.

5.07 PROTECTION AGAINST SILTATION AND BANK EROSION

The CONTRACTOR shall arrange his operations to minimize siltation and bank erosion on construction sites and on existing or proposed watercourses and drainage ditches. The CONTRACTOR, at his own expense, shall remove any siltation deposits and restore to original grade. The CONTRACTOR shall provide, at his own expense, an N.P.D.E.S. plan and permit complying with the U.S. E.P.A. requirements for Orange County, Florida.

PART 6 - ACCESS TO THE PUBLIC SERVICES

6.01 ACCESS

Neither the materials excavated nor the materials or equipment used in the construction of the work shall be so placed as to prevent free access to public services. All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing streets, sidewalks and driveways. Excavated material suitable for backfilling shall be stockpiled separately on the site. No material shall be placed closer than two feet (2') from the edge of an excavation. Fire hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters shall be kept clear or other satisfactory provisions made for street drainage. Natural watercourses shall not be obstructed or polluted. Surplus material and excavated material unsuitable for backfilling shall be transported and disposed of off the site in disposal areas obtained by the CONTRACTOR, at his expense.

PART 7 - PUBLIC NUISANCE

7.01 PUBLIC NUISANCE

The CONTRACTOR shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, or excessive noise or dust. The CONTRACTOR shall eliminate noise to as great an extent as practicable at all times.

PART 8 - CONSTRUCTION HOURS

8.01 HOURS

No work shall be done between the hours of 7:00 P.M. and 7:00 A.M., or on Saturdays and Sundays unless the proper and efficient prosecution of the work requires operations during the night or weekend. Written notification for doing the work shall be provided to the COUNTY a minimum of twenty-four (24) hours before starting such items of the work.

PART 9 - CONSTRUCTION IN EASEMENTS AND RIGHTS OF WAY

9.01 CONSTRUCTION IN EASEMENTS

In easements across private property, the CONTRACTOR shall confine all operations within the easement area and shall be responsible and liable for all damage outside of the easement area. Trees, fences, shrubbery or other type of surface improvements located in easements will require protection during construction. Precautions shall be taken by adequate sheeting or other approved method to prevent any cave-in or subsidence beyond the easement limits or damage to improvements within the easement. In general, the easement area is intended to provide reasonable access and working area for efficient operation by the CONTRACTOR. Where easement space for efficient operation is not provided, the CONTRACTOR shall be responsible for organizing his operations to perform within the restrictions shown on the plans.

9.02 CONSTRUCTION IN FLORIDA DEPARTMENT OF TRANSPORTATION RIGHT OF WAY

The CONTRACTOR shall strictly adhere to the requirements of the Florida Department of Transportation where construction work is in a right of way under the jurisdiction of the State of Florida, and shall take care to avoid any unreasonable traffic conflicts due to the work in road right of way. CONTRACTOR's work shall conform to the requirements described in the F.D.O.T. right-of-way utilization permit.

9.03 CONSTRUCTION IN ORANGE COUNTY RIGHT OF WAY

Work shall be governed by the Orange County Right of Way Utilization Regulations as amended.

PART 10 - SUSPENSION OF WORK DUE TO WEATHER

10.01 SUSPENSION OF WORK

During inclement weather, all work, which might be damaged or rendered inferior by such weather conditions, shall be suspended. During suspension of the work from any cause, the work shall be suitably covered and protected so as to preserve it from injury by the weather or otherwise.

PART 11 - USE OF CHEMICALS

11.01 CHEMICALS

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either United States Environmental Protection Agency, National Safety Foundation or United States Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict conformance with label instructions.

PART 12 - COOPERATION WITH OTHER CONTRACTORS AND FORCES

12.01 OTHER CONTRACTORS AND FORCES

During construction progress, it may be necessary for other contractors and persons employed by the COUNTY to work in or about the site. The COUNTY reserves the right to put such other contractors to work and to afford such access to the construction site and at such times as the COUNTY deems proper. The CONTRACTOR shall not impede or interfere with the work of such other contractors and shall cooperate with the other contractors for proper prosecution of the work.

PART 13 - SUBSURFACE EXPLORATION

13.01 EXPLORATION

The CONTRACTOR shall make such subsurface explorations as he believes necessary to perform the work, or as directed by COUNTY representatives in writing. Such explorations directed by the COUNTY shall be paid for by the COUNTY.

PART 14 - CLEANING

14.01 DURING CONSTRUCTION

During construction the CONTRACTOR shall, at all times, keep the construction site and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the COUNTY, such material, debris or rubbish constitutes a nuisance or is objectionable.

14.02 FINAL CLEANING

At the conclusion of the work, all tools, temporary structures and materials belonging to the CONTRACTOR shall be promptly taken away. The CONTRACTOR shall remove and promptly dispose of all water, dirt, rubbish, or any other foreign substances.

PART 15 - SALVAGE

15.01 SALVAGE

Any existing COUNTY owned equipment or material including but not limited to valves, pipes, fittings, couplings, etc., which is removed or replaced as a result of construction may be designated as salvage by the COUNTY, and if so, shall be carefully excavated if necessary and delivered to the COUNTY at a location within the COUNTY, at the CONTRACTOR's expense.

END OF SECTION

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SECTION 02031

SITE PREPARATION, SURFACE REMOVAL AND RESTORATION

PART 1 - GENERAL

1.01 GENERAL

This Section covers clearing, grubbing, and stripping of the construction site. The CONTRACTOR shall clear and grub all of the area within the limits of construction as shown on the plans and approved by the COUNTY prior to the beginning of any work. All site work shall conform to the applicable site-clearing ordinance and landscaping and tree ordinances of the COUNTY. All labor, materials, equipment and testing covered in this section shall be provided by the CONTRACTOR at his sole expense, unless otherwise specifically noted.

PART 2 - CLEARING AND GRUBBING

2.01 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, trees and shrubs shall be preserved in accordance with "Article VIII, 'Tree Protection and Removal', Chapter 15, Orange County Code." Where construction necessitates the removal of trees, the Contractor shall obtain all required permits. Removal of trees shall be only as directed by the Project Manager. 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.

B. As determined by the Project Manager/Engineer, where excavation, tree removal, stripping or trimming may result in damage to existing trees, shrubs or bushes, the Contractor shall employ a licensed arborist to oversee the work and provide protection of the trees. The arborist shall submit a detailed plan of action to the Project Manager prior to any work.

2.02 GRUBBING

Grubbing shall consist of the complete removal of all stumps, roots larger than one and one-half inches (1-1/2") 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 eighteen inches (18") below the sub grade. All depressions excavated below the original ground surface for or by the removal of such objects shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

2.03 STRIPPING

In areas, so designated, top soil shall be stripped and 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.

2.04 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

The CONTRACTOR shall at his expense, dispose of all material and debris from the clearing and grubbing operation in accordance with all applicable ordinances. No cleared and grubbed material may remain on the site longer than 3 days, or as directed by the COUNTY.

PART 3 - DUST CONTROL

3.01 DUST CONTROL

CONTRACTOR shall control dust resulting from clearing and grubbing operations to prevent nuisance to adjacent property owners and the general public. CONTRACTOR shall use dust control methods and materials approved by the COUNTY. All paved roads shall be kept free of dirt and debris.

PART 4 - SURFACE REMOVAL

4.01 SURFACE REMOVAL

Along the proposed pipelines as indicated on the plans, CONTRACTOR shall remove surface materials only to such widths as will permit a trench to be excavated, which will afford sufficient room for proper efficiency and proper construction. All applicable COUNTY and FDOT regulations shall be followed. Where sidewalks, driveways, pavements, curb and gutter are encountered, care shall be taken to protect against fracture or disturbance beyond reasonable working limits. All fractured, broken or disturbed surfaces shall be restored to original condition prior to completion of the work.

PART 5 - RESTORATION

5.01 RESTORATION

Restoration of all surfaces including road sub base, soil cement, limerock base, asphaltic concrete surface, Portland cement concrete pavement and driveways, sidewalks and concrete curbs shall be in strict accordance with Road Construction Specifications. All grassing and mulching shall be done as specified in the Road Construction Specifications. Solid sodding shall be placed on all locations indicated on the plans and where existing sod is removed or disturbed by the work. In addition, CONTRACTOR shall restore all storm drains, culverts, inlets and storm manholes to equal or better condition in accordance with the Road Construction Specifications.

PART 6 - SODDING, SEEDING & MULCHING

6.01 GENERAL

Work includes sodding, seeding and mulching of road shoulders, ditches, embankments and other areas left barren or disturbed by construction to establish a dense stand of grass. All existing sodded areas disturbed by the construction shall be restored with sod of the same species as the surrounding area.

6.02 SCOPE

Immediately after construction is completed in any area, trim and compact the surface to smooth contours. Prepare topsoil for grassing, and construct seeding, mulching, and sodding.

Maintain grassed areas as specified in FDOT Standard Specifications, paragraph 570-5, to establish a dense stand of grass. Maintenance shall include watering, mowing, weeding, replacing mulch, fertilizing, replanting and all other operations necessary to establishing a dense stand of grass.

Sod all ditches, swales and existing grassed areas disturbed during construction.

Any area outside the limits of work that is disturbed by construction shall be immediately replaced with sod or ground cover of the species that was disturbed.

6.03 REFERENCED STANDARDS

Florida Department of Transportation (FDOT) Standard Specifications for road and bridge.

Florida State Department of Agriculture Standards.

6.04 PRODUCTS

A. Grass Seed: Common Bermuda and Argentine Bahia (see 6.05):

1. Add brown-top millet for summer month's application.

2. Add annual rye for winter month's applications.

All seed shall meet the Florida Department of Agriculture Standards. The labels of the bags of seed to be used shall be submitted to the Resident Project Representative before applying the seed.

B. Sod: Sod shall be strong, well-rooted Argentine Bahia sod, or the equivalent existing species with compacted growth.

Sod shall be certified to meet Florida Department of Agriculture Standards, absolutely true to varietals type, and free from weeds or other objectionable vegetation, fungus, insects, and disease of any kind.

Before being cut and lifted, the sod shall have been mowed three (3) times, with the final mowing not more than one (1) week before cutting into uniform dimensions.

C. Fertilizer: Chemical composition of 8-8-8, meeting Florida Department of Agriculture requirements.

D. Mulch: Thoroughly shredded straw or hay.

6.05 EXECUTION

Construct seed and mulch in accordance with Florida Department of Transportation Section 570.

Seed Application Rates:

Bermuda	30 lbs. per acre
Argentine Bahia	120 lbs. per acre
Annual Rye	20 lbs. per acre (October - March)
Brown-Top Millet	20 lbs. per acre (April - September)

Fertilizer Application Rate: 1,000 lbs. per acre.

Construct sod in accordance with Florida Department of Transportation Section 575. Sod shall be Argentine Bahia grass and shall be dense and well rooted.

END OF SECTION

SECTION 02032

EXCAVATION, BACKFILL, COMPACTION AND GRADING

PART 1 - GENERAL

1.01 GENERAL

This Section covers excavation, backfill, compaction and grading associated with utility trench and structural construction. All such work shall be performed by the CONTRACTOR concurrently with the work specified in these Specifications. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals and testing unless specifically excepted necessary to perform all excavation, backfill, fill, compaction, grading and slope protection required to complete the work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to: pump stations, manholes, vaults, conduit, pipe, roadways and paving; all backfilling, fill and required borrow; grading; disposal of surplus and unsuitable materials; and all related work such as sheeting, bracing, dewatering and water handling. All labor, material, equipment and testing covered in this section shall be provided by the CONTRACTOR at his sole expense, unless otherwise specifically notes.

PART 2 - SOIL BORINGS AND SUBSURFACE INVESTIGATIONS

2.01 SOIL CONDITIONS

The CONTRACTOR shall examine the site and undertake subsurface investigations including soil borings before commencing the work. The COUNTY will not be responsible for presumed or existing soil conditions in the work area.

PART 3 - EXISTING UTILITIES

3.01 LOCATING UTILITIES

The CONTRACTOR shall locate existing utilities in the areas of work. If utilities are to remain in place, the CONTRACTOR shall provide adequate means of protection during earthwork operations. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, the CONTRACTOR shall consult the owner of such piping or utility immediately for directions. Payment for damage and repair to such piping or utilities shall be by the CONTRACTOR's. Refer to these specifications for utility coordination requirements.

The COUNTY shall not be responsible for uncharted or incorrectly charted water, reuse water, wastewater mains or other utilities. It is the CONTRACTOR's responsibility to ensure that such facilities exist at the presumed point prior to commencing construction.

PART 4 - MATERIALS

4.01 GENERAL

Materials for use as bedding and backfill, whether in situ or borrow, shall be as described under this Section. The CONTRACTOR shall upon request by the COUNTY, make an appropriate sample of this material available for testing by the COUNTY or its designated representative.

4.02 STRUCTURAL FILL

Materials for structural fill shall be bedding rock or select common fill as specified herein or other suitable material as approved by the COUNTY.

4.03 COMMON FILL

Common fill shall consist of mineral soil, substantially free of clay, organic material, loam, wood, trash and other objectionable material which may be compressible or which cannot be compacted properly. Common fill shall not contain stones larger than three and a half inches (3 1/2 ") in diameter, asphalt, broken concrete, masonry, rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Additionally common fill shall be no more than twelve percent (12%) by weight finer than the No. 200 mesh sieve unless finer material is approved for use in a specific location by the COUNTY.

Material falling within the above specifications, encountered during the excavation may be stored in segregated stockpiles for reuse. All material, which, in the opinion of the COUNTY, is not suitable for reuse, shall be spoiled as specified herein for disposal of unsuitable materials.

4.04 SELECT COMMON FILL

Select common fill shall be as specified above from common fill, except that the material shall contain no stones larger than one-half inches (1/2") in largest dimension, and shall be no more than five percent (5%) by weight finer than the No. 200 mesh sieve.

4.05 BEDDING ROCK

Bedding rock shall be three-sixteenths inch to three-quarter inch (3/16"-3/4") washed and graded stone (FDOT #57). This stone shall be graded so that ninety to one hundred percent (90%-100%) will pass a three-quarter inch (3/4") screen and ninety-five to one hundred percent (95%-100%) will be retained on a No. 8 screen. No stones larger than one inch (1") in any dimension shall be accepted.

PART 5 - SHEETING AND BRACING IN EXCAVATIONS

5.01 GENERAL

If required to support the sides of excavations, to prevent any movement, which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, existing piping and/or foundation material from disturbance, undermining or other damage, the CONTRACTOR shall construct brace and maintain cofferdams consisting of sheeting and bracing. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

5.02 MISCELLANEOUS REQUIREMENTS

When trench sheeting for pipes, no sheeting is to be withdrawn if driven below mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot (1') above the top of any pipe unless otherwise directed by the COUNTY. If during the progress of the work, the COUNTY decides that additional wood sheeting should be left in place, it may direct the CONTRACTOR to do so. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given by the COUNTY for an alternate method of removal. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction of other structures, utilities, existing piping or property. Unless otherwise approved or indicated on the Drawings or in the Specifications, all sheeting and bracing shall be removed after completion of the substructure. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools specially adapted for that purpose, by watering or otherwise as may be directed by the COUNTY.

The right of the COUNTY to order sheeting and bracing left in place shall not be construed as creating any obligation on its part to issue such orders and its failure to exercise its right to do so shall not relieve the CONTRACTOR from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the CONTRACTOR to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

The CONTRACTOR shall construct the cofferdams and sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing and cofferdams shall be adequate to withstand all pressures to which the structure will be subjected. Pumping, bracing and other work within the cofferdam shall be done in a manner to avoid disturbing any construction already performed. Any movement or bulging, which may occur, shall be corrected by the CONTRACTOR at his own expense so as to provide the necessary clearances and dimensions.

PART 6 - DEWATERING, DRAINAGE AND FLOTATION

6.01 GENERAL

The CONTRACTOR shall excavate, construct and place all pipelines, concrete work, fill, and bedding rock, in the dry. In addition, the CONTRACTOR shall not make the final twenty-four inches (24") of excavation until the water level is a minimum of one foot (1') below proposed bottom of excavation. For purposes of these Specifications, "in-the-dry" is defined to be within two percent (2%) of the optimum moisture content of the soil. The COUNTY reserves the right to ask the CONTRACTOR to demonstrate that the water level is a minimum of one foot (1') below proposed bottom of excavation before allowing the construction to proceed.

Contractor is responsible for acquiring all permits required to discharge the water and shall protect waterways from turbidity during the operation. Discharge water shall be clear, with no visible soil particles. Discharge from dewatering shall be disposed of in such a manner that it will not interfere with the normal drainage of the area in which the WORK is being performed, create a public nuisance or form ponding. The operation shall not cause damage to any portion of the WORK completed, in progress, to the surface of streets or to private property. The dewatering operation shall comply with the requirements of National Pollutant Discharge Elimination System (NPDES) and other state and COUNTY regulatory agencies. Additionally, the Contractor shall obtain proper right of entry where private property will be involved. Contractor shall comply with relevant Supplemental Conditions/Special Provisions (Part G), and Technical Provisions TP 900-3 (Part H) of the Construction Contract. No flooding of streets, roadways, driveways or private property will be permitted. Engines driving dewatering pumps shall be equipped with residential type mufflers.

6.02 ADDITIONAL REQUIREMENTS

The CONTRACTOR shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed sub grade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.

Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the sub grade soils at proposed bottom of excavation.

It is expected that well points will be required for pre drainage of the soils prior to final excavation for some of the deeper in-ground structures, or piping and for maintaining the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline or fill will not be floated or otherwise damaged. Well points shall be surrounded by suitable filter sand.

The CONTRACTOR shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.

During backfilling and construction, water levels shall be measured in observation wells located as directed by the COUNTY.

Continuous pumping will be required as long as water levels are required to be below natural levels.

PART 7 - EXCAVATION

7.01 GENERAL

Excavation consists of removal, storage and disposal of material encountered when establishing required grade elevations and in accordance with the Construction Plans.

Authorized earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, and other materials encountered that are not classified as rock excavation or unauthorized excavation. Unauthorized excavation consists of removal of material beyond the limits needed to establish required grade and subgrade elevations without specific direction of the COUNTY. Unauthorized excavation, as well as remedial work directed by the COUNTY shall be at the CONTRACTOR's expense. Such remedial work shall be performed as directed by the COUNTY.

If requested by the COUNTY, when excavation has reached required sub grade elevations, a Geotechnical/Soils Engineer shall make an inspection of conditions. If the sub grade is unsuitable, CONTRACTOR shall carry excavation deeper and replace excavated material with select common fill or bedding rock, as directed by the COUNTY.

If the CONTRACTOR excavates below grade through error or for his own convenience or through failure to properly dewater the excavation or disturbs the sub grade before dewatering is sufficiently complete, he may be directed by the COUNTY to excavate below grade and refill the excavation using select common fill or bedding rock.

Slope sides of excavation shall comply with local codes and ordinances, and with OSHA requirements. CONTRACTOR shall shore and brace where sloping is not possible due to space restrictions or stability of the material excavated. Sides and slopes shall be maintained in a safe condition until completion of backfilling.

The CONTRACTOR shall stockpile satisfactory excavated materials at a location approved by the COUNTY until required for backfill or fill. When needed in the work, material shall be located and graded at the direction of the COUNTY.

Stockpiles shall be placed and graded for proper drainage. All soil materials shall be located away from the edge of excavations. All surplus and/or unsuitable excavated material shall be

legally disposed of by the CONTRACTOR. Any permits required for the hauling and disposing of this material shall be obtained by the CONTRACTOR prior to commencing hauling operations.

7.02 EXCAVATION FOR STRUCTURES

All such excavations shall conform to the elevations and dimensions shown on the drawings within a tolerance of plus or minus one-tenth foot (±0.10') and extending a sufficient distance from footings and foundations to permit placing and removing formwork, installation of services and other construction, inspection or as shown on the Drawings. In excavating for footings and foundations, care shall be exercised not to disturb the bottom of the excavation. Bottoms shall be trimmed to required lines and grades to leave a solid base to receive concrete.

7.03 TRENCH EXCAVATION

Excavation for all trenches required for the installation of utility pipes shall be made to the depths indicated on the Drawings and in such manner and to such widths as will give suitable room for laying the pipe within the trenches, for bracing and supporting and for pumping and drainage facilities.

The bottom of the excavations shall be firm and dry and in all respects acceptable to the COUNTY.

Excavation shall not exceed normal trench width as specified in the Standard Drawings. Any excavation, which exceeds the normal trench width, shall require special backfill requirements as determined by the COUNTY.

Where pipes are to be laid in bedding rock, select common fill or encased in concrete, the trench may be excavated by machinery to or just below the designated sub grade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

Where the pipes are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated shall be done manually in such a manner that will give a shaped bottom, true to grade, so that pipe can be evenly supported on undisturbed material, as specified in the Standard Drawings. Bell holes shall be made as required. This work must comply with the Florida Trench Safety Act.

PART 8 - BEDDING AND BACKFILL

8.01 GENERAL

Material placed in fill areas under and around structures and pipelines shall be deposited within the lines and to the grades shown on the Drawings or as directed by the COUNTY, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces, which have been inspected and approved by the COUNTY. If sufficient select common or common fill material is not available from excavation on site, the CONTRACTOR shall provide fill as may be required.

Fill shall be brought up in substantially level, approximately one foot (1') lifts starting in the deepest portion of the fill. The entire surface of the work shall be maintained free from ruts and in such condition, that construction equipment can readily travel over any section.

Fill shall be placed and spread in layers by a backhoe or other approved method, unless otherwise specified. Prior to the process of placing and spreading, all materials not meeting those specified under Part 4 - Materials, shall be removed from the fill areas. The CONTRACTOR shall assign a sufficient number of men to this work to insure satisfactory compliance with these requirements.

If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by another method approved by the COUNTY before the succeeding layer is placed.

All fill materials shall be placed and compacted "in-the-dry." The CONTRACTOR shall dewater excavated areas as required to perform the work and in such manner as to preserve the undisturbed state of the natural inorganic soils.
Prior to filling, the ground surface shall be prepared by removing vegetation, debris, unsatisfactory soil materials, obstructions and deleterious materials. CONTRACTOR shall plow strip or break up sloped surfaces steeper than one vertical to four horizontal (1:4) so fill material will bond with existing surface. When existing ground surface has a density less than that specified herein, for the particular classification, CONTRACTOR shall break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

Before compaction, material shall be moistened or aerated as necessary to provide the optimum moisture content. Material, which is too wet, shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits. If added moisture is required, water shall be applied by sprinkler tanks or other sprinkler systems, which will insure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued. The CONTRACTOR shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment and all other materials and equipment necessary to place water in the fill in the manner specified. CONTRACTOR shall compact each layer to required percentage of maximum dry density or relative dry density in accordance with Part 9 - Compaction. Backfill or fill material shall not be placed on surfaces that are muddy or saturated.

8.02 BEDDING AND BACKFILL FOR STRUCTURES

Bedding rock shall be used for bedding under all structures as indicated on the Standard Drawings. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed. Structural fill shall be used as backfill against the exterior walls of the structures. Fill shall be compacted sufficiently in accordance with Part 9 - Compaction. If compaction is by rolling or ramming, material shall be wet down as required.

Backfilling shall be carried up evenly on all walls of an individual structure. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength.

In locations where pipes pass through building walls, the CONTRACTOR shall take precautions to consolidate the fill up to an elevation of at least one foot (1') above the bottom of the pipes. Structural fill in such areas shall be placed for a distance of not less than three feet (3') either side of the centerline of the pipe in level layers not exceeding eight inches (8") in depth.

The surface of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the Drawings. No soft spots or uncompacted areas will be allowed in the work.

Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling.

8.03 BEDDING AND BACKFILL FOR PIPES

Bedding for pipe shall be as shown on the Plans and detailed on the Standard Drawings. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed.

Backfilling over and around pipes shall begin as soon as practicable after the pipe has been laid, jointed and inspected. All backfilling shall be prosecuted expeditiously and as detailed on the Standard Drawings.

Any space remaining between the pipe and sides of the trench shall be carefully backfilled and spread by hand or approved mechanical device and thoroughly compacted with a tamper as fast as placed, up to a level of one foot (1') above the top of the pipe. The filling shall be carried up evenly on both sides. Compaction shall be in accordance with the Standard Drawings and Part 9 - Compaction.

The remainder of the trench above the compacted backfill, as just described above shall be filled and thoroughly compacted in uniform layers. Compaction shall be in accordance with the Standard Drawings and Part 9 - Compaction.

PART 9 - COMPACTION

9.01 GENERAL

The COUNTY shall provide for the initial geotechnical/soils testing. The CONTRACTOR will be responsible for the cost of all results.

When existing trench bottom has a density less than that specified under 9.02, the CONTRACTOR shall break up the trench bottom surface, pulverize, moisture-condition to the optimum moisture content and compact to required depth and percentage of maximum density.

9.02 PERCENTAGE OF MAXIMUM DENSITY REQUIREMENTS

Fill or undisturbed soil from the bottom of the pipe trench to one foot (1') above the pipe shall be densified to a minimum density of ninety-eight percent (98%) of the maximum dry density as determined by AASHTO T-180.

Backfill from one foot (1') above utility pipes to grade shall be densified to a minimum density of ninety-eight percent (98%) of the maximum dry density as determined by AASHTO T-180.

Fill under and around structures, and to the extent of the excavation shall be densified to a minimum density of ninety-eight percent (98%) of the maximum dry density as determined by AASHTO T-180.

PART 10 - GRADING

10.01 GENERAL

All areas within the limits of construction, including transition areas, shall be uniformly graded to produce a smooth uniform surface. Areas adjacent to structures or paved surfaces shall be graded to drain away from structures and pavement. Ponding shall be prevented. After grading, the area shall be compacted to the specified depth and percentage of maximum density.

No grading shall be done in areas where there are existing pipelines that may be uncovered or damaged until such lines have been relocated or protected.

PART 11 - MAINTENANCE

11.01 GENERAL

The CONTRACTOR shall protect newly graded areas from traffic and erosion and keep them free of trash and debris. CONTRACTOR shall repair and reestablish grades in settled, eroded and rutted areas.

Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, CONTRACTOR shall scarify surface, and reshape and compact to required density prior to further construction.

PART 12 - INSPECTION AND QUALITY ASSURANCE

12.01 INSPECTION

The CONTRACTOR shall examine the areas and conditions under which excavating, filling and grading are to be performed, and not proceed with the work until unsatisfactory conditions have been corrected.

The CONTRACTOR shall examine existing grade prior to commencement of work and report to the COUNTY if elevations of existing grade vary from elevations shown on Drawings.

12.02 QUALITY ASSURANCE

All work shall be performed in compliance with applicable requirements of governing authorities having jurisdiction.

PART 13 - TUNNELLING

13.01 TUNNELLING

At the direction of the COUNTY representative, the contractor shall tunnel by hand method under trees, bushes, fences or other objects in order to provide minimal disruption to the objects. Approved methods of trench safety shall be used.

END OF SECTION

SECTION 02040

TELEVISING SANITARY SEWER SYSTEMS

PART 1 - GENERAL

1.01 SCOPE OF WORK

The work covered within this section is for the internal closed circuit television (CCTV) inspection of sanitary sewer pipes. The interior of the line sections shall be carefully inspected to determine alignment, grade variations, separated joints, location and extent of any deterioration, breaks, obstacles, obstructions, debris, quantities of infiltration/inflow and the locations of service connections.

After the sewer main and/or lateral cleaning operation is completed, the line sections shall be visually inspected internally by means of color closed-circuit television. The television inspection shall be performed one line section at time.

Recovery of Equipment: The contractor shall be responsible for recovering any equipment that becomes lodged or lost in the pipeline including, but not limited to, any cost associated with required excavation and site restoration.

1.02 REQUIREMENTS

A. The contractor shall inspect the sewer interior using a color closed circuit television camera (CCTV) and document the inspection on a digital recorder. All inspection video shall be captured in either MPEG or Windows Media Video (.WMV) file format and saved on DVDs or portable hard drives for submittal. Each inspected main line sewer reach, referenced manhole to manhole, and each inspected sewer lateral referenced to the property address and corresponding sewer main should have an associated MPEG or WMV file. Digital photographs (.JPG files), inspection reports (.PDF files) and any handwritten inspection logs or field maps shall accompany the video inspections for each sewer reach (manhole-to-manhole) or lateral inspected.

B. Contractor shall provide inspection video, data and reports in accordance with the requirements specified herein. Contractor shall provide all video on either DVD(s) or portable hard drive as specified. All work will conform to current NASSCO Pipeline Assessment Certification Program (PACP) coding conventions and all software used by the Contractor will be PACP compliant. An electronic database will be provided by the Contractor in a PACP exported format approved by the County.

C. Contractor shall maintain a copy of all report material. The contractor shall provide comments as necessary to fully describe the existing condition of the sewer on the inspection forms.

D. Contractor shall be responsible for modifications to equipment and/or inspection procedures to achieve report material of acceptable quality.

E. No work shall commence prior to approval of the submitted material by the Project Manager. Once accepted, the report material shall serve as a standard for the remaining work.

F. CCTV Inspection Contractors pre-approved by Orange County include: Altair Environmental Group, American In-line Inspection, Inc., Southeast Pipe Survey, Inc. and B&D Enterprises. Contact information is available on the Orange County web site at:
http://www.orangecountyfl.net/PlanningDevelopment/UtilitiesPlanningandConstruction.aspx
All other Contractors must meet the specifications herein and will require approval, as specified at the County web site above, prior to installation.

1.03 QUALITY ASSURANCE

A. Each CCTV field inspection supervisor shall be NASSCO PACP certified. Use of PACP certified technicians to review/document defects in the office (post process) is not acceptable.

B. The inspection contractor must have an internal quality assurance/quality control program in place and all inspection data shall be subjected to the procedures prior to submittal to the County. The County will perform QA/QC audits on submitted data.

C. QA/QC shall be performed by NASSCO PACP certified personnel.

1.04 SUBMITTALS

A. The following deliverables shall be submitted at the completion of inspection:
1. Inspection videos saved in MPEG format or Windows Media video format
2. Electronic version (.pdf) of the pipe inspection reports
3. PACP export pipe inspection database (.mdb) saved on CD-R's, DVD, or portable hard drives
4. Inspection digital photographs in JPEG format saved on CD-Rs, DVD or portable hard drives
5. QA/QC report

B. The above deliverables shall be submitted to the County for approval.

C. The sewer inspection video, report documents, and sewer inspection database shall be in accordance with County data standards and NASSCO PACP.

1.05 NOTIFICATION

Contractor shall notify the County a minimum of 48 hours prior to performing any inspection work. No payment will be made for inspections performed without proper notification.

PART 2 -PRODUCTS

2.01 EQUIPMENT

A. Closed Circuit Television Camera:

The television camera used for the inspection shall be one specifically designed and constructed for sanitary sewer inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100 percent humidity/submerged conditions. The CCTV camera equipment will provide a view of the pipe ahead of the equipment and of features to the side of the equipment through turning and rotation of the lens. The camera shall be capable of tilting at right angles along the axis of the pipe while panning the camera lens through a full circle about the circumference of the pipe. The lights on the camera shall also be capable of panning 90-degrees to the axis of the pipe.

If the equipment proves to be unsatisfactory, it shall be replaced with adequate equipment. The camera unit shall have sufficient quantities of line and video cable to inspect two complete, consecutive sewer reaches with access approximately 750 feet apart.

The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the County. The television camera, electronic systems and monitor shall provide an image that meets the following specifications, or approved equal.

1. The gray scale shall show equal changes in brightness ranging from black to white with a minimum of five stages.
2. With the monitor control correctly adjusted, the six colors - Yellow, Cyan, Green, Magenta, Red, and Blue, plus black and white shall be clearly resolved with the primary colors in order of decreasing luminance. The gray scale shall appear in contrasting shades of gray with no color tint.
3. The picture shall show no convergence or divergence over the whole of the picture. The monitor shall be at least 13 inches diagonally across the picture tube.
4. The live picture on the CCTV monitor shall be capable of registering a minimum of 500 lines horizontal resolution and be a clear, stable image with no interference.
5. Lighting intensity shall be remote controlled and shall be adjusted to minimize reflective glare. Lighting and camera quality shall provide a clear, in-focus picture of the entire inside periphery of the sewers and laterals for all conditions except submergence. Under ideal conditions (no fog in the sewer) the camera lighting shall allow a clear picture up to five pipe diameter lengths away for the entire periphery of the sewer. The lighting shall provide uniform light free from shadows or hot spots.
6. Camera focal distance shall be remotely adjustable through a range of 6 inches to infinity.
7. The monitor and software shall also be able to capture and save screen images of typical sewer details and all defects. Screen images shall be embedded into the pipe inspection report document submitted with the inspection video.

The video camera shall be capable of displaying on screen data as specified in Section 3.Data Displays.

B. Lateral Video Camera

Lateral cameras may be push type or launched from the sewer main line. Lateral cameras shall be color, shall be self leveling, and equipped with a footage counter to provide on screen display of footage measurement. Monitor resolution shall be as specified above in paragraph 2.01 A. Closed Circuit Television Camera, or approved equal.

C. Video Capture System:

The video and audio recordings of the sewer inspections shall be made using digital video equipment. A video enhancer may be used in conjunction with, but not in lieu of, the required equipment. The digital recording equipment shall capture sewer inspection on DVD disks or hard drive, with each sewer reach inspection recorded as an individual movie file (.MPEG, .MPG, or .WMV) or approved equal. The video files will be named in accordance with the County file naming convention:

Upstream MH ID_Downstream MH ID_Inspection Date (year_month_day).wmv
Example:
39540008_39540007_2009_08_05.wmv

1. The video file names will be referenced in the inspection database and in an inspection report generated in PDF format. The pipeline collection and real time video capture and data acquisition systems shall be provided.
2. The system shall use the most current PACP compliant application software and shall be fully object oriented or approved equal. It shall be capable of printing pipeline inspection reports with captured images of defects or other related significant visual information on a standard color printer.
3. The imaging capture system shall store digitized color picture images and be saved in digital format on a DVD, hard drive or approved equal. Also, this system shall have the capability to supply the County with inspection data reports for each line segment.
4. The contractor shall have the ability to store the compressed video files in industry standard and approved County format and be transferable with the PACP compliant inspection database.
5. The contractor's equipment shall have the ability to "Link". “Linking” is defined as storing the video time frame code with each observation or defect with the ability to navigate from/to any previously recorded observation or defect instantaneously.
6. The system shall be able to produce data reports to include, at a minimum, all observation points and pertinent data. All data reports shall match the defect severity codes in accordance with PACP naming conventions
7. The data-sorting program shall be capable of sorting all data stored using generic sort key and user defined sort fields.

8. Camera footage, date & manhole numbers shall be maintained in real time and shall be displayed on the video monitor as well as the video character generators illuminated footage display at the control console.
9. Depth gage: The camera shall have a depth gage or approved method to measure deflection in the pipe and joint separation approved by the County.

2.02 REPORTING CAPABILITIES

A. The CCTV system shall be capable of printing pipeline inspection reports with pipeline schematics and captured images of defects and other related significant visual information. The system shall have the ability to display any combination of the following formats and features simultaneously.

The following information is mandatory for all inspections.

1. Inspection Information – Refers to the area of pipe to be inspected between two manholes or the address of the lateral to be inspected.
    a. Project Name;
    b. Surveyed by (Operator/Surveyor's name);
    c. Operator/Surveyor Certificate number;
    d. System Owner;
    e. Date;
    f. Drainage Area (tributary pump station number);
    g. Time;
    h. Sheet number (report sheet number
    i. Street Name and Number;
    j. Locality (Orange County);
    k. Additional Location Information (e.g. backyard, parking lot, etc);
    l. Upstream Manhole Number (County standard Asset Number);
    m. Upstream MH rim to invert (depth);
    n. Downstream Manhole Number (County standard Asset Number);
    o. Downstream MH rim to invert (depth);
    p. Direction of inspection (Upstream or Downstream);
    q. DVD Identification Number;
    r. Flow control (e.g. plugged, lift station, bypassed, not controlled);
    s. Type of Pipe;
    t. Pipe Height;
    u. Pipe Width;
    v. Pipe Shape;
    w. Pipe Material;
    x. Lining Material (for lined sewers);
    y. Pipe Joint Length:

z. Purpose of Inspection (new line, year end warranty, CIP R/R project, etc.);

aa. Pre Cleaning (jetter, heavy cleaning, no pre-cleaning);

bb. Media Number (Video file name) ;

cc. Weather;

dd. Additional information/Comments

2. Observation Data – Refers to the portion of pipe where an observation is discovered. Observations shall be noted by text descriptions and defect code number using PACP defects codes, still frame pictures and video clips captured and recorded. Each observation shall include the following:

a. Actual observation footage;

b. Video reference;

c. Location of defect; clock position;

d. Code (Group/Descriptor/Modifier/Severity)

e. Whether it is a continuous defect

f. Whether the defect occurs at a joint

g. Severity level;

h. DVD Identification number;

i. DVD counter;

j. Final footage;

k. Video clip ID for each observation

l. Image reference (file name of photos)

m. Remarks (as appropriate or needed)

3. Formats - Standard and/or custom designed reports shall have the following formats available and shall be able to be produced in hard copy or viewed on the monitor.

a. Site Observation: Displays detailed site observation reports in landscape or portrait views.

b. Directory Report: Displays a list of all the projects sorted by pump station number and manhole number

c. Picture Reports: Displays site data and include full size single photos or half size double photos of discrepancies

d. Pipe Run: Displays a graphical display of the site indicating footage, observations, and comments.

e. Project Data: Displays the project, client, and contractor information.

f. Custom Sort: Creates user-defined reports of selected site, project, and observation data.

PART 3 - EXECUTION

3.01 GENERAL

A. The CCTV camera shall be positioned as close to the spring line as possible while maintaining the required equipment stability.

B. The contractor shall begin the video recording at the top of the manhole to view the condition of the manhole and any pie that is connected to the manhole. The contractor shall record as the camera is lowered down the manhole all the way to the preset footage and continuously throughout the pipe reach until the down stream manhole is reached.

C. The contractor shall also inspect and document all manholes included in this work. The camera shall pan the periphery of the start and finish manhole from casting to invert.

D. Wherever possible the inspections shall be performed in the upstream to downstream direction.

E. Flow levels within the pipe to be inspected shall not exceed 5% of the pipe diameter. If water levels prevent adequate televising of the sewer, then conducting the work during low flow periods or other methods like plugging and bypass pumping may be implemented.

F. The survey unit shall be slowed, stopped, or backed-up to perform detailed inspections of significant features. The camera shall be stopped at all defects, changes in material, water level, size, side connections, manholes, junctions, or other unusual areas. When stopped at the defect or feature, the operator shall pan the camera to the area and along the circumference of the pipe.

G. The camera unit shall be paused long enough at areas suspected of leaking to determine if a leak exists currently or if deposits have occurred.

H. The operator shall also record audio of the type of defect or feature, clock position, footage, extent or other pertinent data.

I. Digital photographs or screen captures shall be taken at all laterals, defects and general condition photographs shall be taken at least every 200 feet.

J. At the contractor's discretion or direction of the owner, the camera shall be stopped or backed up (when conditions allow) to view and analyze conditions that appear to be unusual or uncommon for a sound sewer. The lens and lighting shall be readjusted, if need be, in order to ensure a clear, distinct, and properly lighted feature.

K. Audio shall be recorded during each inspection by the operating technician, electronic voice text recognition or approved equal on the inspection video as the sewer is inspected and shall include the sewer location, identification of beginning and terminating manholes including location (address or cross streets), inspection direction, length of inspection, side sewer identification, flow information, complete descriptions of the sewer line conditions as they are encountered, description of the rehabilitation work, reason for termination, and other relevant commentary to the inspections. In addition, the audio reports shall include the distance traveled on the specific run, a description of abnormal conditions in the sewer and side sewer connections as they are encountered, explanations for pausing, backing up, or stopping the survey, and the final measured center to center distances between

consecutive manholes. The audio portion of the composite video shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of the oral report. Audio dubbing after the inspection is prohibited.

L. The contractor shall be responsible for all traffic control measures required to perform the work.

M. Lateral inspections shall be performed from the main line using a lateral launch camera or shall be pushed from cleanouts to the sewer main using sewer rods. Lateral camera travel measurements shall be displayed on screen and on the captured video.

3.02 PRECONSTRUCTION INSPECTION (NOT USED)

A. Procedure:

1. Prior to any repair work, the entire sewer line (from manhole to manhole) shall be televised. The pre-construction inspection shall be used to determine whether the line has been cleaned sufficiently; to confirm the location and nature of defects; and to confirm that the proposed method of repair is proper method for the defects observed.

2. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and power rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire manhole section, the contractor shall set up his equipment so that the inspection can be performed from the opposite manhole. (reverse set-up)

3. When manually operated winches are used to pull the television camera through the line, telephones, radios or other suitable means of communication shall be set up between the two manholes of the section being inspected to insure good communication between members of the crew.

4. The importance of accurate distance measurements is emphasized. The location of defects shall be within two (2) feet ±.

5. During the internal inspection the television camera shall be temporarily stopped at each defect along the line. The contractor shall record the nature and location of the defect. Where defects are also active infiltration sources, the rate of infiltration in gallons per minute shall be estimated by the contractor and recorded. The camera shall also be stopped at active service connections where flow is discharging. Flows from service connections that are determined to be infiltration/inflow shall also be recorded.

B. Documentation of Television Inspection:

1. Television Inspection Logs - Printed location records shall be kept by the contractor and will clearly show the location in relation to an adjacent manhole of each infiltration point observed during inspection. In addition, other points of significance such as locations of building sewers, unusual conditions, roots, storm sewer connections, broken pipe, presence of scale and corrosion, and other discernible features will be recorded and a copy of such records will be supplied to the County. The contractor shall record all visuals observations on a "Television Inspection Report" form.
2. Once recorded, the digital data shall be labeled and become the property of the County. The contractor shall have all readings and necessary playback equipment readily accessible for review by the County during the project.

3.03 POST CONSTRUCTION INSPECTION

A. Procedure:

1. After the sewer line rehabilitation has been completed, the entire sewer line from manhole to manhole shall be televised. The post construction inspection shall be used to determine whether or not all of the approved sewer line defects and infiltration sources previously located have been fully repaired to the satisfaction of the County.
2. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, power rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. If, during the inspection operation, the television camera will not pass through the entire manhole section, the contractor shall set up his equipment so that the inspection can be performed from the opposite manhole or direction.(reverse-setup)
3. When manually operated winches are used to pull the television camera through the line, telephones, radios or other suitable means of communication shall be set up between the two manholes of the section being inspected to insure good communication between members of the crew.
4. The importance of accurate distance measurements is emphasized. The location of defects shall be within one foot.
5. During the internal inspection the television camera shall be temporarily stopped at each repair. The camera shall also be stopped at any unnoticed or non-repaired point source of infiltration.

3.04 SEWER BYPASSING AND DEWATERING

Contractor shall be responsible for bypassing sewer flow around his work and dewatering of sewer lines in accordance with the requirements of Section 01516 – Collection System Bypass. Where sags or submerged sections of the sewer are encountered during TV inspection, the contractor shall first complete inspection of the entire reach to determine the extent of such areas prior to dewatering the sewer. Dewatered sections of the sewer

shall then be TV inspected.

On all sewer mains which have sags or dips, to an extent that the television camera lens becomes submerged during the television inspection, the contractor shall use a high pressure cleaner to draw the water out of the pipe, or other means, to allow inspection of the pipe and identification of pipe defects, cracks, holes and location of service connections.

3.05 LINEAR MEASUREMENT

The CCTV camera location footage counter shall be zeroed at the beginning of each inspection. The survey unit location entered on the footage counter at the start of the inspection shall allow for the distance from the accepted start of the length of the sewer to the initial point of observation of the camera (pre-set footage). In the case of resuming an inspection at an intermediate point within a sewer reach, the footage counter shall be set to start at the distance from the upstream maintenance hole to that point, as previously recorded by the counter. The CONTRACTOR shall ensure that the footage counter starts to register immediately when the survey unit starts to move.

The lateral camera shall be pushed from cleanouts to the sewer main and be equipped with a footage counter to display and record inspection footage. Maximum rate of travel shall be 30 feet per minute when recording.

Prior to commencing inspections, the CONTRACTOR shall demonstrate compliance with the linear measurement tolerance specified below:

A. The equipment shall measure the location of the camera unit in 1-foot increments from the beginning (upstream end) of each continuous section. This footage location must be displayed on the CCTV monitor and recorded on the videotapes.

B. The accuracy of the measured location shall be within + 0.5% of the actual length of the sewer reach being surveyed, or 1 foot, whichever is greater.

3.06 MEASUREMENT OF SAGS

The CCTV camera shall be equipped with a measuring device capable of accurately measuring the depth of standing water up to 3 inches. The measuring device shall be mounted to the front of the unit and be capable of being read as the unit advances through the pipe.

3.07 CCTV MONITOR DISPLAY

The images displayed on the CCTV monitors will be a view of the pipe above the water surface as seen by the CCTV camera as the unit is conveyed through the sewer.

The camera lighting shall be fixed in intensity prior to commencing the survey and the white balance set to the color temperature emitted. In order to ensure color constancy, no variation in illumination shall take place during the survey.

The video equipment shall be checked using an approved test card with a color bar prior to commencing each day's survey. The camera shall be positioned centrally and parallel to the test card at a distance where the full test card just fills the monitor screen. The card shall be illuminated evenly and uniformly without any reflection.

3.08 DATA DISPLAYS

The CCTV images shall include an initial data display that identifies the sewer reach being surveyed and a survey status display that provides continuously updated information on the location of the survey unit as the survey is being performed. These data displays shall be in alphanumeric form. The size and position of the data shall not interfere with the main subject of the monitor picture.

The on-screen display should be white during inspections where the background behind the display is dark and, conversely, black where the background is light.

At the beginning of each reach of sewer being inspected, the following information shall be electronically generated and displayed on the CCTV monitors as well as included in the audio track:

A. Date of survey

B. Inspection company name and inspector

C. Street name or location

D. Manhole number to manhole number (in order of inspection)

E. Direction of survey (upstream or downstream)

F. Time of start of survey

During inspections, the following information shall be electronically generated, automatically updated, and displayed on the CCTV monitors:

A. Survey unit location in the sewer line in feet and tenths of feet from adjusted zero

B. Sewer diameter

C. Upstream and downstream manholes reference numbers as per approved drawings or County GIS.

3.09 PHOTOGRAPHS

During CCTV inspections, screen captures will be taken from the monitor images and saved electronically by the in-sewer inspection crew of typical conditions every 200 feet and at all defects. The screen capture shall have the interceptor name, reach (identified by the upstream and downstream manholes), survey direction, footage, and date when photograph was taken. The annotation shall be clearly visible and in contrast to its background, shall have a figure size no greater than 1/4-inch, and shall be type-printed. The annotation shall be positioned on the front of the photograph so as to not interfere with the subject of the photograph. Photograph files shall be named by the video capture system and automatically referenced to the logged defect.

The image of the sewer shall fill the photographic image. Photographs must clearly and accurately show what is displayed on the monitor, which shall be in proper adjustment. Where significant features exist within 6-feet of each other, one photograph shall be made to record these features. Where there is a continuous feature, photographs shall not be taken at intervals of less than 6-feet unless absolutely necessary to show a change in the feature.

The images shall be kept electronically, copied to a DVD or hard drive, and submitted with the inspection videos, database and reports.

3.10 MANHOLE NUMBERING, INSPECTION FORMS AND DEFECT CODES

The CONTRACTOR will be required to use the manhole numbering as shown in the County's GIS and sewer maps provided when performing the inspections for this project. In addition, the County inspection forms and standard defect codes shall be used. The defect codes, inspection forms, inspection database and inspection protocols shall be in accordance with the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP).

3.11 DELIVERABLES

The CONTRACTOR will be required to submit the following deliverables at the completion of inspection.

A. Inspection Reports to include:
   1. Inspection session header information (see required fields above)
   2. Defect log report including photo captures from CCTV video
   3. Schematic drawing of pipe showing defects
   4. Format:
      a. Adobe Acrobat PDF files – 1 report PDF per pipe
      b. File name: <upstream MH ID>_<downstream MH ID>_<Date (year_mo_day format)>.PDF

         Example: 30060002_30060001_2010_02_16.pdf

B. Inspection video files on DVD or portable hard drive, labeled as follows:

   DVD/Hard drive Labels - Typed labels shall be attached to the face of each DVD. The typed index labels shall include the following information:
   1. Content (CCTV)
   2. Contractor name
   3. Purpose of Survey
   4. Tributary Pump station number
   5. Reaches included (from Manhole Number ## to Manhole Number ##)
   6. Date of survey
   7. Contract Number / Delivery Order Number (if applicable)

C. Electronic Inspection Data stored and exported in a NASSCO Pipeline Assessment and Certification Program (PACP) compliant Microsoft Access database (.MDB) version 4.4 delivered on DVD or portable hard drive.

D. Inspection photograph digital files (jpeg) indexed to NASSCO PACP compliant database.

3.12 ACCEPTANCE

Inspection submittals will be reviewed for quality control. A minimum of 5% of the submitted inspections will be randomly reviewed. A quality control check will be performed for each CCTV operator and each operator must exceed 90% accuracy.

END OF SECTION

SECTION 02050

DEMOLITION OF EXISTING STRUCTURES

PART 1-GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish all labor, materials, equipment and incidentals required for the demolition, relocation, and/or disposal of all structures, building materials, equipment, and accessories to be removed as shown on the Drawings and as specified herein.

2. There may be existing and active stormwater, wastewater and/or water facilities on site as indicated on the Drawings. It is essential that these facilities, when encountered, remain intact and in service during the proposed demolition. Consequently, the contractor shall exercise due concern for the operation of these facilities and shall diligently direct all his activities toward maintaining continuous operation of the existing facilities and minimizing operational inconvenience.

3. Demolition generally includes:
   a. Complete demolition and removal of all structures, as shown on the Drawings and specified herein.
   b. Complete demolition and removal of all below ground structures, vaults, and underground utilities (water, wastewater, electrical, etc.) as shown on the Drawings and specified herein.
   c. All material, equipment, rubble, debris and other products of the demolition shall become the property of the Contractor for his disposal off site in accordance with all applicable laws and ordinances, and at the Contractor's expense. The sale of salvageable materials by the Contractor shall only be conducted off-site. The sale of removed items on the site is prohibited by the Owner.

4. The Contractor shall examine the various Drawings, visit the site and determine for himself the extent of the work, the extent of work affected therein and all conditions under which he is required to perform the various operations.

5. The Contractor shall fill and compact all voids left by the removal of pipe, structures, etc. with materials described in Earthwork Section to a grade that will provide for positive drainage of the disturbed area to drain run-off in a direction consistent with the surrounding area. The Contractor shall provide all fill materials to the site as needed.

1.02 QUALITY ASSURANCE

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

B. Notices: Contractor shall issue written notices of planned demolition to companies or local authorities owning utility conduit, wires or pipes running to or through the project site. Copies of said notices shall be submitted to the Engineer.

C. Utility Services: Contractor shall notify utility companies or local authorities furnishing gas, water, electrical, telephone or sewer service to remove any equipment owned by them in structures to be demolished and to remove, disconnect, cap or plug their services to facilitate demolition.

1.03 CONDITIONS

A. The existing stormwater, wastewater and/or water facilities are not operational and are ready for demolition.

B. The Owner and the Engineer assume no responsibility for the actual condition of the structures to be demolished or relocated.

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

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

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

1.04 RULES AND REGULATIONS

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

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

C. Contractor shall notify the Orange County Risk Management Department prior to beginning any demolition work.

1.05 DISPOSAL OF MATERIAL

A. Prior to bid advertisement, in the areas designated for demolition, the Owner will remove from the site(s) all salvageable or useable material or equipment to be retained by the Owner. The Contractor shall promptly remove all other materials from the site as indicated or shown on the Drawings.

B. All materials not retained by the Owner shall become the Contractor's property and shall be removed off site.

C. The storage of or sale of removed items on-site is prohibited by the Owner. Sale of salvageable material by the Contractor off-site is encouraged.

1.06 SUBMITTALS

A. Submit to the Engineer for his approval, two (2) copies of proposed methods and operations of demolition or relocation of the structures specified below prior to the start of work. Include in the schedule the coordination of shut-off, capping and continuation of utility service as required.

B. Provide a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the Owner's operations.

C. Before commencing demolition work, all structure relocation, by-passing, capping or modifications necessary will be completed. Actual work will not begin until the Engineer has inspected and approved the prerequisite work, and authorized commencement of the demolition work.

D. The above procedure must be followed for each individual demolition operation.

1.07 TRAFFIC AND ACCESS

A. Conduct demolition and modification operations, and the removal of equipment and debris to ensure minimum interference with roads, streets, walks both on site and off site and to ensure minimum interference with occupied or used facilities.

B. Special attention is directed towards maintaining safe and convenient access to the existing facilities remaining in operation by plant personnel and plant associated vehicles, including but not necessarily limited to, trucks and delivery vehicles.

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

1.08 PROTECTION

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

1.09 DAMAGE

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

1.10 UTILITIES

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

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

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

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

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

1.11 EXTERMINATION

A. If required, before starting demolition, employ a certified rodent and vermin exterminator and treat the facilities in accordance with governing health laws and regulations. Any rodents, insects, or other vermin appearing before or during the

demolition shall be killed or otherwise prevented from leaving the immediate vicinity of the demolition work.

1.12 POLLUTION CONTROL

A. For pollution control, use water sprinkling, temporary enclosures, and other suitable methods as necessary to limit the amount of dust and dirt rising and scattering in the air to the lowest level of air pollution practical for the conditions of work. Comply with the governing regulations.

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

PART 2 - MATERIALS (Not Used)

PART 3 - EXECUTION

3.01 SEQUENCE OF WORK

A. The sequence of demolition and relocation of existing facilities will be in accordance with the approved critical path schedule as specified in paragraph 1.06 above.

3.02 REMOVAL OF EXISTING PROCESS EQUIPMENT, PIPING AND APPURTENANCES

A. Equipment to be retained by the Owner will be removed by the Owner prior to bidding as specified in Paragraph 1.05 above. Subject to the constraints of maintaining existing facilities in operation as shown or indicated on the Drawings, all other remaining existing process equipment, non-buried valving and piping, and appurtenances shall be removed from the site.

3.03 DEMOLITION

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

1. TO BE DEMOLISHED: For this work, where indicated on the Drawings, demolition shall be the breaking up, cutting, performing any other operations required, and the removal from the site of all structures, substructures, floor slabs, equipment, tanks, pipes, fittings, electric and light poles, wiring, underground conduits and wiring, isolated slabs, sidewalks, etc as indicated on the Drawings, filling of any holes resulting and final grading of the area. All pieces of concrete, metal, and any other demolished material shall be removed to a depth of at least five (5.0) feet below existing grade. Complete removal of structures, slabs, and walls shall be required when as noted on Section Drawings. Broken pieces of concrete may be size reduced by an on-site crusher, but in any event must be removed from the project site.

Before commencing structural demolition, remove all mechanical, electrical, piping and miscellaneous appurtenances. Completely remove the structure by thoroughly breaking up concrete into pieces no more than two feet across the largest dimension.

2. TO BE REMOVED: Where indicated on the Drawings, the structure or equipment shall be completely removed from the site with all associated connecting piping or electrical service. The item shall be taken whole or in parts to be salvaged or disposed of by the Contractor.

3. TO BE ABANDONED: Where indicated on the Drawings, the structure shall be left in place as follows: shall be drained and the contents properly disposed. All tankage to be abandoned with bottom slabs below five (5.0) feet of land surface shall be drilled (min 1" dia. hole for each 50 sq. ft) or hole punched to prevent flotation and filled with clean common fill.

4. SLAB TO BE DEMOLISHED: Where indicated, slabs shall be broken up, cut, or by other means reduced to manageable size and removed from the site. All pieces of concrete, metal and any other demolished material shall be removed from the site. Thoroughly break up concrete into pieces no more than two (2.0) feet across the largest dimension.

5. SLAB TO BE ABANDONED: Where indicated on the Drawings, slabs on grade shall be left in place. Bottom slabs of tankage shall be drilled (min. 1" dia hole for each 50 sq. ft.) or hole punched to prevent flotation and shall be filled with clean common fill.

6. PIPING TO BE REMOVED: Where indicated on the Drawings, pipe (or conduit) shall be drained and the contents properly disposed. The pipe (or conduit) shall then be completely removed from the site, including fittings, valves and other in-line devices. Connections to existing piping to remain shall be plugged by mechanical means (M.J. plugs, tie-rods, thrust blocks, etc.).

7. PIPING TO BE ABANDONED: Where indicated on the Drawings, piping (or conduit) shall be left in place. All such piping shall be drained and the contents properly disposed. The pipe (or conduit) shall then be filled with grout (flowable fill, o.e.) and each end of the pipe (or conduit) shall be plugged using a concrete plug in a manner acceptable to the Engineer.

8. TO BE PROTECTED: Where indicated on the Drawings, the utility service, fence, structure, tree, device etc. so designated shall be temporarily protected (during the prosecution of the demolition work) as specified in Division 1.

9. TO REMAIN where indicated on the Drawings, the designated structure, building, etc. shall remain intact and in service during the prosecution of the demolition work.

3.04 DEWATERING OF EXISTING PROCESS UNITS AND DISPOSAL OF RESIDUE

A. The Contractor shall notify the Owner prior to beginning the dewatering work on any existing process units which contain wastewater, grit, sludge, etc. The Contractor, at his own expense, shall remove the entire contents of each structure and dispose of it off site. The proper transport and disposal of all residues shall remain the responsibility of the Contractor.

END OF SECTION

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SECTION 02080

ABANDONMENT, REMOVAL AND SALVAGE OR DISPOSAL OF EXISTING PIPE REMOVED FROM SERVICE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, equipment and incidentals required to abandon, remove, salvage and/or dispose of existing pipelines as shown on the Drawings and as specified herein.

1.02 QUALITY ASSURANCE

A. Permits and Licenses: Contractor shall obtain and pay respective fees for all necessary permits and licenses for performing the Work and shall furnish a copy of same to the Engineer prior to commencing the Work. The Contractor shall comply with the requirements of the permits. All removal or abandonment of asbestos pipe material shall be performed by a licensed asbestos abatement contractor or subcontractor registered in the State of Florida.

B. Notices: Contractor shall issue written notices of planned work to companies or local authorities owning utility conduit, wires or pipes running to or through the project site. Copies of said notices shall be submitted to the Engineer.

C. Standards:

1. Florida Administration Code, Chapter 17-251, "Asbestos".

2. National Emission Standards Hazardous Air Pollution (NESHAP), 40 CFR Part 61, Subpart M, latest revision.

3. Occupational Safety and Health Act, 29 CFR

4. The Environmental Protection Agency (EPA) Asbestos Abatement Worker Protection Rule.

5. Florida Statute 455.300.

D. Quality Control

1. It shall be the responsibility of the Contractor to provide supervision and inspections to ensure that the existing piping is removed and disposed, salvaged or abandoned as designated in the Drawings and as specified herein.

2. Asbestos Pipe

a. All removal or abandonment of pipe material containing asbestos shall be performed by a licensed asbestos abatement contractor or subcontractor.

b. The asbestos abatement contractor or subcontractor shall contact the Orange County Environmental Protection Division (407-836-7400) prior to removal or abandonment of any asbestos material and shall obtain all required permits and licenses and issue all required notices as required by the Orange County Environmental Protection Division. The Contractor shall be responsible for all fees associated with permits, licenses and notices to the governing regulatory agencies.

c. The asbestos abatement contractor shall perform all work in accordance with all applicable standards referenced in paragraph 1.02.C of this section.

1.03 SUBMITTALS

A. Shop Drawings

1. Shop drawings shall be submitted to the Engineer for review and acceptance prior to construction in accordance with Division 1 for the following:

a. Grout

b. Caps and plugs

c. Credentials of licensed asbestos abatement contractor.

PART 2 - MATERIALS (Not Used)

PART 3 - EXECUTION

3.01 REMOVAL, ABANDONMENT AND DISPOSAL

A. General: Existing piping designated on the Drawings to be removed shall be exposed and removed by the Contractor in accordance with the requirements specified herein.

B. Types of pipe to be removed:

1. Asbestos-Cement Water Main and Force Main

2. Ductile Iron Water Main and Force Main

3. PVC Water Main, Force Main and Sanitary Sewer

4. Vitrified-Clay Sanitary Sewer

5. Galvanized Steel Water Main

C. Removal and Disposal:

1. Pipe designated to be removed and disposed by the Contractor shall be completely drained and the contents properly disposed. The pipe shall then be completely removed from the site, including fittings, valves and other in-line devices.

2. Asbestos: Pipe material containing asbestos shall be removed and disposed by a licensed asbestos abatement contractor or subcontractor in accordance with the standards referenced in paragraph 1.02.C of this section.

D. Removal of material to be salvaged:

1. Pipes, valves and any other material designated on the Drawings to be removed and salvaged shall be completely drained and the contents properly disposed. The pipe shall then be thoroughly pressure washed, palletized on wooden skids to a dimension not exceeding the recommendation of the manufacturer, and conveyed to the Owner at the location designated by the Owner. Any salvaged materials need to be delivered to a location given by the Operation Department.

E. Abandonment:

1. Pipe, valves and any other material designated on the Drawings to be abandoned (or retired in place) shall be left in place, drained and its contents properly disposed. Segments requiring removal shall be done so in accordance with Article 3.01C above. Abandoned pipes are required to be completely filled with grout and each end of the pipe shall be plugged in a manner acceptable to the Engineer. All other pipe requires only end caps or plugs.

2. Grout: Pipe to be abandoned shall be filled with grout in accordance with Section 03600, "Grouting".

3. Plugs: Pipe to be abandoned shall be capped or plugged with a fitting or material that will prevent soil or other deposits form entering the pipe. All caps and plugs shall be submitted to the Engineer for review and acceptance.

END OF SECTION

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SECTION 02140

DEWATERING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The Work to be performed under this section shall include furnishing all equipment and labor necessary to remove storm or subsurface waters from excavation areas in accordance with the requirements set forth, as shown on the Drawings and as stated in the respective geotechnical report if furnished under separate cover.

1.02 QUALITY ASSURANCE

A. The dewatering of any excavation areas and the disposal of the water shall be in strict accordance with the latest revision of all local and state government rules and regulations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 DEWATERING

A. The Contractor shall provide adequate equipment for the removal of storm or subsurface waters which may accumulate in the excavation. Within and adjacent to residential areas, all pumping equipment shall be electrically powered without the use of internal combustion engines or generators associated unless approved in writing by the Owner.

B. If subsurface water is encountered, the Contractor shall utilize suitable equipment to adequately dewater the excavation so that it will be dry for work and pipe laying. A wellpoint system or other Engineer accepted dewatering method shall be utilized if necessary to maintain the excavation in a dry condition for preparation of the trench bottom and for pipe laying.

C. Dry condition shall be defined as groundwater table lowered to a minimum of one (1) foot below the proposed trench bottom or trench bottom soils within 2% optimum moisture content.

D. Dewatering by trench pumping will not be permitted if migration of fine grained natural material from bottom, side walls, or bedding material will occur.

E. In the event that satisfactory dewatering cannot be accomplished due to subsurface conditions or where dewatering could damage existing structures, the Contractor shall obtain the Engineer's review and acceptance of wet trench construction or procedure before commencing construction.

F. Dewatering shall be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

G. The CONTRACTOR shall furnish all materials and equipment and perform all WORK required to install and maintain the drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.

H. During backfilling and construction, water levels shall be measured in observation wells. Observation wells shall be located as directed by UTILITIES.

I. Continuous pumping will be required as long as water levels are required to be below natural levels.

3.02 DISPOSAL

A. Contractor is responsible for acquiring all permits required to discharge the water and shall protect waterways from turbidity during the operation.

B. Contractor shall comply with relevant Supplemental Conditions/Special Provisions (Part G), and Technical Provisions TP 900-3 (Part H) of the Construction Contract for groundwater treatment and disposal.

C. No flooding of streets, roadways, driveways or private property will be permitted. Engines driving dewatering pumps shall be equipped with residential type mufflers.

D. Where the project will require dewatering; water samples at each dewatering location shall be collected and analytical tests from a certified laboratory for the parameters required in the FDEP GENERIC PERMIT FOR THE DISCHARGE OF PRODUCED GROUND WATER FROM ANY NON-CONTAMINATED SITE ACTIVITY 62-621.300 (2). The Contractor shall apply and obtain FDEP permit 62-621.300 (2). Parameters in violation of 62-621.300(2) shall require the DEVELOPER to apply and obtain FDEP permit GENERIC PERMIT FOR DISCHARGES FROM PETROLEUM CONTAMINATED SITES 62-621.300(1).

E. Discharge water shall be clear, with no visible soil particles. Discharge from dewatering shall be disposed of in such a manner that it will not interfere with the normal drainage of the area in which the WORK is being performed, create a public nuisance or form ponding. The operation shall not cause damage to any portion of the WORK completed, in progress, to the surface of streets or to private property. The dewatering operation shall comply with the requirements of National Pollutant Discharge Elimination System (NPDES) and other state and COUNTY regulatory

agencies. Additionally, the CONTRACTOR shall obtain proper right of entry where private property will be involved.

END OF SECTION

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SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY OF WORK

A. This Section includes the following:

4. Preparing and grading subgrades for fill areas, ponds, swales, slabs-on-grade, walks, pavements, grassed areas and landscaping.

5. Subbase course for pavement areas.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 - Section 01001 - General Requirements for special sequencing requirements.

2. Division 2 - Section 02031 - Site Preparation for site stripping, grubbing, topsoil removal, and tree protection.

3. Division 3 - Section 03300 - Cast-In-Place Concrete for concrete encasings, cradles, and appurtenances for utility systems.

1.02 REFERENCES

A. Florida Department of Transportation "Standard Specifications for Road and Bridge Construction, latest edition".

1.03 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, or topsoil materials.

C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

D. Subbase Course: The layer placed between the subgrade and base course in a paving system.

E. Base Course: The layer placed between the subbase and surface pavement in a

paving system.

F. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor's expense.

G. Structures: Footings, foundations, flow control walls slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

H. Utilities include on-site underground pipes, conduits, ducts, and cables.

1.04 SUBMITTALS

General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

A. Product data for the following:

1. Each type of plastic warning tape.

B. Samples of the following:

1. 20-lb samples, sealed in air-tight containers, of each proposed fill and backfill material from on-site or borrow sources.

C. 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 density curve for each soil material.

3. Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.

B. Testing and Inspection Service: Employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.

C. Preinstallation Conference: Before commencing earthwork, meet with

representatives of the governing authorities, Owner, Engineer, consultants, Geotechnical Engineer, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

1.06 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Engineer and then only after acceptable temporary utility services have been provided.

1. Provide minimum of 48-hour notice to the Engineer, and receive written notice to proceed before interrupting any utility.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

General: Provide approved borrow soil materials from off-site when approved soil materials are not available from on site excavations.

A. Satisfactory Soil Materials: ASTM D2487 soil classification groups GW, GP, GM, SW, SP and SM; free of rock or gravel larger than 2 inches in any dimension, debris, waste, organics (muck or peat), vegetation and other deleterious materials.

B. Unsatisfactory Soil Materials: ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.

C. Backfill and Fill Materials: Satisfactory soil materials.

D. Aggregate for stabilizing Subbase: Conforming to FDOT Section 911.

E. Bedding Material: Natural or crushed gravel and sand, ASTM D2940, with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 2 feet 6 inches deep.

1. Tape Colors: Provide tape colors to utilities as follows:

a. Red: Electric

b. Yellow: Gas, oils, steam, and dangerous materials.

c. Orange: Telephone and other communications.

d. Blue: Water Systems.

e. Green: Sewer systems.

B. Non-detectable Warning Tape with 12 gauge locating wire: Tape as specified above without metallic core. Install 12 gauge copper locating wire as depicted on the Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion control measures including silt fences to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent wetlands.

D. Tree protection is specified in the Division 2 - Section 02031 - Site Preparation.

3.02 DEWATERING

A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.03 EXCAVATION GENERAL

A. Explosives: Do not use explosives.

B. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.

3.04 STABILITY OF EXCAVATIONS

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction to maintain stable excavations.

3.05 EXCAVATION FOR STRUCTURES

Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspection.

A. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

B. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Appurtenances: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot. Do not disturb bottom of excavations intended for bearing surface.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

Excavate surface under pavements to indicated cross-sections, elevations and grades.

3.07 APPROVAL OF SUBGRADE

A. Notify Engineer when excavations have reached required subgrade.

B. When Engineer determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Engineer.

3.08 UNAUTHORIZED EXCAVATION

A. When unsuitable soil is encountered at the bottom of excavation (bottom of trenches, foundations, structures and pavements areas), the Engineer must be notified to assess and approve overexcavation and replacement of the unsuitable soil.

B. Overexcavate and remove all unsuitable material to a depth and lateral extent indicated by the Engineer and replace with suitable materials, placed in 12 inch lifts when loose, compacted to the corresponding density requirements for the bottom of excavation.

C. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to the Engineer.

1. Fill unauthorized excavations under other construction as directed by the Engineer.

D. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the Engineer.

3.09 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing; see section 3.3 C for separation of soil during lake excavation. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

3.10 BACKFILL

Backfill excavations promptly, but not before completing the following:

A. Acceptance of construction below finish grade.

B. Surveying locations of underground utilities for record documents.

1. Removal of concrete formwork.

2. Testing, inspection, and approval of underground utilities.

3. Concrete formwork removal.

4. Removal of trash and debris from excavation.

5. Removal of temporary shoring and bracing, and sheeting.

6. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.11 PROOFROLLING

A. Proofroll and compact exposed stripped subgrade using a vibratory roller with minimum static drum weight of 4 tons and minimum impact energy of 36,000 lb, i.e., DYNAPAC CA-25 or equivalent. Dewatering may be necessary before proofrolling.

B. Make a minimum of 10 overlapping passes in a criss-cross pattern in all building and paved areas. Compact subgrade to 95 percent modified Proctor dry density (ASTM D-1557) to a minimum depth of 2.0 feet.

3.12 FILL

A. Preparation: Remove vegetation, topsoil, debris organic material (muck or peat), wet and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.

1. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.

B. Place fill material in layers to required elevations for each location listed below.

1. Under grass, use satisfactory excavated or borrow material.

2. Under walks and fence line slabs, use subbase or base material, or satisfactory excavated or borrow material.

3. Under asphalt concrete base course, use stabilized fill.

4. For building pads, use satisfactory excavated or borrow soil material.

3.13 MOISTURE CONTROL

Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

A. Do not place backfill or fill material on surfaces that are muddy, oily, frozen, or contain frost or ice.

B. Remove and replace, or scarify and air-dry, satisfactory soil material that is too wet to compact to specified density.

1. Stockpile or spread and dry the excavated wet "satisfactory soil material".

3.14 COMPACTION

A. Place backfill and fill materials in layers not more than 12 inches thick, when loose for material

B. Compacted by heavy compaction equipment, and not more than 6 inches thick, when loose for material compacted by hand-operated tampers.

C. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.

D. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D 1557: Under structures, building slabs and steps, and pavements, compact the top 12 inches below subgrade and each layer of backfill or fill material at 98 percent maximum dry

density.

1. Under walkways, compact top 6 inches below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.

2. Under lawn or unpaved areas, compact top 6 inches below subgrade and each layer of backfill or fill material to 90 percent maximum dry density.

3.15 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 existing adjacent grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to conform to 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 0.10 foot.

2. Walks: Plus or minus 0.10 foot.

3. Pavements: Plus or minus 1/2 inch.

C. Grading Within Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 SUBBASE COURSES

A. Under pavements, place subbase course material on prepared subgrades. Place base course material over subbase courses to pavements.

1. Stabilize and compact subbase courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of ASTM D 4254 relative density. Stabilize per FDOT Specifications to a minimum Florida Bearing Value of 75 psi or limerock bearing ratio of 40.

2. Shape subbase and base to required crown elevations and cross-slope grades.

3.17 FIELD QUALITY CONTROL

A. Testing Agency Services: Testing agency will inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Perform field in-place density tests according to ASTM D 1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2937 (drive cylinder method), as applicable.

    a. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.

    b. 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.

2. Footing Subgrade: At footing subgrades, perform at least one test of each soil stratum to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to Engineer.

3. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 10,000 sq. ft. or less of paved area or building slab, or no further than 200 feet apart.

4. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in-place density test for each 150 feet or less of trench, but no fewer than two tests.

B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

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 re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Engineer; reshape, and recompact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved 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.

3.19 DISPOSAL OR STOCKPILE OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus unsatisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

B. Stockpile: Transport surplus satisfactory soil to designated storage areas on the Owner's property. Stockpile or spread soil as directed by Engineer.

END OF SECTION

SECTION 02260

FINISH GRADING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Finish grade sub-soil.

B. Cut out areas to receive stabilizing base course materials for paving and sidewalks.

C. Place, finish grade and compact top soil.

D. For areas where subsequent work by others is anticipated, the Contractor shall provide rough grading and shall maintain the area until the subsequent work is performed.

1.02 PROTECTION

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

PART 2 - PRODUCTS

2.01 MATERIALS

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

PART 3 - EXECUTION

3.01 SUB-SOIL PREPARATION

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

B. Cut out areas to sub-grade elevation, which are to receive stabilizing base for paving and sidewalks.

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

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

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

3.02 PLACING TOPSOIL

A. Place topsoil in areas where seeding, sodding, and planting is to be performed. Place to the following minimum depths, up to finished grade elevations.

1. 6-inches for seeded areas.

2. 4-1/2-inches for sodded areas.

3. 24-inches for shrub beds.

4. 18-inches for flower beds.

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

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

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

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

F. Lightly compact placed topsoil.

3.03 SURPLUS MATERIAL

A. Remove surplus sub-soil and topsoil from site.

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

END OF SECTION

SECTION 02512

ASPHALT RESURFACING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section includes provisions for hot-mixed asphalt paving as resurfacing over a prepared sub base or as an overlay to existing pavement sections.

1.02 SUBMITTALS

A. General: Submit shop drawings in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceed, specified requirements.

C. Pavement marking plans indicating lane separations and defined parking spaces. Note dedicated handicapped spaces with international graphics symbol, if applicable.

1.03 REFERENCE STANDARDS

A. Comply with Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, latest edition, and with local governing regulations if more stringent than herein specified.

1.04 SITE CONDITIONS

A. Weather Limitations: Apply prime and tack coats when ambient temperature is above 50 deg F (10 deg C), and when temperature has not been below 35 deg F (1 deg C) for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

B. Construct hot-mixed asphalt surface course when atmospheric temperature is above 40 deg F (4 deg C), and when base is dry. Base course may be placed when air temperature is above 30 deg F (minus 1 deg C) and rising.

C. Grade Control: Establish and maintain required lines and elevations.

PART 2 - PRODUCTS

2.01 MATERIALS

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

B. Base Course Aggregate (Alternate): Ocala or Miami formation limerock, FDOT Section 911.

C. Base Course: Soil-cement mixture, FDOT Section 921.

D. Surface Course Aggregate: Gradation for Type S-3, FDOT Section 331.

E. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with ASTM D 242 and FDOT Section 917.

F. Asphalt Cement: FDOT Paragraph 916-1, and ASTM D 3381 for viscosity-graded material; ASTM D 946 for penetration-graded material.

1. Viscosity grade AC-20 or AR-8000.

G. Prime Coat: Cut-back asphalt type; ASTM D 2027; MC-30, MC-70 or MC-250. FDOT Paragraph 916-2.

H. Tack Coat: Emulsified asphalt; ASTM D 977. FDOT Paragraph 300-2.3.

I. Herbicide Treatment: Commercial chemical for weed control, registered by Environmental Protection Agency. Provide granular, liquid, or wetable powder form.

J. Lane Marking Paint: FDOT Section 971, Code T-2.

1. Color: White, except blue at handicapped parking.

2.02 ASPHALT-AGGREGATE MIXTURE

Provide plant-mixed, hot-laid asphalt-aggregate mixture complying with ASTM D 3515 and meeting FDOT requirements for Type S-3.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. General: Remove loose material from compacted sub base surface immediately before applying herbicide treatment or prime coat. Where called for in the Drawings, existing surface shall be milled to a minimum depth of one inch (1") prior to cleaning, preparation and prime coating.

B. Proof-roll prepared sub base surface to check for unstable areas and areas requiring additional compaction. Stabilized sub base shall have Florida Bearing Value of 75 psi.

1. Notify Owner/Engineer of unsatisfactory conditions. Do not begin paving work until deficient sub base areas have been corrected and are ready to receive paving.

C. Herbicide Treatment: Apply chemical weed control agent in strict compliance with manufacturer's recommended dosages and application instructions. Apply to compacted, dry sub base prior to application of prime coat.

D. Base Course: As needed, construct a soil cement base course, thickness as indicated, according to FDOT Section 270. Compressive strength shall be 300 psi at 7 days.

E. Alternate Base Course: As needed, construct a limerock base course, thickness as indicated, according to FDOT Section 200. Compact to 98 percent Modified Proctor Density and Local Bearing Ratio of 100.

F. Prime Coat: Apply according to FDOT Section 300 at a rate of 0.20 to 0.50 gal. per sq. yd., over compacted sub grade. Apply material to penetrate and seal, but not flood, surface. Cure and dry as long as necessary to attain penetration and evaporation of volatile materials.

G. Tack Coat: Apply to primed base course after 14 days and contact surfaces of previously constructed asphalt or Portland cement concrete and surfaces abutting or projecting into hot-mixed asphalt pavement. Distribute at rate of 0.05 to 0.15 gal. per sq. yd. of surface.

   A. Allow to dry until at proper condition to receive paving.

H. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.

3.02 PLACING MIX

A. General: Place hot-mixed asphalt mixture on prepared surface, spread and strike off. Spread mixture at minimum temperature of 225 deg F (107 deg C). Place areas inaccessible to equipment by hand. Place each course to required grade, cross-section, and compacted thickness. Comply with FDOT Section 330.

B. Paver Placing: Place in strips not less than 10 feet wide, unless otherwise acceptable to Engineer. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.

   1. Immediately correct surface irregularities in finish course behind paver. Remove excess material forming high spots with shovel or lute.

C. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density and smoothness as other sections of hot-mixed asphalt course. Clean contact surfaces and apply tack coat.

3.03 ROLLING

A. General: Begin rolling when mixture will bear roller weight without excessive displacement.

   1. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

C. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

D. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained 95 percent laboratory maximum density.

E. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot-mixed asphalt. Compact by rolling to specified surface density and smoothness.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.04 TRAFFIC AND LANE MARKINGS

A. Cleaning: Sweep and clean surface to eliminate loose material and dust.

B. Striping: Use specified traffic lane-marking paint, factory-mixed, quick-drying, and non-bleeding.

1. Do not apply traffic and lane marking paint until layout and placement has been verified with the Owner/Engineer.

2. Apply paint with mechanical equipment to produce uniform straight edges. Apply in 2 coats at manufacturer's recommended rates to provide minimum 12 to 15 mils dry thickness.

3.05 FIELD QUALITY CONTROL

A. General: Testing in-place hot-mixed asphalt courses for compliance with requirements for thickness and surface smoothness will be done by Owner's testing laboratory. Repair or remove and replace unacceptable paving as directed by Engineer.

B. Thickness: In-place compacted thickness tested in accordance with ASTM D 3549 will not be acceptable if exceeding following allowable variations:

1. Base Course: Plus or minus 1/2 inch.

2. Surface Course: Plus or minus 1/4 inch.

C. Surface Smoothness: Test finished surface of each hot-mixed asphalt course for smoothness, using 10-foot straightedge applied parallel with and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness:

1. Base Course Surface: 1/4 inch.

2. Wearing Course Surface: 3/16 inch.

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

D. Check surface areas at intervals as directed by Engineer.

END OF SECTION

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SECTION 02570

CONCRETE SIDEWALKS AND DRIVEWAYS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

The work under this section includes constructing new concrete sidewalks, driveways and curbs and gutters as shown on the drawings.

1.02 QUALITY ASSURANCE

A. Codes and Standards: Comply with applicable sections of F.D.O.T. Specifications and local governing regulations.

B. The mixture, placement, and curing of all concrete work shall be in accordance with F.D.O.T. Specifications.

1.03 SUBMITTALS

Furnish manufacturer's product data, design mixes, test reports, and materials certifications.

1.04 JOB CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities, as specified under Section 01001 – General Requirements.

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

1.05 GUARANTEE

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

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. Forms: Steel or wood for each type of use of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

1. Use flexible spring steel forms or laminated boards to form radius bends as required.
2. Coat forms with a non-staining form release agent that will not discolor or deface the surface of the concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, galvanized, AASHTO M55 (ASTM A185).

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

D. Concrete Materials: Comply with requirements of F.D.O.T. Section 345 for concrete materials, admixtures, bonding materials, curing materials, and others as required.

E. Epoxy Resin Grout: Type N as specified in F.D.O.T. Section 926.

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

2.04 CONCRETE MIX, DESIGN AND TESTING

A. Comply with requirements of applicable F.D.O.T. Section 345 for concrete mix design, sampling and testing, and quality control, and as herein specified.

B. Design the mix to produce standard weight concrete consisting of Portland cement, aggregate, air-entraining admixture and water to produce the following properties.

1. Compressive Strength - Class B, 3,000 psi for walks and curbs.

2. Compressive Strength - Class A, 4,000 psi for driveways.

3. Air Content: 3% to 6%

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

PART 3 - EXECUTION

3.01 CONCRETE SIDEWALK, DRIVEWAY, CURB AND GUTTER

A. Surface Preparation:

1. Remove loose material from the compacted sub base surface immediately before placing concrete.

2. Proof-roll prepared sub base surface to check for unstable areas and the need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving. Comply with requirements of F.D.O.T. Section 230, paragraph 230-6.

B. Form Construction:

1. Set forms to the required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of the work and so that forms can remain in place at least 24 hours after concrete placement.

2. Check completed formwork for grade alignment to the following tolerances:

   a. Top of forms not more than 1/8" in 10'.

   b. Vertical face on longitudinal axis, not more than 1/4" in 10'.

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

C. Concrete Placement:

1. Do not place concrete until sub base and forms have been checked for line and grade. Moisten if required to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are completed to required finish elevation and alignment. Use special colors or aggregate as required to match existing material.

2. Place concrete using methods, which prevent segregation of the mix. Consolidate concrete along the face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels and joint devices. Do not use vibrators to push or move concrete in forms or chute.

3. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place a construction joint.

4. Automatic machine may be used for sidewalk or curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed the minimum herein specified. Machine placement must produce sidewalks and/or curbs and gutters to the required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

5. Joints: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of the concrete, unless otherwise indicated. Construct transverse joints at right angles to the centerline, unless otherwise indicated. When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

   a. Weakened-Plane Joints: Proved weakened-plane (contraction) joints sectioning concrete into areas as shown on the drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, by sawing within 24 hours of placement or formed during finishing operations. Place joints at intervals not to exceed 10' if not otherwise indicated.

b. Construction Joints: Place construction joints at the end of all pours and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such pours terminate at expansion joints. Construction joints shall be as shown or, if not shown, use standard metal keyway-section form of appropriate height.

c. Expansion Joints:
   (1) Provide premolded joint filler for expansion joints abutting concrete curbs, catch basin, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.
   (2) Locate expansion joints at 30' o.c. for concrete walks unless otherwise indicated.
   (3) Extend joint fillers full-width and depth of joint, and not less than 1/2" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.
   (4) Furnish joint fillers in one-piece lengths for the full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together. Pieces shorter than 4" shall not be used unless specifically shown as such.
   (5) Protect the top edge of the joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.
   (6) Fillers and Sealants: Comply with the requirements of these specifications for preparation of joints, materials installation, and performance, and as herein specified.

D. Concrete Finishing:

1. After striking-off and consolidating concrete, smooth the surface by screening and floating. Use hand methods only where mechanical floating is not possible. Adjust the floating to compact the surface and produce a uniform texture.

2. After floating, test surface for trueness with a 20' straightedge. Variations exceeding 1/3" for any two points within 10' shall not be acceptable. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

3. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round 10 1/2" radius, unless otherwise indicated. Eliminate any tool marks on concrete surface.

4. After completion of floating and when excess moisture or surface sheen has disappeared broom finish sidewalks by drawing a fine-hair broom across concrete surface, perpendicular to a line of pedestrian traffic. If existing material has another finish, match existing finish.

5. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas.

E. CURING

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

F. Repairs and Protections:

1. Repair or replace broken or defective concrete, as directed by the Engineer.

2. Drill test cores where directed by the Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy resin grout.

3. Protect concrete from damage until acceptance of work. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

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

3.05 FIELD QUALITY CONTROL

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

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

END OF SECTION

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SECTION 02575

PAVEMENT REMOVAL AND REPLACEMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Work included under this section consists of cutting, removing, protecting and replacing existing pavements of the various types encountered including roadways, driveways, sidewalks, curb and combination curb and gutter.

B. Permits: The Contractor shall obtain the necessary permits prior to any work involving existing pavement removal or replacement. Additionally, the Contractor shall provide advance notice to the appropriate authority, as required, prior to construction operations.

C. Protection of Existing Improvements: The Contractor shall be responsible for the protection of all pavements, sidewalks and other improvements within the work area. All damage to such improvements, because of the Contractor's operations, beyond the limits of the work of pavement replacement as described herein, shall be repaired by the Contractor at his expense.

D. Maintenance of Traffic: The Contractor shall furnish all labor, materials, equipment and incidentals required to maintain public vehicular and pedestrian traffic within the limits of this project, for the work prescribed herein. Maintenance of traffic shall include all such detour facilities, safety devices, traffic control personnel, and operations as are required for the safety and convenience of the public. If requested by the governing authority, the Contractor shall prepare a complete maintenance of traffic plan and submit for review and comment.

E. Signalization/Pavement Markings: The Contractor shall be responsible for repair or replacement of all traffic signalization devices and loops damaged during construction. The Engineer/Project Manager shall be notified a minimum of 48 hour prior to signalization disruption. All pavement markings damaged by removal and replacement of the respective permanent pavement areas shall be replaced to equal condition of the existing.

1.02 JURISDICTIONAL REQUIREMENTS

A. Agency Compliance: Work within the rights-of-way of public thoroughfares shall conform to the requirements of the governmental agency or governing authority having jurisdiction. Specifically, work within state highway right-of-way shall be in full compliance with all requirements of the permit drawings, and to the satisfaction of the Florida Department of Transportation and work within Orange County right-of-way shall be in full compliance with all requirements of the Orange County Public Works Department.

B. Applicable Standards:

1. Portions of the Standard Specifications for Road and Bridge Construction of the Florida Department of Transportation, latest revision, and supplements thereto herein after referred to as the FDOT Specifications, are referred to herein and amended, in part, and the same are hereby made a part of this Contract to the extent of such references, and shall be as binding upon the Contract as though reproduced herein in their entirety.

2. Florida Department of Transportation Utility Accommodation Guide, latest revision.

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

4. Right-of-way Utilization Regulations, Orange County, Florida.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials, including soil cement, bituminous prime and tack coat, and asphaltic concrete for the above work shall meet the requirements established therefore by the FDOT Specifications.

1. Cement shall be Portland cement, Type I, II, III, or Type 1-P per FDOT Specification Section 921.

2. Bituminous prime coat material shall be cutback asphalt Grade RC-70.

3. Bituminous tack coat material shall be emulsified asphalt Grade RS-2.

4. Asphaltic concrete shall be Type S-I for structural courses and FC for friction courses, unless specified otherwise in the drawings.

5. Concrete shall be Class B, 3,000 psi concrete in accordance with Division 3 - Concrete, unless specified otherwise in the drawings.

PART 3 - EXECUTION

3.01 GENERAL

A. Pedestrian or School Crossings: Where the work crosses or interferes with school or pedestrian crossings, extreme care shall be taken by the Contractor to insure the safety of schoolchildren or other pedestrians. Temporary road re-surfacing, sidewalks, signalization and markings shall be constructed or repaired immediately following excavation and backfilling.

3.02 PERFORMANCE

A. Removals:

1. Pavement Removal: Where existing pavement is to be removed, the surfacing shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge, with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal and pavement width shall be limited as shown on the Drawings.

2. Sidewalk, Driveway, & Curb Removal: Asphalt and concrete sidewalks, curbs, combination curb and gutter, walks, drive ribbons, or driveways shall be removed by initially sawing the structure, with a suitable power saw, as specified above for pavement. When a formed joint in the concrete exists within 3 feet of the proposed saw cut and parallels the proposed saw cut, the removal line shall be extended to the formed joint. After sawing, the material shall be removed and disposed of by the Contractor. Unless otherwise shown on the Drawings, the limits of removal and replacement of asphalt and concrete driveways shall extend from the edge of the existing pavement to the right-of-way line.

B. Permanent Pavement Replacement/Restoration:

1. General: Pavement cut and removed under this contract that is designated to remain or roadway surface which are to receive asphalt overlay with no additional base course construction shall be restored in accordance with FDOT Specifications and specifications provided herein.

2. Asphalt Roadway Pavement Restoration:

a. Construction methods and equipment utilized for permanent pavement restoration shall generally meet the requirements therefore as established in the FDOT Specifications, but shall be modified to meet the relatively narrow strip construction conditions. Any such modifications shall be approved by the Engineer prior to their use.

b. Stabilized sub grade shall be compacted for its full thickness (minimum 12") to not less than 98 percent of maximum density as determined by AASHTO Designation T 180.

c. Joints with existing surface and base shall be straight and neat. If necessary to obtain a straight neat joint, the Contractor shall cut out sufficient existing material and replace it with new material.

d. After compaction of the stabilized sub grade, the Contractor shall install a replacement base course to match the existing or in conformance with the minimum requirements of FDOT when within their right-of way, and/or shall install a replacement base course consisting of a minimum 8", 3000 psi high early strength concrete when within Orange County right-of-way.

e. After base reconstruction, the surface shall be tack-coated and an asphaltic concrete structural course consisting of matching type and thickness of that removed shall be constructed to match the undisturbed grade at all edges.

3. Asphalt Driveway Restoration: Driveway pavement with limerock base cut and removed in connection with trench excavation shall be replaced or restored with the new limerock base course and shall equal the existing base course in thickness, except that in no case shall new driveway base course be less than 6 inches in thickness. Muck or unsuitable material found under existing driveway construction shall be removed and replaced as directed by the Engineer.

4. Concrete Sidewalk, Walkway, Driveways, Driveway Ribbon and Curb Restoration:

a. Concrete sidewalks, walkways, driveways, driveway ribbons and curbs required to be removed for the installation of facilities under this Contract shall be restored within five days of the closing of trench. Class B concrete shall be used in all cases.

b. Replaced portions of these items shall conform to the lines, grades and cross sections of the removed portions. Concrete sidewalks and walkways shall be of 4-inch thickness; concrete driveways and driveway ribbons shall be of 6-inch thickness and be reinforced to match the existing concrete. Replaced concrete curb and/or gutter shall join neatly to the remaining section.

5. Unpaved Walkways, Driveways or Roadways: Stabilized soil, clay, gravel or mulched walkways, driveways or roadways shall be repaired with like materials to provide a surface comparable to or better than the disturbed surface.

3.03 CLEAN-UP AND PROTECTION OF NEW WORK

A. After all repair and restoration has been completed, all excess asphalt, dirt, rock and other debris shall be removed from the roadways, gutters and storm systems. Any defects caused by the construction shall be repaired by the Contractor at no additional cost to the Owner.

B. Do not permit vehicular or pedestrian traffic of any kind on any new asphalt or concrete surface until the surface has hardened sufficiently not to be distorted, marked or damaged.

C. The Contractor shall maintain all temporary pavement surfaces until permanent pavement has been completed or until the temporary pavement has been removed to accommodate proposed work by others.

3.04 WARRANTY

A. The Contractor shall maintain pavement under this Contract during the warranty period of one (1) year after acceptance or until removed by the roadway improvement construction, and shall promptly refill and repave areas, which have settled, cracked or are otherwise unsuitable for traffic.

END OF SECTION

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SECTION 02660
WASTEWATER TRANSMISSION MAINS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work under this Section includes providing a complete system for wastewater transmission pressure piping and appurtenant items.

1.02 QUALITY ASSURANCE

A. Design Requirements:

1. Piping shall be laid with a minimum cover of 36 inches below finished grade, unless otherwise indicated.

2. Wastewater Transmission Mains as specified under this section shall be constructed of Polyvinyl Chloride (PVC) Pipe (Section 15064 – PVC Pipe and Fittings) or High Density Polyethylene (HDPE) Pipe (Section 15071 – HDPE Pipe and Fitting, if applicable) as shown no the Drawings or listed in the Bid Schedule.

3. Changes in horizontal and vertical alignment of PVC pipe may NOT be achieved through pipe or joint deflection.

4. All force mains shall be installed with a continuous, insulated 10 gauge copper wire color coded the same as the pipe and installed directly on top of the pipe for location purposes. Wire shall terminate at the top of each valve and be capable of extending 18" above the top of the box.

5. All PVC force mains shall be a solid green.

B. Pipe Inspection: The Contractor shall obtain from the pipe manufacturers a certificate of inspection to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications. All pipe and fittings shall be subjected to visual inspection at time of delivery by rail or truck, also just before they are lowered into the trench to be laid, and joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor. The entire product of any plant may be rejected when, in the opinion of the Owner, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

C. Prevention of Electrolysis: Where shown on Drawings or deemed necessary, electrolytic action through the contact of dissimilar metals shall be prevented by either:

1. The separation of one material from the other by means of an insulating or dielectric coupling (polyethylene wrap), or

2. The use of alternative materials, as directed by the Engineer.

1.04 SUBMITTALS

A. Shop drawings shall be submitted to the Engineer for review and acceptance prior to construction in accordance with Division 1 for the following:

1. Pipe materials including linings and coatings

2. Joints including restrained, mechanical and push on joints

3. Restrainers

4. Detailed laying schedule for pipeline

5. Valves and valve boxes

6. Fittings

7. Temporary plug and anchorage system for hydrostatic pressure test

8. Tapping sleeves and valves

9. Air release valves, enclosures and vaults

10. Identification tape and locator balls (See Section 02533)

B. Acceptance Of Material: The Owner reserves the right to sample and test any pipe or fitting after delivery and to reject all pipe and fittings represented by any sample which fails to comply with the specified requirements.

1.05 JOB CONDITIONS

A.Water in Excavation: Water shall not be allowed in the trenches while the pipes are being laid and/or tested. The Contractor shall not open more trench than the available pumping facilities are able to dewater to the satisfaction of the Engineer. The Contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the territory in which he is working. In no case shall the pipelines being installed be used as drains for such water, and the ends of the pipe shall be kept properly and adequately blocked during construction by the use of accepted stoppers and not by improvised equipment. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other obstructing matter into the pipelines. If on completion of the work any such material has entered the pipelines, it must be cleaned as directed by the Engineer so that the entire system will be left clean and unobstructed,

PART 2 - PRODUCTS

2.01 MATERIALS

All materials furnished for this project shall be in accordance with the "APPENDIX D - LIST OF APPROVED PRODUCTS" as appended to these specifications.

A. Polyvinyl Chloride Pipe and Fittings: Polyvinyl chloride (PVC) pipe shall meet the requirements of Section 15064 - Polyvinyl Chloride Pipe and Fittings.

B. High Density Polyethylene (HDPE) Pipe and Fittings: High Density Polyethylene (HDPE) pipe and fittings shall meet the requirements of Section 15071 – High Density Polyethylene (HDPE) Pipe and Fittings.

C. Plug Valves: Wastewater force mains shall have plug valves as shown on the PLANS. Valves shall be installed as detailed on the Standard Drawings.

1. Plug valves shall be eccentric, ballcentric, or full port.

2. Plug valves shall be installed complete with operating hand wheels, extension stems, buried gear actuators, 2-inch operating nuts as required for normal operation.

3. Valves shall have the name of the manufacturer and the size of the valve cast or molded onto the valve body. A permanent plate shall be attached to the valve or operator indicating serial number, order number, accessories, operator model and manufacturer, etc.

4. Ballcentric/Eccentric plug valves shall be of the non-lubricated type with 80 percent port areas. The port area for valves 4 to 20 inch shall have a minimum 80 percent nominal pipe diameter. Valves 24 inches and larger shall have a minimum port area of 70 percent of nominal pipe diameter.

5. Minimum pressure rating of valves 4 to 12 inches shall be 175 psi; valves 14 to 72 inches shall be 150 psi. Valve bodies shall be cast iron ASTM A 126, Class B and fusion bonded epoxy coated. Valve ends shall be screwed, flanged or mechanical joint as indicated on the drawings. Plugs shall be cast iron or ductile iron with neoprene facing and shall be of the single piece design. The plug shall be of the same configuration for all valves and shall require no stiffening member opposite the plug for balance or support. Valve body seats shall have a welded in overlay of not less than 90 percent nickel. Packing shall be adjustable and safely replaceable. Bushings shall be 316 stainless steel in both upper and lower journals and be protected from foreign matter with the use of a grit seal or similar. The valve should be capable of drip tight shut off with flow in either direction at the full pressure of the valve. All exposed nuts, bolts, springs, and washers on buried service valves shall be 304 stainless steel. All above grade valves shall have 316 stainless steel hardware.

6. Face to Face dimensions shall be in conformance to ASME B16.10 and the following dimensions:

Valve Size (inches)	Face to Face (inches)
4	9.0
6	10.5
8	11.5
12	14.0
16	17.75
20	23.5
24	42.0

D. Valve Boxes:

1. Cast iron valve boxes shall be provided for all valves installed underground. The valve boxes shall be adjustable to fit the depth of earth cover over the valve and shall be designed so as to prevent the transmission of surface loads directly to the valve or piping. The valve boxes shall be provided with covers marked SEWER which shall be so constructed as to prevent tipping or rattling. Extension sections shall be cast or ductile iron only. The protective concrete collar shall be constructed of Class B concrete, of the dimensions as shown on the drawings and be constructed with bronze identification disc as shown. The barrel shall be two-piece, screw type, having 5-1/4 inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with cast iron covers.

2. Valve box with operating nut extension is required for any size main that is six feet or greater below finished grade. The extension shall be high strength, corrosion resistant steel construction and permanently attached to the operating nut. The operation nut extension insert shall be one complete assembled unit with a self-adjusting extension stem system that fits inside a standard valve box that will accommodate variable trench depths six-feet and greater as shown in the Standard Drawings. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. A valve box centering device designed to eliminate the shifting of the valve box against the operating nut of the valve shall be used. Valve box assembly shall be adjustable to accommodate variable drench depths six-foot and greater as shown in the Standard Drawings.

3. The stem assembly shall be of the telescoping design that allows for variable adjustment length. The material shall be at minimum galvanized square steel tubing. The stem assembly shall have a built-in device that prevents the stem assembly from disengaging at its fully extended length. The extension stem must be capable of surviving a torque test to 1,000 ft-lb without failure.

4. Valve boxes shall have locking lids.

5. All valve boxes in non-paved areas shall be installed with a valve collar as shown in the Standard Drawings

6. Accessories include valves, collars, tracing wire, and valve markers.

J. Air Release Valves:

1. Wastewater force mains shall be equipped with combination air release valves located at the high points on the mains as shown on the plans. Valves shall be located in an enclosure as detailed on the Standard Drawings.

2. Wastewater Combination Air Release Valve:
The valve body shall be conical in shape and shall be 316 stainless steel with a funnel shape lower body to automatically drain sewage back into the system. All internal parts shall be corrosion resistant 316 stainless steel or non-metallic plastic parts.

3. On flanged connections 316 stainless steel bolts, nuts, and washers are to be used along with the proper sized gasket.

F. Tapping Sleeves and Valves: Tapping sleeves and tapping valves used to make "wet" taps into existing mains shall be provided and installed at locations as shown in the Drawings. Tapping sleeve shall be steel fusion epoxy coated body with stainless steel straps, bolts, nuts and washers. Contractor shall determine the outside diameter of the existing main prior to order sleeve. Tapping valve shall be standard resilient seat gate valve meeting the requirements of AWWA C509. For wastewater service the tapping valve shall be installed on its side, left fully open with the operating nut removed and followed by a plug valve meeting the requirements as indicated above.

G. Concrete: Concrete shall conform to the requirements of Division 3.

H. Tie Rods: Steel for tie rods and tie bolts shall conform to the requirements of ASTM Designation A 242, and rods shall be galvanized in conformance with requirements of ASTM Designation A 123.

I. Additional Work: Additional items of construction, necessary for the complete installation of the systems, shall conform to specific details shown on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these specifications.

PART 3 - EXECUTION

3.01 PREPARATION

A. Bedding:

1. Pipe Cradle: Upon satisfactory installation of the pipe bedding material as specified in Section 02220, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.

2. Cleanliness: The interior of the pipes shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other methods accepted by the Engineer. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

3.02 INSTALLATION

A. Pipe:

1. Gradient: Lines shall be laid straight, and depth of cover shall vary to provide uniform gradient or slope to pipe, whether grading is completed or proposed at time of pipe installation. When a grade or slope is shown on the Drawings, batter boards with string line paralleling design grade, or other previously approved means, shall be used by the Contractor to assure conformance to required grade.

2. Pipe Joint Deflection: Changes in horizontal and vertical alignment of PVC pipe may NOT be achieved through pipe or joint deflection. The maximum allowable tolerance in the joint due to variances in installation is 0.75 degrees (3-inches per joint per 20 ft stick of pipe). No bending tolerance in the pipe barrel shall be acceptable. Alignment change shall be made only with sleeves and fittings.

3. Rejects: Any pipe found defective shall be immediately removed and replaced with sound pipe at the Contractor's expense.

4. Joint Compounds: No sulphur base joint compound shall be used.

5. Thrust restraints shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the drawings or herein. Restraining devices shall be specified in Sections 15062 - Ductile Iron Pipe and Fittings and 15064 - Polyvinyl Chlorine Pipe and Fittings, respectfully.

B. Installing Valves and Boxes:

1. Valves: Valves shall be carefully inspected, opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Plug valves shall have the disc shaft installed horizontally. Any valve that does not operate correctly shall be removed and replaced.

2. Valve Boxes: Valve boxes shall be carefully centered over the operating nuts of the valves so as to permit a valve key to be fitted easily to the operating nut. In unpaved areas, valve boxes shall be set to conform to the level of the finished surface and held in position by a concrete collar placed under the support flange as shown on the Drawings. The valve box shall not transmit surface loads to the pipe or valve. Extensions or risers for valve boxes shall be an integral part of the box. No cut sections of D.I. or PVC pipe shall be used in extending the box to its proper height. Care shall be taken to prevent

earth and other material from entering the valve box. Any valve box which is out of alignment or whose top does not conform to the finished ground surface shall be dug out and reset. Before final acceptance of the work all valve boxes shall be adjusted to finish grade.

C. Concrete Encasement (Only if approved by OCU RPR):

1. Concrete encasement shall be constructed in accordance with details shown on the Drawings and shall be constructed of Class C concrete. Encasement shall be constructed where:
   a. Indicated on the Drawings.
   b. The Engineer shall order the line encased.

2. The points of beginning and ending of pipe encasement shall be not more than 6 inches from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

3. Concrete Collar: Each valve installed in an unimproved area (outside of pavement, driveways or sidewalks) shall require a 24" x 24" x 6" concrete pad or collar as shown in the Drawings.

4. Identification Disc: Each valve installed shall be identified by a 3" diameter bronze disc anchored in the concrete pad or collar in unimproved areas and/or anchored on a 4" x 4" x 18" long concrete post set flush with the pavement surface in improved areas. The disc shall be stamped with the following information as shown on the Drawings:
   a. size of the valve
   b. type of valve
   c. service
   d. direction and number of turns to open

D. Flush Out Connections: Flush out connections shall be installed at the locations as determined by the Engineer and be full pipe size.

E. Backfilling: Backfilling shall be in accordance with Section 02220 of these specifications.

3.03 CLEANING

A. General: At the conclusion of the work, the Contractor shall thoroughly clean the new pipe lines by flushing with water or other means to remove all dirt, stones or other material which may have entered the line during the construction period.

B. Correction of Non-Conforming Work: All non-conforming work shall be repaired or replaced by the Contractor at no additional expense to the Owner. Non-conforming work shall be defined as failure to adhere to any specific or implied directive of this Project Manual and/or the drawings, including but not limited to paid not laid straight, true to the lines and grades as shown on the drawings, damaged or unacceptable materials, misalignment or diameter ring deflection in pipe due to

bedding or backfilling, visible or detectable leakage and failure to pass any specified test or inspection.

3. 04 WATER FOR USE IN TESTING AND FLUSHING

A. The Contractor will provide the water required for pressure testing and flushing. Where potable water is used for flushing, the Contractor shall furnish backflow protection through a "jumper" assembly as approved by the Owner and Engineer. Where reclaimed water is used for flushing, the Contractor shall coordinate all disposal of the flushing water with FDEP.

B. Swabbing (in lieu of flushing for pipes larger than 12-inch):

1. In lieu of flushing, new water mains may be hydraulically or pneumatically cleaned with a polypropylene swabbing device to remove dirt, sand and debris from the main.
2. The purpose of swabbing a new pipeline is to conserve water while thoroughly cleaning the pipeline of all foreign material, sand, grit, gravel, construction debris and other items not found in a properly cleaned system. Prior to pressure testing and chlorinating of a new pipeline swabbing shall be utilized to remove foreign matter.
3. If swabbing access and egress points are not provided in the design drawings, it will be the responsibility of the CONTRACTOR to provide temporary access and egress points for the cleaning, as required.
4. Cleaning of the water main shall be done in conjunction with the initial filling of the main for its hydrostatic test. After initial slow fill, pipe shall sit for a full 24 hours to facilitate cleaning and collection of the debris from interior of the pipe. The line to be cleaned shall only be connected to the existing distribution system at a single connection point. Mains shall be hydraulically or pneumatically cleaned with a polypropylene swabbing device.
5. The CONTRACTOR shall insert flexible polyurethane foam swabs (two pounds per cubic foot density) complete with rear polyurethane drive seals, into the first section of pipe. The swabs shall remain there until the pipeline construction is completed.
6. Cleaning and flushing shall be accomplished by propelling the swab down the pipeline to the exit point with potable water. Swabbing speed shall range between two and five feet per second. Flushing shall continue until the water is completely clear and swab is retrieved. Passage of cleaning poly swabs through the system shall be constantly monitored, controlled and all poly swabs entered into the system shall be individually marked and identified so that the exiting of the poly swabs from the system can be confirmed.
7. Locate and open all new in-line valves beyond the point of connection on the pipeline to be cleaned during the swabbing operation.
8. At the receiver or exit point(s) for the poly swab, the Contractor is responsible for creating a safe environment for collection of debris, water and the swab. Considerations shall be made for protecting surrounding personnel and property and safe retrieval of the swab.
9. The Contractor shall re-apply a series of individual swabs in varying diameters and/or densities as required, to attain proper cleanliness of

pipeline.

10. After the swabbing process, pressure testing and disinfection of the pipe shall be completed in accordance with these specifications.
11. Only UTILITIES personnel shall operate the supply valve from the existing distribution system. Cleaning and flushing shall be accomplished by propelling the swab down the pipeline to the exit point with potable water. Flushing shall continue until the water is completely clear and swab is retrieved.
12. Swabbing speed shall range between 2 and 5 feet per second.
13. After the swabbing process, pressure testing and disinfection of the pipe shall be completed in accordance with this manual

3.05 FIELD QUALITY CONTROL

A. Flushing: All pipelines shall be flushed and/or swabbed to remove all sand and other foreign matter. The Contractor shall dispose of the flushing water without causing a nuisance or property damage.

B. Pressure and Leakage Tests of Pressure Piping:

1. General: The Contractor shall perform hydrostatic pressure and leakage tests on all pressure piping. Tests shall be conducted on segments between valves and no more than 2000 linear feet is to be tested at one time unless otherwise accepted by the Engineer.

2. Standard: AWWA C600, Section 4, with the exceptions required herein and the exception that the Contractor shall furnish all gauges, meters, pressure pumps and other equipment needed to test the lines.

3. Hydrostatic Pressure Test:
   a. Test Pressure: 50 percent above the normal working pressure, but not less than 100 psi, unless otherwise noted on the drawings.
   b. Test Duration: 24 hours
   c. Air Release: Corporation cocks at least 3/4-inch in diameter, pipe riser and angle globe valves shall be provided at each dead-end to bleed air from the line.

4. Hydrostatic Leakage Test
   a. General: Following the pressure test, the Contractor shall perform the leakage test. The line shall be filled with water and all air removed for the test. The Contractor shall provide a pump to maintain the test pressure for the entire test period.
   b. Test Pressure: Maximum operating pressure as determined by the Engineer but not less than 100 psi unless otherwise noted.
   c. Test duration: 2 hours.
   d. Allowable leakage:

$$L = \frac{SD(P)^{0.5}}{148{,}000}$$

L = Allowable leakage (gallons per hour)
S = Length of pipe tested (feet)
D = Nominal diameter of pipe (inches)
P = Average test pressure maintained (psig)

e. Visible Leakage: All leaks evident at the surface shall be repaired and leakage eliminated regardless of the measured total leakage.

f. Leakage Measurement: The amount of water required to maintain the test pressure is the leakage.

C. Approval: The wastewater line shall not be placed in service until the requirements of the State and/or County Public Health Department are met, and the letter of clearance is obtained from the Florida Department of Environmental Protection.

END OF SECTION

SECTION 02661

RECLAIMED WATER TRANSMISSION SYSTEM

PART 4 - GENERAL

4.01 DESCRIPTION

A. Scope of Work: Provide a complete system for reclaimed water transmission/distribution pressure piping and appurtenant items.

4.02 QUALITY ASSURANCE

A. Design Requirements:
   1. Piping shall be laid with a minimum cover of 36-inches below finished grade for mains sized 12-inch and below and a minimum cover of 48-inches for mains sized 16-inch and greater. Pipe located within Local roadways (subdivisions) or within an easement, shall be laid with a minimum cover of 30-inches.
   2. Pipelines shall be constructed of the materials indicated in this specification and on the Drawings.

B. Pipe Inspection:
   1. The Contractor shall obtain a certificate of inspection from the pipe manufacturer stating that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications.
   2. The entire product of any plant may be rejected when, in the opinion of the County, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.
   3. All pipe and fittings shall be subjected to a visual inspection at the time of delivery and before being lowered into the trench. Joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor.
   4. The County reserves the right to sample and test any pipe or fitting after delivery and to reject all pipe and fittings represented by any sample which fails to comply with the specified requirements.

C. Prevention of electrolysis is required in accordance with AWWA C105 and when crossing, or adjacent to, a power easement, gas easements, any location where induced currents may be present, in areas where aggressive soils exist, and where shown on Drawings. Electrolytic action through the contact of dissimilar metals shall be prevented by either:
   1. The separation of one material from the other by means of an insulating or dielectric coupling (polyethylene wrap), or
   2. The use of alternative materials, as directed by the County.

4.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County for review and acceptance prior to construction

in accordance with the General Conditions and specifications Section 01300 "Submittals".

1. Mill test certificates or certified test reports on pipe.
2. Details of restrained and flexible joints.
3. Detailed laying schedule for pipe.
4. Valves and valve boxes.

4.04 JOB CONDITIONS

A. Water in Excavation:
   1. Dewatering shall be in accordance with. Section 02140 "Dewatering". Water shall not be allowed in the trenches while the pipes are being laid and/or tested. The Contractor shall not open more trench than the available pumping facilities are able to dewater to the satisfaction of the County. The Contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the territory in which he is working.
   2. In no case shall the pipelines being installed be used as drains. The ends of the pipe shall be kept properly and adequately blocked during construction by the use of approved stoppers and not by improvised equipment.
   3. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other obstructing matter into the pipelines. If on completion of the Work any such material has entered the pipelines, it must be cleaned as directed by the County so that the entire system will be left clean and unobstructed.

PART 5 - PRODUCTS

5.01 GENERAL

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

5.02 MATERIALS

A. All materials shall be in accordance with Appendix D "List of Approved Products" as appended to these specifications.

B. Pipe, Fittings, Valves, and Ancillary Equipment shall be installed as shown on the Drawings and as specified in Division 15.

C. Additional Work: Additional items of construction, necessary for the complete installation of the systems, shall conform to specific details shown on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these specifications.

PART 6 - EXECUTION

6.01 PREPARATION

A. Bedding:
   1. Pipe Cradle: Upon satisfactory installation of the pipe bedding material as specified in Section 02220 "Excavating, Backfilling and Compacting", a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.
   2. Cleanliness: The interior of the pipes shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other methods approved by the County. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

6.02 INSTALLATION

A. Pipe Identification/Location
   1. All PVC reclaimed water mains shall be solid pantone purple (522-C) in color. All lettering shall appear legibly on the pipe and shall run the entire length of the pipe. Lettering shall read as is acceptable for the intended use.
   2. All ductile iron reclaimed water mains shall be color-coded pantone purple with tape. The tape (minimum 2”) shall be permanently affixed to the top and each side of the pipe (three locations parallel to the axis of the pipe). For pipes less than 24-inches in diameter, a single tape may be used along the top of the pipe.
   3. All HDPE reclaimed water mains shall be either a solid purple or black with four co-extruded equally spaced purple stripes of the same material as the pipe. Stripes painted on the pipe outside surface shall not be acceptable.
   4. If main is located over 30 feet from the edge of the pavement or in an easement, the Contractor shall install four inch diameter schedule 80 PVC utility pipe line markers over the pipe alignment at 1000 feet intervals, at all valves, and at all locations where fittings deflect the pipe alignment in the horizontal plane. Utility pipe line markers shall include a decal and shall be colored purple for reclaimed water service.
   5. All mains (PVC, HDPE, and DI) shall be installed with a continuous, insulated 10-gauge copper wire installed directly above the pipe for location purposes. Locate wire shall terminate in a test station box and be capable of extending 12-inches above the top of the box. Directionally drilled pipe shall be installed with two insulated 10-gauge copper wires.

B. Pipe: The color stripe and pipe text shall be located at the top of the pipe when installed. When installing PVC pipe, no additional joints will be installed until the preceding pipe joint has been completed and the pipe carefully embedded and secured in place.
   1. Gradient: Pipe shall be laid straight and depth of cover shall vary to provide uniform gradient or slope to pipe, whether grading is completed or proposed at time of pipe installation. When a grade or slope is shown on the Drawings, batter boards with string line paralleling design grade, or other previously approved means, shall be used by the Contractor to assure conformance to required grade.
   2. Pipe Joint Deflection:
      a. Ductile Iron Pipe: Whenever it is desirable to deflect pipe, the amount of deflection shall not exceed 75% of the maximum limits as shown in AWWA Standard C600 for ductile iron pipe.
      b. PVC Pipe: Joint deflection or pipe bending shall not be permitted. The maximum allowable tolerance in the joint due to variances in installation is 0.75 degrees (3-inches per joint per 20 foot stick of pipe). No bending tolerance in the pipe barrel shall be acceptable. Alignment change shall be made only with sleeves and fittings.
   3. Rejects: Any pipe found defective shall be immediately removed and replaced with sound pipe at the Contractor's expense.
   4. Joint Compounds: No sulfur base joint compound shall be used.
   5. Thrust restraints shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein. Restraining devices shall be specified in Sections 15062 "Ductile Iron Pipe and Fittings" and 15064 "Polyvinyl Chlorine (PVC) Pipe and Fittings", respectfully.

C. Installing Valves and Boxes:
   1. Valves: Valves shall be carefully inspected, fully opened, and then tightly closed and the various nuts and bolts shall be tested for tightness. Any valve that does not operate correctly shall be removed and replaced.
   2. Valve Boxes: Valve boxes shall be carefully centered over the operating nuts of the valves so as to permit a valve key to be fitted easily to the operating nut. In unpaved areas, valve boxes shall be set to conform to the level of the finished surface and held in position by a concrete collar placed under the support flange as shown on the Drawings. The letter "V" shall be etched in the curb at each valve location. The valve box shall not transmit surface loads to the pipe or valve but be supported by bedding rock as shown on the Drawings. Extensions or risers for valve boxes shall be an integral part of the box. No cut sections of D.I. or PVC pipe shall be used in extending the box to its proper height. Care shall be taken to prevent earth and other material from entering the valve box. Any valve box which is out of alignment or whose top does not conform to the finished ground surface shall be dug out and reset. Before final acceptance of the Work all valve boxes shall be adjusted to finish grade.
   3. Concrete Collar: Each valve installed in an unimproved area (outside of pavement, driveways or sidewalks) shall require a 24-inch x 24-inch x 6-inch concrete pad or collar as shown in the Drawings.

4. Identification Disc: Each 16-inch or larger valve (unless otherwise shown on the Drawings) installed shall be identified by a 3-inch diameter bronze disc anchored in the concrete pad or collar in unimproved areas and/or anchored on a 4-inch x 4-inch x 18-inch long concrete post set flush with the pavement surface in improved areas. The disc shall be stamped with the following information as shown on the Drawings:
    a. Size of the valve.
    b. Type of valve.
    c. Service.
    d. Direction and number of turns to open.

D. Concrete Encasement:
    1. Concrete encasement shall be constructed in accordance with details shown on the Drawings and shall be constructed of Class C concrete. Encasement shall be constructed where:
        a. Indicated on the Drawings.
        b. The County orders the pipe encased.
    2. The points of beginning and ending of pipe encasement shall be not more than 6-inches from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

E. Flush Out Connections: Flush out connections shall be installed at the locations as determined by the County and be full pipe size.

F. Service Connections: Service connections shall be installed at the locations determined by the County and in the manner shown on the Drawings. No service line shall terminate under a driveway.

G. Backfilling: Backfilling shall be in accordance with Section 02220 "Excavating, Backfilling and Compacting" of these specifications.

6.03 CLEANING

A. General: At the conclusion of the Work, the Contractor shall thoroughly clean the new pipe lines by flushing with water or other means to remove all dirt, stones, or other material which may have entered the line during the construction period. Flushing is permitted for pipes less than or equal to 12-inch diameter.

B. Correction of Non-Conforming Work: All non-conforming work shall be repaired or replaced by the Contractor at no additional expense to the County. Non-conforming work shall be defined as failure to adhere to any specific or implied directive of this Project Manual and/or the Drawings, including but not limited to pipe not laid straight, true to the lines and grades as shown on the Drawings, damaged or unacceptable materials, misalignment or diameter ring deflection in pipe due to bedding or backfilling, visible or detectable leakage, or failure to pass any specified test or inspection.

6.04 FIELD QUALITY CONTROL

A. Flushing:

1. All pipelines less than or equal to 12 inches shall be flushed to remove all sand and other foreign matter. After initial slow-fill, pipe shall sit full for 24 hours to facilitate cleaning and collection of debris from interior of pipe. Flushing shall be accomplished through full pipe size connections at full pipe depth. The velocity of the flushing water shall be at least 2.5 feet per second. Flushing shall be terminated at the direction of the County. The Contractor shall dispose of the flushing water without causing a nuisance or property damage. The Contractor shall arrange with the County and pay for the source of flushing water.
2. In lieu of flushing, new reclaimed water mains may be hydraulically or pneumatically cleaned with a polypropylene swabbing device in accordance with "Orange County Utilities Standards and Construction Specifications Manual".
    a. The Contractor is responsible to provide temporary access and egress points.
    b. Passage of the cleaning swabs through the system shall be constantly monitored, controlled, and all poly swabs entered into the system shall be individually marked and identified.
    c. Cleaning of the system shall be done in conjunction with the initial filling of the system for its hydrostatic test.
    d. The Contractor is responsible for collection of debris, water, and the swab. Considerations shall be made for protecting surrounding property and personnel.
    e. Swabbing speed shall range between two and five feet per second.

B. Pressure and Leakage Tests of Pressure Piping
1. General: The Contractor shall perform hydrostatic pressure and leakage tests on all pressure piping. Tests shall be made between valves and shall not exceed 2,000 feet. Each side of all valves shall be pressure tested. Multiple sections of main may be tested simultaneously providing there are non-pressurized sections in between each pressure tested section.
2. Standard: AWWA C600, Section 4, with the exceptions required herein and the exception that the Contractor shall furnish all gauges, meters, pressure pumps, and other equipment needed to test the lines.
3. Hydrostatic Pressure Test:
    a. Test Pressure: 50 percent above the normal working pressure, but not less than 150 psi, unless otherwise noted on the Drawings.
    b. Test Duration: 2 hours. If during the test, the integrity of the tested line is in question, the County may require a six-hour pressure test.
    c. Air Release: Corporation cocks at least 3/4-inch in diameter, pipe riser, and angle globe valves shall be provided at each dead-end to bleed air from the line.
4. Hydrostatic Leakage Test
    a. General: Following the pressure test, the Contractor shall perform the leakage test. The line shall be filled with water and all air removed for the test. The Contractor shall provide a pump to maintain the test pressure for the entire test period.
    b. Test Pressure: Maximum operating pressure as determined by the County but not less than 150 psi unless otherwise noted.
    c. Test duration: 2 hours.
    d. Allowable leakage: $L = \frac{SD(P)0.5}{148,000}$

L = Allowable leakage (gallons per hour)
S = Length of pipe tested (feet)
D = Nominal diameter of pipe (inches)
P = Average test pressure maintained (psig)

e. Visible Leakage: All leaks evident at the surface shall be repaired and leakage eliminated regardless of the measured total leakage.
f. Leakage Measurement: The amount of water required to maintain the test pressure is the leakage.

C. Wire Continuity Check: The Contractor shall perform a continuity check of the 10-gauge locate wire for the entire length of the main by performing a continuity test at each valve test station box.

6.05 SUPPLIER'S FIELD SERVICE:

A. The Contractor shall, at no additional cost to the County, arrange for a pipe supplier's field representative to be on-site to provide instruction to each crew working on the installation for a minimum of four push-on joints (PVC, DIP). The supplier's field representative shall certify that the installations observed were satisfactorily completed and all pipe installation crews were familiar with the proper methods and procedures for the pipeline installations.

6.06 WATER FOR USE IN FLUSHING, TESTING, AND DISINFECTION:

A. The Contractor shall arrange with the County for water required for pressure testing and flushing required by the Contractor. The Contractor shall provide meter and backflow preventer.

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SECTION 02662

POTABLE WATER TRANSMISSION/DISTRIBUTION MAINS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work under this Section includes providing a complete system for water transmission/distribution pressure piping and appurtenant items.

1.02 QUALITY ASSURANCE

A. Design Requirements:

1. Piping shall be laid with a minimum cover of 36 inches below finished grade, unless otherwise indicated.

2. Pipelines shall be constructed of the materials indicated on the Drawings. Ductile iron pipe may be substituted for the polyvinyl chloride pipe with written approval of the Engineer.

3. Changes in horizontal alignment of DI mains may be achieved through use of allowable pipe deflection in lieu of fittings shown on the Drawings at the Contractor's option, but subject to approval of the Engineer as to layout. Said deflection shall not exceed 50% of the limits set forth in applicable AWWA Standards. Changes in horizontal and vertical alignment of PVC pipe may NOT be achieved through pipe or joint deflection.

4. All water mains shall be installed with a continuous, insulated 10 gauge copper wire, color to match pipe identification color, installed directly on top of the pipe for location purposes. Wire shall loop at the top of each valve and be capable of extending 18" above the top of the box.

5. All PVC water mains shall be solid blue. All lettering shall appear legibly on the pipe and shall run the entire length of the pipe. Lettering shall read as is acceptable for the intended use.

6. All ductile iron water mains shall be marked with a continuous stripe located within the top 90 degrees of the pipe. Said stripe shall be a minimum 2 inches in width and shall be oil based paint, blue in color. Backfill shall not be placed for 30 minutes following paint application.

7. All pipe on this project shall be supplied by a single manufacturer unless otherwise directed, in writing by the Engineer.

B. Pipe Inspection: The Contractor shall obtain from the pipe manufacturers a certificate of inspection to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications. All pipe and fittings shall be subjected to visual inspection at time of delivery by rail or

truck, also just before they are lowered into the trench to be laid, and joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor. The entire product of any plant may be rejected when, in the opinion of the Owner, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

C. Prevention of Electrolysis: Where shown on Drawings or deemed necessary, electrolytic action through the contact of dissimilar metals shall be prevented by either:

1. The separation of one material from the other by means of an insulating or dielectric coupling.

2. The use of alternative materials, as directed by the Engineer.

1.03 SUBMITTALS

A. Shop drawings shall be submitted to the Engineer for comment prior to construction in accordance with Division 1 for the following:

1. Pipe materials including linings and coatings

2. Joints including restrained, mechanical and push on joints

3. Restrainers

4. Detailed laying schedule for pipeline

5. Valves and valve boxes

6. Fittings

7. Temporary plug and anchorage system for hydrostatic pressure test

8. Tapping sleeves and valves

9. Air release valves, enclosures and vaults

10. Identification tape and locator balls (See Section 15180)

B. Acceptance Of Material: The Owner reserves the right to sample and test any pipe or fitting after delivery and to reject all pipe and fittings represented by any sample which fails to comply with the specified requirements.

1.04 JOB CONDITIONS

A. Water in Excavation: Water shall not be allowed in the trenches while the pipes are being laid and/or tested. The Contractor shall not open more trenches than the available pumping facilities are able to dewater to the satisfaction of the Engineer. The Contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the territory in which he is working. In no case

shall the pipelines being installed be used as drains for such water, and the ends of the pipe shall be kept properly and adequately blocked during construction by the use of directed stoppers and not by improvised equipment. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other obstructing matter into the pipelines. If on completion of the work any such material has entered the pipelines, it must be cleaned as directed by the Engineer so that the entire system will be left clean and unobstructed.

PART 2 - PRODUCTS

2.01 MATERIALS

All materials furnished for this project shall be in accordance with the "APPENDIX D - LIST OF APPROVED PRODUCTS" as appended to these specifications.

A. Ductile Iron Pipe and Fittings: Ductile iron pipe shall meet the requirements of Section 15062 - Ductile Iron Pipe and Fittings.

B. Polyvinyl Chloride (PVC) Pipe and Fittings: Polyvinyl chloride (PVC) pipe shall meet the requirements of Section 15064 - Polyvinyl Chloride (PVC) Pipe and Fittings.

C. High Density Polyethylene Pipe and Fittings: High Density Polyethylene (HDPE) pipe shall meet the requirements of Section 15071 - High Density Polyethylene (HDPE) Pipe and Fittings.

D. Gate Valves: Resilient seated gate valves shall be used for potable water mains (unless otherwise indicated on the Drawings).

1. Gate valves shall be resilient seat gate valves, manufactured to meet or exceed the requirements of AWWA C509/C515, latest revision, and in accordance with these specifications. Valves shall have an unobstructed water way equal to or greater than the full nominal diameter of the valve. Valves shall have a minimum pressure rating of 250 psi.

2. Gate Valves shall be installed vertically per the design drawings and with minimum depth of cover per the PLANS. Vertical valves 16" and larger shall be AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with spur gear actuators unless noted by the Engineer. The valve body, bonnet and bonnet cover shall be ductile iron ASTM A536. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating in accordance with AWWA C550. A 2-inch wrench nut shall be provided for operating the valve. All valves are to be tested in strict accordance with AWWA C515.

3. Directional Opening: All valves shall open left or counter clockwise.

4. The valves shall be non-rising stems with the stem made of cast, forged, or rolled bronze as specified in AWWA C509. Two stem seals shall be provided and shall be of the O-ring type. The stem nut must be independent of the gate.

5. The resilient sealing mechanism shall provide zero leakage at test and normal working pressure when installed with the line flow from either direction.

D. Valve Boxes:

1. Standard Two-Piece Cast Iron Valve Box:
Cast Iron Two-Piece valve boxes are required for mains less than six feet below finished grade and less than or equal to 12 inches in diameter. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surfaces as directed by UTILITIES. The barrel shall be screw type only, having 5-1/4" shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with locking cast iron covers. Covers shall have WATER cast into top for all water mains.

2. Valve Box Assembly:
Valve box assemblies are required for any size main that is size feet or greater below finished grade or if mains are greater than 12 inches in diameter. Valve boxes shall be one complete assembled unit composed of the valve box and extension stem that attaches and locks to the two-inch wrench nut. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. A valve box centering device designed to eliminate the shifting of the valve box against the operating nut of the valve shall be used. Valve box assembly shall be adjustable to accommodate variable trench depths six feet and greater as shown on the Standard Drawings.

3. Valve box insert shall be one complete assembled unit with a self-adjusting extension stem system that fits inside a standard valve box that will accommodate variable trench depths six-feet and greater as shown in the Standard Drawings.

4. Valve boxes shall have locking lids utilizing a five sided nut with a special wrench needed to open. Valve lids to be made as shown in the Standard Drawings.

5. Valve collars shall be 24"x24" square or round and poured in place with 3000psi concrete or made out of a fiberglass re-inforced concrete polymer material manufactured to the specifications as shown in the Standard Drawings.

6. Locating wire shall be 10-guage single strand solid core copper wire with insulation. The color of the insulation shall be the same color as the color code for the pipe being installed.

7. Valve markers are to be made of schedule 80 PVC and have a decal applied containing information as shown in the Standard Drawings. The marker must be the same color as the pipe being marked.

E. Air Release Valves: Air release valves or for use on potable water mains shall be installed in the high points of the water main in an enclosure as shown on the Drawings. The air release valves for use in water mains shall be single body combination air

release valves designed to release large quantities of air at startup, admit air on shut down and release air in operation. Air release valves shall be 316 stainless steel, 316 stainless steel float, bronze water diffuser Buna-N or Viton seat and stainless steel trim. Fittings from the main to the air release valve in the enclosure shall be threaded and made of brass.

F. Fire Hydrants and Valve Assemblies:

1. Fire hydrants shall be 5-1/4 inch minimum valve opening and shall comply with the current AWWA Standard Specifications C502. Fire hydrants shall be of ample length for 3 foot depth of bury with necessary extensions to place safety flange the required 5 inches above finished grade. Each hydrant shall be made in at least two (2) sections bolted together. All interior working parts of the hydrant shall be removable form the top of the hydrant to allow repairs without removing the hydrant barrel after it has been installed. It shall be provided with two (2) 2-1/2 inch hose nozzles and one (1) 4-1/2 inch pumper nozzle, all having its specific Fire District Standard hose threads. All nozzles shall have caps attached by chains. Operating nuts shall be AWWA Standard. Fire hydrants shall be manufactured without drain holes, or the manufacturer shall permanently plug drain or weep holes. Three (3)-operating wrenches shall be furnished for every ten (10) hydrants installed or relocated.

2. All hydrant assemblies shall incorporate anchoring hydrant fittings, including M.J. Locked Hydrant Tee with split gland to provide the locking together of the entire assembly. Gate valve shall be as specified in Paragraph 2.02 of this section.

3. All hydrants shall have a 40-inch to 90-inch square by 6-inch thick reinforced concrete shear pad as shown in the Drawings.

4. Fire hydrants shall be located in the general location as shown on the Drawings. Final field location of all hydrants shall be as directed by the Owner. All hydrants shall be located no less than five (5) and no more than ten (10) feet from the edge of pavement of the adjacent roadway and no less than five (5) feet from any physical feature which may obstruct access or view of any hydrant unless otherwise directed by the Owner.

5. All non-brass parts of the hydrant, both inside and out, shall be painted in accordance with AWWA C502. The shoe of the hydrant below the ground line shall have a fusion bonded epoxy coating and the barrel of the hydrant below ground shall be coated with a mastic material by the manufacturer. The above ground portion of the hydrant shall be coated in accordance with Section 09910 Painting (For Utility Systems). The paint used shall be from the manufacturers and type as listed in Appendix D, “List of Approved Products.”

G. Service Saddles:

1. Stainless Steel service saddles: Epoxy or nylon coated ductile iron body with stainless steel, 18-8 type 304 straps, AWWA tapered threads for 1-inch and 2-inch to be iron pipe threads. Controlled OD saddles to be used on C905 PVC

pipe, double straps to be 2-inch minimum width each, single strap to be minimum of three inches wide.

2. Service Connections:

a. PVC Pipe Service Saddle:
   i) 1-inch and 2-inch services utilize brass body saddle with controlled OD for 12-inches and smaller pipe.
   ii) 1-inch and 2-inch taps on existing pipes larger that 12-inches shall use controlled OD epoxy or nylon coated ductile iron body with stainless steel 18-8 type 304 straps.
   iii) 4-inch or larger services shall be mechanical tapping sleeves.

b. Ductile Iron Pipe Service Saddle:
   i) 1-inch services shall be direct tapped.
   ii) 2-inch services shall use a controlled OD service tapping saddle with stainless steel straps and a ductile iron body that is either nylon or epoxy coated.
   iii) 4-inch or larger services shall be mechanical tapping sleeves.

c. Concrete Pressure Pipe Service Saddle:
   i) Tapped concrete pressure pipe shall be in accordance with AWWA M-9, using a strap-style saddle made specifically for concrete cylinder pressure pipe.

d. HDPE Pipe Service Saddle:
   i) 1-inch and 2-inch shall utilize controlled OD tapping saddle with epoxy or nylon coated stainless steel 18-8 type 304 double straps. Taps to HDPE pipe shall be approved on a case by case basis.
   ii) Taps, 4-inch and larger, shall use wide body tapping sleeves with a broad cross section gasket set in a retaining groove that increases sealing capability as pressure increases.

e. Steel Pipe Service Saddle:
   i) Welded-on steel sleeves shall be used for all sizes and applications.

H. Corporation Stops and Curb Stops: Corporations stops and curb stops shall be all brass suitable for 150 psi operating pressure compatible with the connecting service piping type, threaded in accordance with AWWA C800/C901 and be directed for potable water use and bear the seal of the National Sanitation Foundation (NSF), and shall be of sizes required and/or noted on the Drawings.

I. Polyethylene Service Pipe: Polyethylene tubing for service connections shall comply with AWWA C800/C901 and be directed for potable water use and bear the seal of the National Sanitation Foundation (NSF). The product shall be rated for a minimum working pressure of 150 psi and a Dimension Ration DR-9 size. The tubing shall be designated copper tube size and the material PE-2406 cell classification minimum PE213323C in accordance with ASTM 3350.

J. Tapping Sleeves and Valves: Tapping sleeves and tapping valves used to make "wet" taps into existing mains shall be provided and installed at locations as shown in the Drawings. Tapping sleeve shall be mechanical joint - split body or steel fusion epoxy coated body with stainless steel straps, bolts, nuts and washers. Contractor shall determine the outside diameter of the existing main prior to ordering sleeve. Tapping valve shall be as specified in Paragraph 2.01C of this section.

K. Concrete: Concrete shall conform to the requirements of Division 3.

L. Tie Rods: Steel for tie rods and tie bolts shall conform to the requirements of ASTM Designation A 242, and rods shall be galvanized in conformance with requirements of ASTM Designation A 123.

M. Additional Work: Additional items of construction, necessary for the complete installation of the systems, shall conform to specific details shown on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these specifications.

PART 3 - EXECUTION

3.01 PREPARATION

A. Bedding:

1. Pipe Cradle: Upon satisfactory installation of the pipe bedding material as specified in Section 02220, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.

2. Cleanliness: The interior of the pipes shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other methods directed by the Engineer. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

3.02 INSTALLATION

A. Pipe:

1. Gradient: Lines shall be laid straight, and depth of cover shall vary to provide uniform gradient or slope to pipe, whether grading is completed or proposed at time of pipe installation. When a grade or slope is shown on the Drawings, batter boards with string line paralleling design grade, or other previously directed means, shall be used by the Contractor to assure conformance to required grade.

2. Pipe Joint Deflection: Whenever it is desirable to deflect pipe, the amount of deflection shall not exceed 50% of the maximum limits as shown in AWWA Standard C600 for ductile iron pipe. Changes in horizontal and vertical alignment of PVC pipe may NOT be achieved through pipe or joint deflection.

3. Rejects: Any pipe found defective shall be immediately removed and replaced with sound pipe at the Contractor's expense.

4. Joint Compounds: No sulfur base joint compound shall be used.

5. Thrust restraints shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the drawings or herein. Restraining devices shall be specified in Sections 15062 - Ductile Iron Pipe and Fittings and 15064 - Polyvinyl Chlorine Pipe and Fittings, respectfully.

B. Installing Valves and Boxes:

1. Valves: Valves shall be carefully inspected, opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Any valve that does not operate correctly shall be removed and replaced.

2. Valve Boxes: Valve boxes shall be carefully centered over the operating nuts of the valves so as to permit a valve key to be fitted easily to the operating nut. In unpaved areas, valve boxes shall be set to conform to the level of the finished surface and held in position by a concrete collar placed under the support flange as shown on the Drawings. The valve box shall not transmit surface loads to the pipe or valve. Extensions or risers for valve boxes shall be an integral part of the box. No cut sections of DI or PVC pipe shall be used in extending the box to its proper height. Care shall be taken to prevent earth and other material from entering the valve box. Any valve box which is out of alignment or whose top does not conform to the finished ground surface shall be dug out and reset. Before final acceptance of the work all valve boxes shall be adjusted to finish grade.

3. Concrete Collar: Each valve installed in right-of-way or easement areas (outside of pavement, driveways or sidewalks) shall require a 24" x 24" x 6" concrete pad or collar as shown in the Drawings. The collar shall also include a 2" PVC pipe with a 2" brass/bronze plug (containing the location wire) penetrating the collar and accessible at the surface.

4. Identification Disc: Each valve installed (unless otherwise shown on the Drawings) shall be identified by a 3" diameter bronze disc anchored in the concrete pad or collar in right-of-way or easement areas, in the concrete sidewalk or driveway and/or anchored on a 4" x 4" x 18" long concrete post set flush with the pavement surface in asphalt pavement areas. The disc shall be stamped with the following information as shown on the Drawings:
   a. size of the valve
   a. type of valve
   b. service
   c. direction and number of turns to open

C. Concrete Encasement (Only if approved by OCU RPR):

1. Concrete encasement shall be constructed in accordance with details shown on the Drawings and shall be constructed of Class C concrete. Encasement shall be constructed where:
   a. Indicated on the Drawings.
   b. The Engineer shall order the line encased.

2. The points of beginning and ending of pipe encasement shall be not more than 6 inches from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

D. Flush Out Connections: Flush out connections shall be installed at the locations as determined by the Engineer and be full pipe size.

E. Backfilling: Backfilling shall be in accordance with Section 02220 of these specifications.

3.03 CLEANING

A. General: At the conclusion of the work, the Contractor shall thoroughly clean the new pipe lines by flushing with water or other means to remove all dirt, stones or other material which may have entered the line during the construction period.

B. Correction of Non-Conforming Work: All non-conforming work shall be repaired or replaced by the Contractor at no additional expense to the Owner. Non-conforming work shall be defined as failure to adhere to any specific or implied directive of this Project Manual and/or the drawings, including but not limited to paid not laid straight, true to the lines and grades as shown on the drawings, damaged or unacceptable materials, misalignment or diameter ring deflection in pipe due to bedding or backfilling, visible or detectable leakage and failure to pass any specified test or inspection.

3. 04 WATER FOR USE IN TESTING AND FLUSHING

A. The Contractor will provide the water required for pressure testing and flushing. Where potable water is used for flushing, the Contractor shall furnish backflow protection through a “jumper” assembly as approved by the Owner and Engineer. Where reclaimed water is used for flushing, the Contractor shall coordinate all disposal of the flushing water with FDEP.

B. Swabbing (in lieu of flushing for pipes larger than 12-inch):

1. In lieu of flushing, new water mains may be hydraulically or pneumatically cleaned with a polypropylene swabbing device to remove dirt, sand and debris from the main.
2. The purpose of swabbing a new pipeline is to conserve water while thoroughly cleaning the pipeline of all foreign material, sand, grit, gravel, construction debris and other items not found in a properly cleaned system. Prior to pressure

testing and chlorinating of a new pipeline swabbing shall be utilized to remove foreign matter.

3. If swabbing access and egress points are not provided in the design drawings, it will be the responsibility of the CONTRACTOR to provide temporary access and egress points for the cleaning, as required.
4. Cleaning of the water main shall be done in conjunction with the initial filling of the main for its hydrostatic test. After initial slow fill, pipe shall sit for a full 24 hours to facilitate cleaning and collection of the debris from interior of the pipe. The line to be cleaned shall only be connected to the existing distribution system at a single connection point. Mains shall be hydraulically or pneumatically cleaned with a polypropylene swabbing device.
5. The CONTRACTOR shall insert flexible polyurethane foam swabs (two pounds per cubic foot density) complete with rear polyurethane drive seals, into the first section of pipe. The swabs shall remain there until the pipeline construction is completed.
6. Cleaning and flushing shall be accomplished by propelling the swab down the pipeline to the exit point with potable water. Swabbing speed shall range between two and five feet per second. Flushing shall continue until the water is completely clear and swab is retrieved. Passage of cleaning poly swabs through the system shall be constantly monitored, controlled and all poly swabs entered into the system shall be individually marked and identified so that the exiting of the poly swabs from the system can be confirmed.
7. Locate and open all new in-line valves beyond the point of connection on the pipeline to be cleaned during the swabbing operation.
8. At the receiver or exit point(s) for the poly swab, the Contractor is responsible for creating a safe environment for collection of debris, water and the swab. Considerations shall be made for protecting surrounding personnel and property and safe retrieval of the swab.
9. The Contractor shall re-apply a series of individual swabs in varying diameters and/or densities as required, to attain proper cleanliness of pipeline.
10. After the swabbing process, pressure testing and disinfection of the pipe shall be completed in accordance with these specifications.
11. Only UTILITIES personnel shall operate the supply valve from the existing distribution system. Cleaning and flushing shall be accomplished by propelling the swab down the pipeline to the exit point with potable water. Flushing shall continue until the water is completely clear and swab is retrieved.
12. Swabbing speed shall range between 2 and 5 feet per second.
13. After the swabbing process, pressure testing and disinfection of the pipe shall be completed in accordance with this manual

3.05 FIELD QUALITY CONTROL

A. Flushing: All pipelines shall be flushed and/or swabbed to remove all sand and other foreign matter. The Contractor shall dispose of the flushing water without causing a nuisance or property damage.

B. Pressure and Leakage Tests of Pressure Piping:

1. General: The Contractor shall perform hydrostatic pressure and leakage tests on all pressure piping and against both sides of all valves.

2. Standard: AWWA C600, Section 4, with the exceptions required herein and the exception that the Contractor shall furnish all gauges, meters, pressure pumps and other equipment needed to test the lines.

3. Hydrostatic Pressure Test:
   a. Test Pressure: 50 percent above the normal working pressure, but not less than 150 psi, unless otherwise noted on the drawings.
   b. Test Duration: 24 hours
   c. Air Release: Corporation cocks at least 3/4-inch in diameter, pipe riser and angle globe valves shall be provided at each dead-end to bleed air from the line.

4. Hydrostatic Leakage Test
   a. General: Following the pressure test, the Contractor shall perform the leakage test. The line (in intervals between valves) shall be filled with water and all air removed for the test. The Contractor shall provide a pump to maintain the test pressure for the entire test period.
   b. Test Pressure: Maximum operating pressure as determined by the Engineer but not less than 150 psi unless otherwise noted.
   c. Test duration: 2 hours.
   d. Allowable leakage:

$$L = \frac{SD(P)^{0.5}}{148{,}000}$$

L = Allowable leakage (gallons per hour)
S = Length of pipe tested (feet)
D = Nominal diameter of pipe (inches)
P = Average test pressure maintained (psig)

   e. Visible Leakage: All leaks evident at the surface shall be repaired and leakage eliminated regardless of the measured total leakage.
   f. Leakage Measurement: The amount of water required to maintain the test pressure is the leakage.

3.06 DISINFECTING POTABLE WATER PIPELINES

A. General: Before being placed in service, all potable water pipelines shall be disinfected by chlorination. Taps for chlorination and sampling shall be uncovered and backfilled by the Contractor as required. The Engineer shall approve the disinfection procedure.

B. Standard: AWWA 651, "Standard Procedures for Disinfecting Water Mains".

C. Procedure:

1. Flush all dirty or discolored water from the line and introduce chlorine in directed dosages through a tap at one end while water is being withdrawn at the other end of the line.

2. The chlorine solution shall remain in the pipeline for 24 hours.

3. Following the chlorination period, all treated water shall be flushed from the line and replaced with water from the distribution system.

4. Bacteriological sampling and analysis shall be made in full accordance with AWWA Manual C651 and the appropriate FDEP permit. If necessary, the Contractor will be required to rechlorinate.

5. The Owner shall do sampling and analysis.

D. Approval: The potable water line shall not be placed in service until the requirements of the State and/or County Public Health Department are met, and the letter of clearance is obtained from the Florida Department of Environmental Protection.

END OF SECTION

SECTION 02722

GRAVITY SANITARY SEWAGE COLLECTION SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work included under this section consists of furnishing all labor, equipment and materials necessary for the construction of sanitary sewers, sewer connections and appurtenances as shown on the Drawings or specified herein.

1.02 QUALITY ASSURANCE

A. Storage: Polyvinyl chloride pipe shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the polyvinyl chloride pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes. Where necessary, due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

B. Tests: Certified records of tests made by the manufacturer, or by a reliable commercial laboratory, or both, shall be submitted with each shipment of pipe. All pipe will be inspected upon delivery and that which does not conform to the requirements of these specifications shall be rejected and must be immediately removed by the Contractor. The Contractor shall furnish and provide samples of pipe for the performance of such additional tests as the Utility Owner may deem necessary.

1.03 SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be submitted to the Utility Engineer for approval prior to construction in accordance with the specifications for the following:
   a. Precast manholes
   b. Manhole frames, covers and other castings
   c. Manufacturer's certified test report on castings
   d. Certified test records for polyvinyl chloride pipe
   e. Mill Test Certificates on ductile iron pipe
   f. Manhole - pipe connections
   g. Coal tar epoxy
   h. Special interior coatings

B. Record Information: The Contractor shall submit to the Utility Engineer the elevations of the north edge of the manhole covers and inverts of all pipes in the manholes.

PART 2 - PRODUCTS

2.01 MATERIALS

All materials furnished for the utility work shall be in accordance with the “APPENDIX D -

LIST OF APPROVED PRODUCTS" as appended to these specifications.

A. Ductile Iron Pipe and Fittings: Ductile iron pipe shall meet the requirements of Section 15062 - Ductile Iron Pipe and Fittings.

B. Polyvinyl Chloride Pipe and Fittings: Polyvinyl Chloride (PVC) Pipe shall meet the requirements of Section 15064 - Polyvinyl Chloride Pipe and Fittings.

C. Precast Concrete Manholes:

1. Precast manholes shall conform to the requirements of ASTM Designation C 478.
   a. The minimum shell thickness shall be 5 inches.
   b. Lifting holes through the structures are not permitted.
   c. The design of the structure shall include a precast base of not less than 8 inches in thickness poured monolithically with the bottom section of the manhole walls.
   d. Where drop structures are required, the design of the structure shall include a precast base, for the drop structure, of not less than 8 inches in thickness poured monolithically with the bottom section of the manhole walls.

2. Top sections shall be eccentric, except that concentric top sections shall be used where shallow cover requires a top section less than 3 feet deep.

D. Concrete and Reinforcing Steel: Concrete and reinforcing steel shall conform to the requirements of Division 3 - Concrete. Concrete classes for the various purposes shall be as follows:

1. Manhole bottoms, Class A

2. Precast manholes, Class A (4,000 psi)

3. Pipe and riser encasement, Class C

4. Protective slabs, Class C

E. Castings: Gray iron castings for manhole frames, covers, and other items shall conform to the ASTM Designation A 48, Class 30. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength, or otherwise make them unfit for the service intended. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Casting patterns shall conform to those shown or indicated on the drawings. The words SANITARY and ORANGE COUNTY, FLORIDA shall be cast in all manhole covers as shown on the drawings. All manhole frames and covers shall be traffic bearing unless otherwise specified.

F. Brick: Brick for manhole construction shall be dense, hard burned, shale or clay brick conforming to ASTM Designation C 32, Grade MM or C 62, Grade MW, except that brick absorption shall be between five and twenty-five grams of water absorbed in one minute by dried brick, set flat face down, in 1/8 inch of water.

G. Cement Mortar: Cement mortar for manhole construction shall comply with ASTM Designation C 270, Type M, except that the cement shall be Portland Type II only. No mortars that have stood for more than one hour shall be used.

H. Pipe Adapter: Connection of PVC gravity sewer lines to precast manholes and wetwells shall be made by using a flexible boot type manhole coupling adapter, as manufactured by KOR-N-SEAL or accepted equal.

I. Coal Tar Epoxy: Exterior of all manhole and wetwell surfaces shall have a protective coating of coal tar epoxy with a minimum dry film thickness of 9 mils. Coating shall be applied by the manhole manufacturer in two (2) coats to attain the specified dry film thickness. Material shall be that specified in the Orange County Utilities Standards and Construction Specification Manual - Appendix "D" - List of Approved Products.

J. Protective Interior **Coating**: Interior surfaces of manholes and wetwells shall be coated with material specified in the Orange County Utilities Standards and Construction Specification Manual - Appendix "D" - List of Approved Products unless otherwise shown on the Drawings. Surface preparation (cleaning, sandblasting, acid etching, etc.), material application and curing shall be performed in accordance with the manufacturer's recommendations.

K. Protective Interior **Lining**: Interior surfaces of manholes and wetwells requiring protective linings shall be lined at the precast factory with a high density polyethylene (HDPE) or polypropylene random copolymer (PP-R) lining system. Material shall be that specified in the Orange County Utilities Standards and Construction Specification Manual - Appendix "D" - List of Approved Products.

L. Joint Sealer: Joint sealer material for precast manhole structures shall be preformed flexible plastic material specified in the Orange County Utilities Standards and Construction Specification Manual - Appendix "D" - List of Approved Products. Seal all exterior joints with Portland Type II cement after setting of joint sealer and placement of manhole section to form a watertight joint.

M. Non-Shrink Mortar: Non-shrink mortar for filling annular spaces and holes in precast manholes and wetwells shall be Embeco No. 167 Mortar or accepted equal.

PART 3 - EXECUTION

3.01 PREPARATION

A. Upon satisfactory excavation of the pipe trench, as specified in Section 02220, a continuous trough for the pipe barrel and recesses for the pipe bells shall be excavated by hand digging so that, when the pipe is laid in the trench, true to line and grade, the pipe barrel will receive continuous uniform support and the bell will receive no pressure from the trench bottom.

B. The interior of all pipe shall be thoroughly cleaned of all foreign material before being lowered in the trench and shall be kept clean during laying operations by means of plugs, or other approved methods.

3.02 INSTALLATION

A. Sewer Pipe:

1. General:
   a. Pipe laying shall proceed up gradient with spigot ends pointing in the direction of flow. Before pipe is joined, gaskets shall be cleaned of all dirt and stones and other foreign material. The spigot ends of the pipe and/or pipe gaskets shall be lubricated lightly with a lubricant as specified by the pipe manufacturer and approved by the Utility Engineer. Sufficient pressure shall be applied to the pipe so as to properly seat the socket into the bell of the pipe. Any damage to the pipe due to over-exertion shall be repaired at the Contractor's expense. All pipe shall be laid straight, true to the lines and grades shown on the Drawings in each manhole section.
   b. Variance from established line and grade, at any point along the length of the pipe, shall not be greater than one thirty-second (1/32) of an inch per inch of pipe diameter and not to exceed one-half (1/2) inch, provided that any such variation does not result in a level or reverse sloping invert.
   c. Any pipe, which is disturbed or found to be defective after laying, shall be taken up and relayed or replaced at the Contractor's expense.
   d. Approved utility crossing signs shall be placed on the pipe alignment at each side of any waterway crossing.

2. PVC Pipe:
   a. Handling PVC pipe: The handling of PVC pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Section of the pipes with deep cuts and gouges shall be removed and discarded at no expense to the Utility Owner.
   b. Lowering pipe into trench: Care shall be exercised when lowering pipe into the trench to prevent damage to or twisting of the pipe.

3. Building Laterals/Service Connections
   a. Service connections shall be constructed in accordance with the details therefor as shown or indicated on the Drawings.
   b. Sewer lateral pipe shall be extended to the right-of-way and plugged at the right-of-way line to avoid leakage (unless otherwise indicated on the Drawings). All connections and changes of direction shall be made using standard fittings designed for the purpose.
   c. On curbed streets, the exact location for each service connection shall be marked by etching or cutting an "S" in the concrete curb. Where no curb exists or is planned, locations shall be marked by a method approved by the Utility Owner/Utility Engineer.

4. Thickened PVC Pipe Section: DR 14 PVC pipe shall be substituted for the specified PVC pipe where:
   a. The sewer or service pipe shall have less than 30 inches of cover between the top of the pipe and the final top of pavement or ground line.

b. The PVC sewer main crosses over, or at a depth which provides less than 12 inches clear distance between pipes when crossing under water mains. DR 14 PVC shall extend a minimum of 10 feet on each side of the point of crossing.
c. The lateral separation of the sewer pipe and potable water piping is less than 10 feet.

B. Manholes:

1. Manhole excavation and bedding at manhole junctions shall be performed in accordance with the provisions of Section 02220 of these specifications.

2. The invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section. Steep slopes outside the invert channels shall be avoided. Changes in size and grade shall be made gradually and evenly. Changes in the direction of the sewer or entering branch shall be a smooth curve with radius as long as practicable. Invert channels shall also be formed for pipe stub-outs.

3. The first pipe joint outside the manhole shall be located a minimum distance of 24 inches from the outside surface of the manhole.

4. Precast manhole tops shall terminate at such elevations as will permit laying of brick courses under the manhole frame to make allowance for future street grade adjustments.

5. Frames and covers shall be set accurately to grade to conform to the finished grade of the adjacent areas.

6. Outside drop connections shall be made in accordance with the details therefor shown on the Drawings.

7. Drop connection base slab extensions, where required on precast manholes, shall be manufactured monolithically with the manhole elements at the casting yard. The manufacturer shall submit for approval the method of drop manhole construction.

8. Where additional pipe connections or modifications of existing factory made openings are required on new or existing precast concrete manholes or wetwells, all cutting relative thereto shall be performed only by a power driven abrasive wheel or saw. It is specifically noted that such connections to existing manholes or wetwells shall be installed in accordance with the details for new units shown on the Drawings, and shall be caulked water tight with non-shrinking grout.

9. The exterior surfaces of all manholes shall be factory coated with coal tar epoxy, 9 mils D.F.T. applied in two (2) coats.

10. The interior surfaces shall receive the specified protective coating in the field following installation of the manhole, unless a protective lining is required. The last two (2) manholes (in all directions) upstream of a wastewater pumping

station; and manholes where a force main enters and the next manhole immediately downstream; shall receive a factory applied protective lining.

11. Connection of the pipe entering the manhole shall be made by using a flexible boot type manhole coupling adapter as specified in Article 2.01.H of this Section. At the entry into the manhole no part of the horizontal pipe shall rest against the concrete.

12. Manholes shall be completed as the work progresses so that testing as prescribed in Article 3.03 Field Quality Control, may be completed.

C. Concrete encasement: Class C concrete encasement shall be constructed in accordance with details shown on the Drawings.

1. The Utility Engineer may order the line encased when:
   a. The sewer or service pipe crosses over, or at a depth, which provides less than 18 inches clear vertical distance between pipes when crossing under water mains. Encasement shall extend a minimum of 10 feet on each side of the point of crossing. In lieu of encasement, the sewer line may be constructed of ductile iron pipe and shall be laid such that both joints will be a distance of 10 feet from the crossing.
   b. Through failure to provide suitable trench sheeting, or other causes, the maximum width for trench excavations, as specified elsewhere in these specifications, is exceeded; the Contractor shall construct concrete encasement around the pipe for the length of the excessive excavation. No payment will be made for the concrete encasement required due to excessive trench widths.
   c. The points of beginning and ending of sewer, or service pipe encasement shall be not more than 6 inches from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

D. Concrete protective slabs: Concrete protective slabs as shown on the Drawings shall be constructed over gravity sewers that have less than 3 feet of cover from finish grade.

E. Connections to existing structures: Proposed sewer lines shall be connected to the existing manholes or wetwells by core drilling the proper size opening (if necessary) and installing a flexible boot type manhole adapter as specified in Article 2.01.H of this Section.

F. Invert channels (benching) shall be provided for all new manholes and existing manholes which are connected into. No brick shall be allowed in construction of the manhole invert. Inverts shall be poured using 3000 psi concrete.

3.03 FIELD QUALITY CONTROL

A. Workmanship: It is imperative that all sewers and appurtenances be built practically watertight and that the Contractor adheres rigidly to the specifications for materials and workmanship. All of the sewage must be pumped for disposal and special care and attention must be paid to securing watertight construction. Upon completion, the

sewers, or sections thereof, will be tested and gauged and if leakage is above the allowable limits specified, the sewer will be rejected.

B. Inspection: On completion of each block or section of sewer, or such other times as the Utility Owner/ Utility Engineer may direct, the block or section of sewer shall be cleaned, tested and inspected.

1. Each section of the sewer shall show, on examination from either end, a full circle of light between manholes.

2. Each manhole or other appurtenance to the system shall be of the specified size and form, be watertight (no leakage allowed by visual inspection), neatly and substantially constructed, with the top set permanently to exact position and grade. All repairs shown necessary by the inspection shall be made; broken or cracked pipe replaced; all deposits removed and the sewer left true to line and grade, entirely clean, and ready for use.

3. If required by the Utility Owner/Utility Engineer, a mandrel shall be pulled through the pipe to determine if the pipe is within allowable limits of deformation per ASTM specifications. If the mandrel does not pass the completed section of sewer, the entire section of sewer will be rejected.

C. Closed Circuit Television Inspection: (See Section 02032 – Televising Sanitary Sewers)

D. Vacuum Testing of Manholes:

1. Test all manholes using the vacuum test method, following the manufacturer's recommendations for proper and safe procedures. Vacuum testing of manholes and structures shall be performed after curing of linings. Any visible leakage in the manhole or structure, before, during, or after the test shall be repaired regardless of the test results.

2. All pipes for vacuum testing entering the manhole shall be installed at the top access point of the manhole. A vacuum of 10 inches of mercury (Hg) (5.0 psi) shall be drawn on the manhole, and the time shall be measured for the vacuum to drop to 9 inches of mercury (Hg) (4.5 psi). Manholes will be considered to have failed the air test if the time to drop 1 inch of mercury is less than what is shown in the following table:

Vacuum Test Timetable
Manhole Diameter – Inches

Depth - feet	**48 inches**	**60 inches**	**72 inches**	**96 inches**
4	30 sec.	30 sec.	30 sec.	30 sec.
8	30 sec.	30 sec.	32 sec.	38 sec.
12	30 sec.	39 sec.	48 sec.	57 sec.
16	40 sec.	52 sec.	64 sec.	76 sec.
20	50 sec.	65 sec.	80 sec.	95 sec.
24	60 sec.	78 sec.	96 sec.	114 sec.
+ Each 2'	+5 sec.	+6.5 sec.	+8.0 sec.	+9.5 sec.

3. Manhole depths shall be rounded to the nearest foot. Intermediate values shall be interpolated. For depths above 24 feet, add the values listed in the last line of the table for each 2 feet of additional depth.

4. If the manhole or structure fails the vacuum test, the Contractor shall perform additional repairs and repeat the test procedures until satisfactory results are obtained.

E. Low Pressure Air Exfiltration Testing: (NOT REQUIRED)

1. The Contractor shall provide all labor, equipment and materials and shall conduct all testing required, under the direction of the Utility Engineer. No separate payment will be made for this work and the cost for this work shall be included in the unit price quoted in the proposal for the applicable item of work.

2. Low pressure air testing shall conform to the requirements of UNI-B6-79 "Recommend Practice for Low-Pressure Air Testing of Installed Sewer Pipe", as published by UNI-Bell Plastic Pipe Association.

3. During sewer construction, all service laterals, stubs, and fittings into the sewer test section shall be properly capped or plugged so as not to allow for air loss that could cause an erroneous air test result. Where necessary, the Contractor shall restrain caps, plugs or short pipe lengths such that blowouts are prevented.

4. Before testing, Contractor shall install monitoring wells at each manhole to determine groundwater level and adjust test pressure accordingly. In no case shall the test pressure exceed 9.0 psig. All pressurizing equipment shall include a regulator or relief valve set no higher than 9.0 psig to avoid over-pressurizing.

5. Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4.0 psig greater than the average back pressure of any groundwater above the invert of the pipe, but not greater than 9.0 psig.

   When temperatures have been equalized and pressure stabilized at 4.0 psig (greater than the average groundwater back pressure), the air hose from the control panel to the air supply shall be shut off or disconnected. The continuous monitoring pressure gauge shall then be observed while the pressure is decreased to no less than 3.5 psig (greater than the average groundwater backpressure). At a reading of 3.5 psig (greater than the average groundwater backpressure), timing shall commence with a stop watch or other timing device that is at least 99.8 percent accurate.

6. If the time shown in the table, for the designated pipe size and length, elapses before the air pressure drops 0.5 psig, the section undergoing test shall have passed. The test may be discontinued once the prescribed time has elapsed.

   If the pressure drops 0.5 psig before the appropriate time shown in the table has elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test.

7. Should the section fail to meet test requirements, the Contractor shall determine the source, or sources of leakage, and make all necessary repairs and shall repeat the test until the test section is within established limits. All corrective work shall be at the Contractor's expense.

F. Correction of Non-Conforming Work:

All non-conforming work shall be repaired or replaced by the Contractor at no additional expense to the Utility Owner. Non-conforming work shall be defined as failure to adhere to any specified or implied directive of these Technical Special Provisions and/or the drawings, including but not limited to pipe not laid straight, true to the lines and grades as shown on the drawings, damaged or unacceptable materials, misalignment or diameter ring deflection in pipe due to bedding or backfilling, water standing in any pipe segment or structure, visible or detectable leakage and failure to pass any specified test or inspection.

TEST TIME: For sewer diameter between 8 inches and 36 inches inclusive, the pipe shall be tested between adjacent manholes. The test time for the air pressure to drop the specified one pound shall be as listed below:

SPECIFICATION TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP

1 Pipe Dia. (in.)	**2 Min. Time (min :sec)**	**3 Length For Min. Time (ft)**	**4 Time for Longer Length (sec)**	**a. Feet**							
				100	**150**	**200**	**250**	**300**	**350**	**400**	**450**
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.148 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

END OF SECTION

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SECTION 02726

CURED-IN-PLACE PIPE (CIPP) FOR SANITARY SEWER RENEWAL

PART 1 - GENERAL

1.01 REQUIREMENTS

A. The Work within this section consists of the installation and testing cured-in-place sanitary sewer pipe lining by installation of a resin impregnated flexible felt tube into the existing sewer line utilizing a vertical inversion standpipe and hydrostatic head, pulled in place, or other approved method and curing by circulating hot water or other approved means to produce a hard, impermeable pipe.

B. The finished liner shall extend over the installation length in a continuous, tight fitting, watertight pipe-within-a-pipe and shall be fabricated from materials which, when installed, will be chemically resistant to withstand internal exposure to domestic sewage. The Contractor shall confirm through field measurements the actual length, diameter and depth of the sewer pipe to be rehabilitated prior to fabricating the liner.

1.02 INSTALLER EXPERIENCE

A. The installer must have sufficient experience in the commercial installation of the liner and must have installed a minimum of 500,000 lineal feet. The inability to document such experience may be grounds for rejecting the proposed installer.

1.03 REFERENCES

A. Codes, Specifications, and Standards:
   1. Codes, specifications, and standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise shown or specified.
   2. All pipe materials incorporated in the project shall be approved by the FL Dept. Environmental Protection for the application to be used, prior to receipt of bids.
   3. American Society for Testing and Materials (ASTM) Standards:
      a. D 638 Test Method for Tensile Properties of Plastics
      b. D 790 Test Methods for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials
      c. D 1222 Determining Dimensions of Thermoplastic Pipe and Fittings
      d. D 2837 Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
      e. F 1216-98 Rehabilitation of Existing Pipelines and Conduits by Inversion and Curing of a Resin-impregnated Tube
      f. F 1743-96 Rehabilitation of existing pipelines and conduits by pulled-in-place installation of cured-in-place thermo setting resin pipe
      g. F 2561-6 Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One Piece Main and Lateral Cured-in-Place Liner

B. Only approved products in accordance with Orange County Utilities Specifications and Standards Manual Appendix D, "List of Approval Products" shall be installed.

1.04 RESPONSIBILITY FOR OVERFLOWS AND SPILLS

A. It shall be the responsibility of the Contractor to schedule and perform his work so as to result in no overflows or spills of sewage or combined sewage from the system. If sewage flows are such that they interfere with the Contractor's ability to perform work, the Contractor shall be responsible for scheduling his work during low flow periods or provide bypass pumping. Bypass pumping shall be provided only with the specific written approval of the County.

B. In the event of overflows caused by the Contractor's work activities, the Contractor shall immediately take appropriate action to contain and stop the overflow, clean up the spillage, disinfect the area affected by the spill, and notify the County in a timely manner.

C. Contractor will indemnify and hold harmless the County for any fines or third-party claims for personal or property damage arising out of a spill or overflow that is fully or partially the responsibility of the Contractor. Should fines subsequently be imposed as a result of any overflow for which the Contractor is fully or partially responsible, the Contractor shall pay all such fines and all of the County's legal, engineering, and administrative costs in defending such fines and claims associated with the overflow.

1.05 SUBMITTALS

Submit the following:

1. Manufacturer's Certificate of Compliance certifying compliance with the applicable specifications and standards, a minimum of 500,000 linear feet of liner installed in U.S.
2. Contractor's individual certification of actual documented installations of proposed material liner of 500,000 linear feet in the U.S. including references.
3. Certified copies of test reports of factory tests required by the applicable standards and this Section.
4. Manufacturer's installation instructions and procedures.
5. Contractor's procedures and materials for service renewal including time and duration of sewer service unavailability.
6. Data, measurements, assumptions and calculations for sizing liners, signed and sealed by a professional engineer registered in the state of Florida and certified by the manufacturer as to the compliance of his materials to the values used in the calculations.
7. Sampling procedures and locations for obtaining representative samples of the finished liner.

A. A final certificate of compliance with this specification shall be provided by the manufacturer for all lining material furnished. Tests for compliance by an independent laboratory shall be made according to the applicable ASTM specification and the manufacturer's quality control program.

C. Furnish an extended warranty for liner materials from the Contractor and liner manufacturer for a total of five (5) years from date of Final Completion.

D. As part of the design calculation submittal, the liner manufacturer shall submit a tabulation of time versus temperature. This tabulation shall show the lengths of time that exposed portions of the liner will endure without self-initiated cure or other deterioration beginning. This tabulation shall be at five degree Fahrenheit increments ranging from 70 to 100 degrees Fahrenheit. The manufacturer shall also submit his analysis of the progressive effects of such "pre-cure" on the insertion and cured properties of the liner. This information shall be submitted in a timely fashion prior to construction. The minimum liner thickness is for materials with characteristics as shown. Bidders with materials with other characteristics must supply complete information in their bids of the values as listed for ascertaining minimum thickness.

E. Approval of New Products:
   1. A product will be considered for approval if a minimum of 1,000,000 lineal feet of the proposed pipe liner has been installed in sewer collection pipes in the United States. An acceptable third party testing facility shall perform all tests. These tests shall be based on the following standards:
      a. Materials tested shall be identical to those proposed for installation from samples of materials in final resting place after the trauma of installation and/or reforming of the product. Testing shall be in accordance with applicable ASTM standards. Laboratory samples will not be acceptable;
      b. Short-term tests can be extrapolated using actual short-term test data and applicable ASTM standards for plastic pipe.
      c. An independent third party qualified in these testing procedures shall validate all test data (whether theoretically extrapolated or actual).
      d. The manufacturer shall submit all ASTM standards for installation and/or materials on their product. Foreign standards will not be accepted.
      e. Manufacturer shall submit an engineering design guide and quality control procedures for product manufacturer and for product installation, including detailed inspection, testing of physical properties, retention of product samples, taking of and testing of field samples.
      f. Manufacturer shall submit statements as to country of manufacturer of all major components used to produce the final installed product.
      g. Manufacturer and installer shall submit evidence of installer training, testing and/or certification of being trained to install the product by the manufacturer.
      h. Manufacturer shall provide detailed installation procedures, detailed procedures for reconstruction of existing laterals and for new service connections. This shall include an itemized list of the tasks to be performed and the estimated times for each task. Manufacturer shall include the estimated number of excavations, if any, required for each line segment to be installed.
      i. Manufacturer shall submit detailed procedures of repairing its own product in the event of failure.
      j. In the event change in the product (material) occurred within the past three years, the manufacturer shall disclose in writing, the date each change occurred, what change occurred, the reason for the change, the number of lineal feet installed within each change period, the last date since a change occurred, and the number of

lineal feet installed since the last change. The County reserves the right to require additional detailed information on the product (material) in the event changes have occurred.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall be responsible for the delivery, storage, and handling of products. No products shall be shipped to the job site without the approval of the County.

B. Keep products safe from damage. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

1.07 LINE OBSTRUCTIONS

A. It shall be the responsibility of the Contractor to clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP. If pre-installation inspection reveals an obstruction such as protruding service connection, dropped joint, or a collapse that will prevent the inversion process, that was not evident on the video and it cannot be removed by conventional sewer cleaning equipment, the County will be notified immediately.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials furnished for this work shall be in accordance with Orange County Utilities Specifications and Standards Manual Appendix D, "List of Approval Products" as appended to these specifications.

B. The materials used shall be designed, manufactured, and intended for sewer relining and the specific application in which they are used. The materials shall have a proven history of performance in sewer relining and rehabilitation. All materials shall be stored and handled in accordance with recommendations of the manufacturer. All materials shall be installed in accordance with the manufacturer's written instructions.

C. The finished pipe liner in place shall be fabricated from materials which when complete are chemically resistant to and will withstand internal exposure to domestic sewage having a pH range of 5 to 11 and temperatures up to 150ºF.

D. Take all necessary field measurements of the existing pipe (including diameter, ovality and length) prior to manufacturing liners.

E. The minimum length shall be that deemed necessary by the Contractor to effectively span the distance from the inlet to the outlet of the respective manholes unless otherwise specified. The Contractor shall verify the lengths in the field before manufacturing.

F. The liner thickness shall be sized for a minimum hydrostatic and earth load of 8.0 feet. The earth load and hydrostatic load shall be increased to the manhole depth for bury depths in excess of 8.0 feet unless otherwise noted as shown on the plans.

G. Unless specified otherwise, the liner shall be structurally designed for a minimum service life of 50 years; fully deteriorated host pipe/direct bury condition; prism loading; soil loading of 120 pcf; factor of safety of 2.0; 2% ovality; maximum deflection of 5%; soil modulus of 1000 psi; lining enhancement factor of 7 maximum; H-20 live loading; 50% long-term modulus reduction factor; and hydrostatic load at 100% of depth to invert.

H. The Contractor shall submit the structural design of the liner for sewers and laterals, signed and sealed by a professional engineer in the state of Florida, subject to review by the County.
   1. Design may be based on material properties of the liner that exceed the minimum values specified in ASTM F1216. However, the initial flexural modulus used in structural design calculations shall not exceed 400,000 psi.
   2. All other design criteria, loads, and conditions shall remain as specified in this section.

2.02 CURED-IN-PLACE LINER

A. All cured-in-place lining products shall comply with ASTM F-1216 or intent thereof as determined by the County.

B. The flexible tube shall be fabricated to a size that when installed will neatly fit (minimum 99.75%) the internal circumference of the existing sanitary sewer lines (including services). Allowance shall be made for circumferential stretching during insertion so that the final cured product is snug against the wall of the host pipe.

C. Unless otherwise specified, the contractor will use a polyester filter felt tube and a resin and catalyst system compatible with the inversion process and having the physical properties for the cured pipe identified in TABLE 02726 - 2 Physical Properties.

Table 02726 - 2

Physical Properties

Property	**Standard**	**PSI**
Tensile Strength	ASTM D638	4,000
Flexural Strength	ASTM D790	5,000
Flexural Modulus of Elasticity	ASTM D790	400,000
Modulus of Elasticity	ASTM D2990	150,000
Minimum Long Term (50 years)		

PART 3 EXECUTION

3.01 PREPARATION

A. The following installation procedures shall be adhered to unless otherwise approved by the County.

1. The Contractor shall carry out his operations in strict accordance with all OSHA, State, local, and manufacturer's safety requirements. Particular attention is drawn to those safety requirements involving entering confined spaces. Curing with pressurized steam creates additional safety concerns with regard to high temperatures, quick burn times, potential blow offs, etcetera. Contractors shall take additional precautions to insure the safety of everyone nearby curing mechanisms.
2. It shall be the responsibility of the Contractor to remove all internal debris and clean the existing sewer line and/or lateral in accordance with the recommendations of the liner manufacturer prior to installation of the liner.
    a. Preparation of the interior surface shall be accomplished by a thorough high pressure water-jet cleaning. The pipe shall be left free of all loose sand, rock, or other deleterious materials. Any roots in the pipe shall be either removed or cut off flush with the interior.
    b. If conditions such as broken pipe and major blockages are found that will prevent proper cleaning or where additional damage would result if cleaning is attempted or continued, the contractor shall notify the County immediately. The County will determine what course of action will be taken to complete the project.
    c. Precautions shall be taken by the contractor to ensure that no damage or flooding of public or private property is caused by the cleaning operation.
    d. The County shall inspect the prepared pipe for cleanliness and smoothness before the contractor is authorized to proceed with pipe lining operations.
3. Experienced personnel trained in locating breaks, obstacles and service connections by closed circuit television shall perform inspection of existing sewer lines. The interior of the line shall be carefully inspected to determine the location of any conditions that may prevent proper installation of the liner pipe into the lines, and such conditions shall be noted so they can be corrected. A digital data video and a suitable log shall be prepared by the Contractor during the Work and provided to the County.
4. The Contractor shall provide for the flow of sewage around the section or sections of pipe designated for lining as specified in Section 01516, Collection System Bypass.
    a. Flow control shall be exercised as required to ensure that no flowing sewage comes into contact with sections of the sewer under repair.
    b. A sewer line plug shall be inserted into the sewer upstream from the section to be repaired. The plug shall be so designed that all or any portion of the sewage flows can be released. During the review, testing and installation portion of the operation, flows shall be shut off in order to properly install the cured-in-place pipe lining. The upstream manholes shall be constantly monitored for degree of surcharging. After the installation is complete, flows shall be restored to normal level.
    c. Wherever lines are blocked off and the possibility of backing up the sewage and causing harm to public and private property is foreseen, it shall be the contractor's responsibility to bypass flow from manhole to manhole.
    d. Bypassing shall be accomplished using sewer plugs with pump connections, by pumping down surcharged manholes, or by other methods acceptable to the County. All bypassed flow must be discharged to a sanitary sewer. Bypassed flow shall not be allowed to enter any storm line, drainage ditch or street gutter.
    e. During a bypass operation, the pump shall be manned continuously; the contractor shall maintain the pump and bypass equipment; and shall be responsible for any damages to public or private property due to the malfunction of same.

5. The Contractor shall clear the line of obstructions such as solids, dropped joints, protruding service connections or collapsed pipe that will prevent the insertion of the liner pipe. If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning equipment, then the County shall be notified immediately.
6. Do not install liner if ground water temperatures and/or ambient temperatures are excessive for the product installation procedures.
7. Notification of Public or Customers: Customers shall be notified by the contractor with door hanger advising the customers of when the work will begin, expected date of completion, the type of work and contact person for any questions.
8. Traffic Control: The contractor shall provide all traffic control measures required for the safety of the public, workers and equipment during the Work and in accordance with FDOT and the County.

B. All services connected to a manhole that is rehabilitated shall be renewed.

3.02 INSTALLATION

A. General
1. Alternative methods of liner insertion, pressurization, and processing may be used for products and processes approved by the County, and when the final liner product meets the intent of ASTM installation procedures as determined by the County. Installation shall be in accordance with manufacturer's recommendations, which shall be available for verification by the inspector. Should there be any difference between the requirements, the more stringent shall govern. Prior to construction, the Contractor shall submit to the County such written information which shall include, but not be limited to, storage and handling of liner before installation, preparing liner for installation, installing the liner in the sewer pipe, temperature and pressure requirements for inverting and setting the liner, curing and cool down procedures, end seals and service connections. The contractor shall also submit to the County, a description of his methods for avoiding liner stoppage due to conflict and friction at such locations as the manhole entrance and the bend into the pipe entrance. The Contractor shall also present plans for dealing with a liner stopped by snagging within the pipe.
2. Seal the area where the line enters or leaves each manhole. Finish the inside of the manhole with a quick set cement grout to raise the invert to the grade of the liner pipe. Also use this grout to dress up around the end of the liner. This space may be sealed with a mechanical seal, chemical seal, or combination of both. The contractor shall seal the liner at all manhole reconnections with an approved product, compatible with the liner, to completely seal any annular space present.
3. If the pipe liner fails to make a tight seal due to broken or misaligned pipe at the manhole wall or other reason, the Contractor shall apply a seal at that point.
4. The temperature of water discharged to the sewer system from processing liners shall not exceed 100°F maximum or the level allowed by State or local standards. When draining water, care shall be exercised not to create a vacuum in the line.
5. After the liner has been installed, all active, existing services shall be temporarily reinstated to 100% of the original opening. This shall be done without excavation in pavement areas, and in the case of non-man-entry pipes, from the interior of the pipeline by means of a 360° television camera and a cutting device that re-establishes the service

connection. When a remote cutting device is used and a cleanout is available, then a mini-camera down the service may also be used to assist the operator in cutting or trimming. All coupons shall be recovered at the downstream manhole and removed.

6. The Contractor shall immediately notify the County of any construction delays taking place during the insertion operation. Such delays shall possibly require sampling and testing by an independent laboratory of portions of the cured liner at the County's discretion. The cost of such test shall be borne by the contractor and no extra compensation will be allowed. Any failure of sample tests or a lack of immediate notification of delay shall be automatic cause for rejection of that part of the work at the County's discretion.
7. The cost for maintaining sanitary sewer service for the property owners during construction shall be included in the prices bid and no additional compensation will be allowed. Prior to construction, the Contractor shall submit to the County for review a complete description of the methods he intends to use to reconnect the existing laterals.

B. Cured-In-Place Liner

1. The Contractor shall designate a location where the reconstruction tube will be vacuum impregnated prior to installation. The Contractor shall allow the County to inspect the materials and "wet out" procedure. A catalyst system compatible with the resin and reconstruction tube shall be used. Sufficient excess resin will be provided to insure excretion into cracked pipe and or joints of the hot pipe after curing.
2. The wet out reconstruction tube shall be inserted through an existing manhole or other approved access by means of an inversion process, pulled in place process, or other approved method, and the application of a hydrostatic head, or equivalent pressure sufficient to fully extend it to the next designated manhole or termination point. The reconstruction tube shall be inserted into the vertical inversion standpipe with the impermeable plastic membrane side out. At the lower end of the inversion standpipe, the reconstruction tube shall be turned inside out and attached to the standpipe so that a leak-proof seal is created. The inversion head will be adjusted to be of sufficient height to cause the impregnated tube to invert from manhole to manhole and hold the tube tight to the pipe wall, produce dimples at side connections and flared ends at the manholes. The use of a lubricant is recommended. Care shall be taken during the elevated curing temperature so as not to overstress the felt fiber.
3. After inversion is completed the Contractor shall supply suitable heat source and recirculation equipment. The equipment shall be capable of delivering the heat source throughout the section uniformly to raise the temperature above the temperature required to affect a cure of the resin. This temperature shall be determined by the resin/catalyst system employed. The system, together with the manufacturer's approval, shall be submitted to the County for review prior to lining operations. Temperatures shall be monitored and recorded throughout the installation process to ensure that each phase of the process is achieved at the manufacturer's recommended temperature levels. Copies of these records shall be given to the County at the completion of each installation.
4. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing heat source. Another such gauge shall be placed between the impregnated reconstruction tube and the pipe invert at the remote manhole to determine

the temperatures during cure. The resin manufacturer shall recommend temperature in the line during the cure period.

5. Initial cure shall be deemed to be completed when inspection of the exposed portions of cured pipe appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of a duration recommended by the resin manufacturer, as modified for the cured-in-place inversion process, during which time the recirculation of the heat source and cycling of the heat exchanger to maintain the temperature continues. Contractor shall retain a resin-impregnated sample (wick) to provide verification of the curing process taking place in the host pipe.
6. The Contractor shall cool the hardened pipe to a temperature below 100° F before relieving the static head in the inversion standpipe. Cool-down may be accomplished by the introduction of cool water into the inversion standpipe to replace water being drained from a small hole made in the downstream end discharging to the sewer. Care shall be taken in the release of the static head so that a vacuum will not be developed that could damage the newly installed pipe.

C. Service Lateral Renewal

1. Where mainline sewer segments are relined, all service laterals to the property or easement line, shall be relined. Trenchless service lateral lining shall be similar to and compatible with the cured-in-place mainline.
2. Access to the lateral at the property or easement line shall be made via the installation of a cleanout for each of the existing laterals.
3. Renewed service laterals shall consist of continuous lining per Section 02727, Cured-in-Place (CIPP) Liner for Lateral Renewal.
4. If existing conditions for services under pavement areas prohibit trenchless service lateral lining, services may be replaced by excavation, only if approved by the County on an individual basis.
5. If the County and determines an existing, active sanitary sewer service lateral cannot be relined or replaced, internally reinstate the service opening to 100% after the mainline liner has fully cured. The finished opening shall be smooth with no ragged edges and shall prevent clogging or blockages. This is most commonly accomplished with wire brushes.

3.03 POST INSTALLATION

A. Where liners of any type are installed in two or more continuous manhole segments, the liner invert through the intermediate manholes shall be left intact. Final finishing of the installation in those intermediate manholes shall require removal of the top of the exposed liner and neat trimming of the liner edge where it touches the lip of the manhole bench.

B. Portions of any piece of liner material removed during installation shall be available for inspection and retention by the County.

C. Reinstate openings for all drop assemblies after relining mainline sewer. Everywhere possible, outside drop assemblies shall be lined with a cured-in-place liner compatible with the mainline liner, for the full length of the drop assembly and bend. The vertical pipe shall

be lined, at a minimum. Drop assemblies inside of manholes are not required to be relined, unless directed by the County.

D. Each line segment lined shall be TV inspected as soon as practical after processing to assure complete curing. The liner shall be continuous and free of all visual and material defects except those resulting from pre-lined conditions (such conditions shall be brought to the attention of the County prior to lining). There shall be no damage, deflection, holes, delaminating, uncured resin or other visual defects in the liner. The liner surface shall be smooth and free of waviness throughout the pipe. No visible leakage through the liner or at manhole or service lateral connections will be allowed. Any defects located during the inspection shall be corrected by the contractor to conform to the requirements of the specifications and to the satisfaction of the County. The contractor shall not reactivate any section of lined sewer pipe until authorized to do so by the County. Segments not fully conforming to these Specifications must be immediately brought to the County's attention with a proposed method of correction.

3.04 TESTING

A. After completing lining, service renewals where required, and manhole rehabilitation/replacement, every liner and manhole shall be CCTV inspected as per Section 02725 Televising Sanitary Sewers.

B. The Contractor shall have an independent testing lab analyze finished liner samples taken from manhole cutoffs, service coupons, etc.
   1. A minimum of 1 sample shall be taken of the first segment installed, or as directed by the County.
   2. A minimum of 2 samples shall be taken for each 2,500 LF of liner material installed or for each manufacturing lot, if less, or as directed by the County.
   3. A minimum of 6 samples per project shall be taken for each type of liner furnished, or as directed by the County.
   4. Tests in accordance with ASTM standards for Tensile Properties, Flexural Modulus and wall thickness shall be conducted.
   5. The Contractor shall determine sampling location and procedures to ensure representative samples are obtained from the finished liner, subject to approval by the County.
   6. The Contractor shall furnish removable sizing sleeves, when possible, to collect liner samples, which accurately replicate the host pipe diameter.

3.05 ACCEPTANCE

A. It is the intent of these specifications that the completed liner with all appurtenances shall be essentially equivalent in final quality and appearance to new sewer installation.

B. The finished liner shall be continuous over the entire segment between manholes and homogenous throughout.

C. The finished liner shall be fully rounded and as free as commercially practicable from visible defects, including but not limited to damage, deflection, holes, delamination, ridges, cracks, uncured resin, foreign inclusions or other objectionable defects.

D. There shall be no visible infiltration through the liner, around the liner at manhole connections, at lined service connections or in lined services. Contractor shall repair any visible leaks.

E. Where a defect in the liner requires removal of a section of the liner, in the County's opinion, the Contractor shall make all repairs as required by the County and shall install a segmental liner, compatible with the liner, to accomplish a continuous finished liner. No separate payment will be made for such defect repair or for the post-repair segmental liner.

F. The pipe shall be neatly and smoothly cut off at each manhole. The manhole trough shall be raised to the invert of the liner to preclude snagging and shoaling of debris.

G. Service Connections:
1. The CIPP lateral lining shall not inhibit the CCTV post video inspection of the mainline or service lateral pipes
2. Reinstatement of all building sewer connections shall be done neatly and smoothly.
3. The Contractor shall install any missing clean outs at the road right-of-way.

3.06 CLEAN-UP AND RESTORATION

A. The Contractor shall not allow the site of the work to become littered with trash and waste material, but shall maintain the site in a neat and orderly condition throughout the construction period.

B. On or before completion, the Contractor shall clean and remove from the site of the work all surplus and discarded materials, temporary structures, stumps and portions of trees, and debris of any kind. He shall leave the site of work in a neat and orderly condition, similar or equal to that prior to construction.

C. All private and public property along or adjacent to the work disturbed by construction operations shall be restored to a condition similar or equal to that existing prior to construction.

D. Before final acceptance by the County, the Contractor shall replace and/or restore any water, sewer, drain, and gas lines and appurtenances; electrical, telephone, telegraph conduits and wires, both underground and aboveground, and appurtenances; traffic signals, fire and police alarm systems and appurtenances; sidewalks, curbs, gutter, drainage ditches and pavements and all other public utility facilities and appurtenances along or adjacent to the work that may have been disturbed by construction operations.

E. Conditions permitting, property cleanup and restoration shall begin and be prosecuted to completion on a timely basis as set forth herein.

3.07 PRIVATE SERVICE LINE SHUTDOWN

A. When it is necessary to shutdown a private sewer service line while work is in progress and before the service lines are reconnected, the residents are to be notified by the Contractor at least one day prior to the shutdown. No sewer or water service is to remain shutdown for more than a period of eight (8) hours unless the Contractor provides substitute services for the residents. Commercial sewer services shall be maintained at all times that the business is open. No sewage from the services or main line shall be discharged on the ground or in waterways. Holding pits or tanks are not allowed unless permitted by the State. Contractor shall coordinate pump stations, force main and sanitary sewer operation, by-pass and shutdown control with the County.

3.08 PROSECUTION OF WORK

A. The Contractor is cautioned that only those sewer services that are live and active shall be repaired or reinstated after the sewer main has been lined or replaced.

B. The Contractor shall note that not all sewer lines segments have been televised in their entirety due to obstructions blocking further entry, etc. These obstructions shall be cleared to allow TV viewing of the entire segment length before lining is commenced.

C. The number of service connections on some sewer segments may exceed the number of buildings actually served. It is the Contractor's responsibility to determine through dye testing, or other acceptable methods, the services that are live and require reinstatement prior to commencing lining of the sewer main. Services that are confirmed to be inactive shall not be reconnected. Services that are inactive, but reinstated, shall be plugged at the Contractor's expense.

D. Inactive services to vacant parcels shall be renewed, unless otherwise directed by the County.

3.09 WARRANTY

A. The manufacturer for specified material properties for a particular job shall certify the liner. The manufacturer shall warrant the liner to be free from defects in raw materials for one year from the date of acceptance.

B. The County shall conduct the warranty television inspection within one year after the date of acceptance. Any defective sections of liner located during the inspection shall be promptly repaired or replaced by the contractor as directed by the County. In the event that a sewer liner or service connection is found to be leaking during the inspection, the contractor shall be required to promptly replace it with a new section of pipe or liner or, if approved by the County, to eliminate the leak(s) by other means of repair.

END OF SECTION

SECTION 02727

CURED-IN-PLACE PIPE (CIPP) FOR LATERAL RENEWAL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Renewal of existing sanitary sewer laterals by installation of a resin impregnated flexible felt tube into the existing lateral line utilizing a vertical inversion standpipe and hydrostatic head, pulled in place, or other approved method and curing by circulating hot water or other approved means to produce a hard, impermeable pipe.

1.02 REFERENCES

A. Codes, Specifications, and Standards referred to by number or title shall form a part of this specification to the extent required by the references thereto. Latest revisions shall apply, unless otherwise shown or specified. Only approved products in accordance with Orange County Utilities Standards and Construction Specifications Manual Appendix D, "List of Approved Products" shall be installed.

1.	ASTM F1216-98	Rehabilitation of Existing Pipelines and Conduits by Inversion and Curing of a Resin-impregnated Tube
2.	ASTM F1743-96	Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermo Setting Resin Pipe
3.	ASTM D543	Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
4.	ASTM D5813	Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems

1.03 RESPONSIBILITY FOR OVERFLOWS AND SPILLS

A. It shall be the responsibility of the Contractor to schedule and perform his work so as to result in no overflows or spills of sewage or combined sewage from the system. If sewage flows are such that they interfere with the Contractor's ability to perform work, the Contractor shall be responsible for scheduling his work during low flow periods or provide bypass pumping. Bypass pumping shall be provided only with the specific written approval of the designated Engineer.

B. In the event of overflows caused by the Contractor's work activities, the Contractor shall immediately take appropriate action to contain and stop the overflow, clean up the spillage, disinfect the area affected by the spill, and notify County in a timely manner.

C. Contractor will indemnify and hold harmless the County for any fines or third-party claims for personal or property damage arising out of a spill or overflow that is fully or partially the responsibility of the Contractor. Should fines subsequently be imposed as a result of any overflow for which the Contractor is fully or partially responsible, the Contractor shall pay

all such fines and all of the County's legal, engineering, and administrative costs in defending such fines and claims associated with the overflow.

1.04 SUBMITTALS

A. Submit the following:
   1. Certified copies of test reports of factory tests required by the applicable standards and this Section.
   2. Manufacturer's installation instructions and procedures.
   3. Contractor's procedures and materials for service renewal including time and duration of sewer service unavailability.
   4. Data, measurements, assumptions and calculations for sizing liners, signed and sealed by a professional engineer registered in the state of Florida and certified by the manufacturer as to the compliance of his materials to the values used in the calculations.
   5. Sampling procedures and locations for obtaining representative samples of the finished liner.

B. A final certificate of compliance with this specification shall be provided by the manufacturer for all lining material furnished. Tests for compliance by an independent laboratory shall be made according to the applicable ASTM specification and the manufacturer's quality control program.

C. Furnish an extended warranty for liner materials from the Contractor and liner manufacturer for a total of five (5) years from date of Final Completion.

D. As part of the design calculation submittal, the liner manufacturer shall submit a tabulation of time versus temperature. This tabulation shall show the lengths of time that exposed portions of the liner will endure without self-initiated cure or other deterioration beginning. This tabulation shall be at five degree Fahrenheit increments ranging from 70 to 100 degrees Fahrenheit. The manufacturer shall also submit his analysis of the progressive effects of such "pre-cure" on the insertion and cured properties of the liner. This information shall be submitted in a timely fashion prior to construction. The minimum liner thickness is for materials with characteristics as shown. Bidders with materials with other characteristics must supply complete information in their bids of the values as listed for ascertaining minimum thickness.

E. Approval of New Products:
   1. A product will be considered for approval if a minimum of 1,000,000 lineal feet of the proposed pipe liner has been installed in sewer collection pipes in the United States. An acceptable third party testing facility shall perform all tests. These tests shall be based on the following standards:
      a. Materials tested shall be identical to those proposed for installation from samples of materials in final resting place after the trauma of installation and/or reforming of the product. Testing shall be in accordance with applicable ASTM standards. Laboratory samples will not be acceptable;
      b. Short-term tests can be extrapolated using actual short-term test data and applicable ASTM standards for plastic pipe.

c. An independent third party qualified in these testing procedures shall validate all test data (whether theoretically extrapolated or actual).

d. The manufacturer shall submit all ASTM standards for installation and/or materials on their product. Foreign standards will not be accepted.

e. Manufacturer shall submit an engineering design guide and quality control procedures for product manufacturer and for product installation, including detailed inspection, testing of physical properties, retention of product samples, taking of and testing of field samples.

f. Manufacturer shall submit statements as to country of manufacturer of all major components used to produce the final installed product.

g. Manufacturer and installer shall submit evidence of installer training, testing and/or certification of being trained to install the product by the manufacturer.

h. Manufacturer shall provide detailed installation procedures, detailed procedures for reconstruction of existing laterals and for new service connections. This shall include an itemized list of the tasks to be performed and the estimated times for each task. Manufacturer shall include the estimated number of excavations, if any, required for each line segment to be installed.

i. Manufacturer shall submit detailed procedures of repairing its own product in the event of failure.

j. In the event change in the product (material) occurred within the past three years, the manufacturer shall disclose in writing, the date each change occurred, what change occurred, the reason for the change, the number of lineal feet installed within each change period, the last date since a change occurred, and the number of lineal feet installed since the last change. The County reserves the right to require additional detailed information on the product (material) in the event changes have occurred.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall be responsible for the delivery, storage, and handling of products. No products shall be shipped to the job site without the approval of the County.

B. Keep products safe from damage. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials furnished for this work shall be in accordance with the “Orange County Utilities Appendix D, List of Approved Products” as appended to these specifications unless otherwise noted.

B. The system proposed (materials, methods, workmanship) must be proven through previous successful installations to an extent and nature satisfactory to the County and the Engineer

that is consistent with the size of the project being proposed. Since CIPP is intended to have a minimum 50-year design life, only products deemed to have this performance will be accepted.

C. The finished pipe liner in place shall be fabricated from materials which when complete are chemically resistant to and will withstand internal exposure to domestic sewage having a pH range of 5 to 11 and temperatures up to 150ºF.

D. Unless specified otherwise, the liner shall be structurally designed for a minimum service life of 50 years; fully deteriorated host pipe/direct bury condition; prism loading; soil loading of 120 pcf; factor of safety of 2.0; 2% ovality; maximum deflection of 5%; soil modulus of 1000 psi; lining enhancement factor of 7 maximum; H-20 live loading; 50% long-term modulus reduction factor; and hydrostatic load at 100% of depth to invert.

E. All CIPP lining products shall comply with the latest versions of ASTM D5813 and ASTM F1216 or ASTM F1743, including appendices.

2.02 STRUCTURAL REQUIREMENTS

A. Each CIPP shall be designed to withstand internal and/or external loads as dictated by the site and pipe conditions. When not specified by the County in the contract documents, the design thickness of the CIPP shall be arrived at using standard engineering methodology as found in ASTM F1216. In no case shall the finished thickness of the cured liner be less than three millimeters. The long-term modulus shall not exceed 50 percent of the short-term value for the resin system and shall be verifiable through testing. The thickness calculations, signed and sealed by a professional engineer registered in the State of Florida, shall be submitted to the County/Engineer prior to CIPP installation.

B. When multiple layers are present, the layers of the finished CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or such that the knife blade moves freely between the layers. If separation of the layers occurs during testing of the field samples, new samples will be cut from the work. Any reoccurrence may be cause for rejection of the work. The cured liner shall meet TABLE 02727 - 1 Minimum Physical Properties.

TABLE 02727- 1
Minimum Physical Properties

Property	ASTM Test Method	Minimum Value
Flexural Strength	D790	4,500 psi
Flexural Modulus (Initial)	D790	250,000 psi
Flexural Modulus (50-year)	D790	125,000 psi

2.03 MATERIALS

A. Lateral Liner Tube
   1. The tube shall consist of one or more layers of a flexible needled felt or an equivalent non-woven or woven material, or a combination of non-woven and woven materials, capable of carrying resin, withstanding installation pressures and curing temperatures. The tube should be compatible with the resin system to be used on this project. The material should be able to stretch to fit irregular pipe sections and negotiate bends. Projected changes in groundwater level; temperature and other loading factors shall cause no significant changes in the service characteristics or service life of the sewer pipe liner.
   2. The liner shall be polyester fiber felt tubing saturated with an epoxy vinyl ester or polyester resin prior to insertion which when cured, will be chemically resistant to reagents as defined in ASTM F1216, ASTM F1743, and ASTM D543.
   3. The tube should be fabricated under controlled conditions to a size that, when installed, will tightly fit the internal circumference and the length of the original conduit. Allowances should be made for the longitudinal and circumferential stretching that occurs during placement of the tube. Maximum stretching allowances shall be as defined in ASTM F1216 or ASTM F1743. The Contractor shall verify the lengths in the field before cutting the liner to length.
   4. The tube shall be uniform in thickness and when subjected to the installation pressures shall meet or exceed the designed wall thickness.
   5. Any plastic film applied to the tube on what will become the interior wall of the finished CIPP shall be compatible with the resin system used, translucent enough that the resin is clearly visible, and shall be firmly bonded to the felt material.
   6. At time of manufacture, each lot of liner shall be inspected and certified to be free of defects. The tube shall be marked for distance at regular intervals along its entire length, not to exceed five feet. Such markings shall also include the Manufacturer's name or identifying symbol.
   7. Liners may be made of single or multiple layer construction where any layer must not be less than 1.5 mm thick. A suitable mechanical strengthener membrane or strip may be placed in between layers where required to control longitudinal stretching.
   8. The sewer service lateral liner shall be a single piece liner that lines the lateral and be a contiguous part of the mainline.

B. Resin Components
   1. The resin system shall be a corrosion resistant epoxy vinyl ester or polyester that when properly cured within the tube composite meets the minimum requirements given herein or those that are to be utilized in the design of the CIPP for this project. The catalyst system may be accelerated to promote curing.
   2. The resin used shall not contain non-strength enhancing fillers.
   3. The Contractor shall submit the resin characteristics, including filler identification, to the County and Engineer for approval prior to lining activities.

C. Interface Seal
   1. The interface seal shall be a polyester impregnated, corrosion resistant fiberglass insert. The seal shall be of one-piece construction and shall be designed such that when expanded shall tightly fit both T and Y connections at the interface between the

mainline and lateral sewer. The seal shall extend into the mainline a minimum of four inches (4") and shall provide a minimum of a three-inch (3") overlap inside the mainline pipe and be of equal thickness as the lateral liner at the interface.

2. An epoxy sealant rated for piping applications shall be applied to the seal to ensure that any gap between the interface of the mainline pipe and the CIPP lateral lining is air and watertight.

PART 3 - EXECUTION

3.01 GENERAL

A. It is the intent of this specification to provide for the renewal of sewer service laterals by the installation of a resin-impregnated flexible tube and a mainline/lateral connection seal. The tube is either inverted or pulled into the original service lateral through a newly installed cleanout and then expanded to fit tightly against the lateral by the use of water or air pressure. The resin system shall then be cured by elevating the temperature of the fluid (water/air) used for the inflation to a sufficient enough level for the initiators in the resin to effect a reaction. The finished pipe shall be such that when the thermosetting resin cures, the total wall thickness shall be a homogeneous and monolithic felt and resin composite matrix that will be chemically resistant to withstand internal exposure to domestic sewage.

B. Should it be determined after lateral lining that an interface seal is required or if directed by the contract documents, the system shall then be provided with a seal at the mainline/lateral interface. The finished seal shall be such that when the thermosetting resin cures, the seal bonds to the lateral liner forming an airtight and watertight interface and will provide chemical resistance to domestic sewage.

C. The Contractor shall deliver the liner to the site and provide all equipment required to insert the liner into the host pipe and cure it in place. The Contractor shall designate a location where the tube will be vacuum impregnated prior to installation. If requested by the County, the Contractor shall notify the Engineer at least 72 hours prior to wet out to allow the Engineer to observe the materials and wet out procedure. All procedures to prepare the liner for installation will be in strict accordance with the manufacturer's recommendations. Any material not properly prepared shall be rejected and replaced with acceptable materials at the Contractor's expense.

D. The liner shall be impregnated with resin and stored according with manufacturer recommendations.

3.02 PREPARATION

A. The Contractor shall notify all residents affected by this construction at least 24 hours prior to any service disruption affecting their service connection. The mainline sewer shall be kept in operation during the lateral lining operations. Customers shall be notified by the Contractor with door hanger advising the customers of when the work will begin, expected date of completion, the type of work and contact person for any questions.

B. The Contractor shall install a cleanout at the respective right-of-way line, property line or easement line prior to or immediately after the lining procedure. Cleanouts shall be installed per the County's requirements as shown on the drawings and specified herein.

C. The Contractor shall perform cleaning of the lateral and affected areas of the existing sewer line in accordance with the liner manufacturer's recommendations, videotaping, and inspection prior to installation of the CIPP lateral. The Contractor, when required, shall remove all internal debris out of the pipeline that will interfere with the installation of the CIPP. The Contractor shall provide an appropriate dumpsite for all debris removed during the cleaning operations. Precautions shall be taken by the Contractor to ensure that no damage or flooding of public or private property is caused by the cleaning operation.

D. It shall be the responsibility of the Contractor to notify the County of line obstructions, offset joints, or collapsed pipe that will prevent the insertion of the tube or significantly reduce the capacity of the lateral. The County with input from the Contractor, shall determine the method of pipe repair required and shall address these concerns on a case-by-case basis.

E. Protruding laterals or services shall be trimmed flush with the inside of the main sewer wall prior to lining. Trimming shall not cause damage to the lateral or service beyond the inside face of the main sewer.

3.03 BYPASS PUMPING

A. When the flow demand on the lateral dictates that bypass pumping is required, the Contractor shall furnish all necessary pumping equipment, conduit, etc. to adequately and safely divert sewage flow around the work in a manner approved by the County and as set forth in Section 01516. No flow shall be discharged on the surface, into storm sewers, in ditches, or in waterways.

B. During a bypass operation, the pump shall be manned continuously; the contractor shall maintain the pump and bypass equipment; and shall be responsible for any damages to public or private property due to the malfunction of same

3.04 TELEVISION INSPECTION

A. The Contractor shall provide television equipment capable of properly documenting the conditions as found within the lateral. The camera equipment shall be capable of launching into the full length of each lateral and providing an accurate picture of the lateral to be lined. Lighting for the camera shall illuminate the entire periphery of the lateral.

B. Both a pre-lining and post-lining digital data video shall be submitted to the County and Engineer for approval. The Contractor shall launch into each lateral connection on both pre and post inspections. The digital data video shall be clearly and properly labeled. A digital

data video and a suitable log shall be prepared by the contractor during the Work and provided to the County

3.05 CIPP LINER INSTALLATION

A. The following installation procedures shall be adhered to unless otherwise approved by the County.
   1. The Contractor shall carry out his operations in strict accordance with all OSHA, State, local, and manufacturer's safety requirements. Particular attention is drawn to those safety requirements involving entering confined spaces. Curing with pressurized steam creates additional safety concerns with regard to high temperatures, quick burn times, potential blow offs, etcetera. Contractors shall take additional precautions to insure the safety of everyone nearby curing mechanisms.
   2. It shall be the responsibility of the Contractor to remove all internal debris and clean the existing sewer line and/or lateral in accordance with the recommendations of the liner manufacturer prior to installation of the liner.
      a. Preparation of the interior surface shall be accomplished by a thorough high pressure water-jet cleaning. The pipe shall be left free of all loose sand, rock, or other deleterious materials. Any roots in the pipe shall be either removed or cut off flush with the interior.
      b. If conditions such as broken pipe and major blockages are found that will prevent proper cleaning or where additional damage would result if cleaning is attempted or continued, the contractor shall notify the County immediately. The County will determine what course of action will be taken to complete the project.
      c. Precautions shall be taken by the contractor to ensure that no damage or flooding of public or private property is caused by the cleaning operation.
      d. The County shall inspect the prepared pipe for cleanliness and smoothness before the contractor is authorized to proceed with pipe lining operations.

B. The CIPP shall be installed in accordance with the practices given in ASTM F1216 (for direct inversion installations) or ASTM F1743 (for pulled-in-place installations). The quantity of resin used for the tube's impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances being made for polymerization shrinkage and the loss of any resin through cracks and irregularities in the original pipe wall. A vacuum impregnation process shall be used in conjunction with a roller system to achieve a uniform distribution of the resin throughout the tube.

C. The resin-impregnated tube shall be installed into the host pipe by methods approved by the manufacturer and proven through previous successful installations. The insertion method shall not cause abrasion or scuffing of the tube. Hydrostatic or air pressure shall be used to inflate the tube and mold it against the walls of the host pipe. There will be no use of sewage in place of clean water for insertion of the tube, or for the curing of the liner.

D. The tube is to be installed at a rate sufficient to cause controlled installation of the tube into the conduit. The tube shall be installed in such a manner that no damage is done to the tube.

E. Should there be any difference between the referenced requirements, the more stringent shall govern. Prior to construction, the contractor shall submit to the County such written information which shall include, but not be limited to, storage and handling of lateral liner before installation, preparing liner for installation, installing the liner in the sewer lateral, temperature and pressure requirements for inverting and setting the liner, curing and cool down procedures, end seals and service restore.

F. The contractor shall have on hand at all times, for use by his personnel and the County, a digital thermometer or other means of accurately and quickly checking the temperature of exposed portions of the liner.

3.06 CURING

A. After inversion is completed the Contractor shall supply suitable heat source and recirculation equipment. The equipment shall be capable of delivering heat throughout the section to uniformly raise the temperature above the temperature required to affect a cure of the resin. This temperature shall be determined by the resin/catalyst system employed.

B. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing heat supply. Thermocouples shall be placed between the tube and the host pipe to determine the liner temperature during cure. The water or air temperature in the pipe during the cure period shall be as recommended by the resin manufacturer.

C. Initial cure shall be deemed to be completed when inspection of the exposed portions of cured pipe appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of a duration recommended by the resin manufacturer, as modified for the installation process, during which time the recirculation and cycling of the heat exchanger to maintain the temperature continues. The heat source shall be shut down during the post cure.

D. Temperatures shall be monitored and recorded throughout the installation process to ensure that each phase of the process is achieved at the manufacturer's recommended temperature levels. Copies of these records shall be given to the County at the completion of each installation.

3.07 COOL DOWN

A. Cool down may be accomplished by the introduction of cool water or air into the installation standpipe to replace the initial heating agent. The Contractor shall cool the hardened pipe to a temperature below 100° F before relieving the pressure in the pressure apparatus. A minimum period of post cure shall be maintained under a static head to provide a minimum hoop tension on the tube felt. Care shall be taken in the release of the static head so that a vacuum will not be developed.

3.08 FINISH

A. The finished lining shall be continuous over the entire length of the lateral and be as free as commercially practical from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. The lining shall be homogeneous, impervious, and free of any leakage from the surrounding ground to the inside of the lined pipe. The lateral CIPP shall not inhibit the post video televising of the mainline or the service lateral pipes.

B. During the warranty period, any defects which will affect the integrity or strength of the liner, collect solids, or reduce hydraulic flow capabilities of the product shall be repaired at the Contractor's expense in a manner mutually agreed upon by the County and the Contractor.

C. The liner shall be continuous and free of all visual and material defects except those resulting from pre-lined conditions (such conditions shall be brought to the attention of the County prior to lining). There shall be no damage, deflection, holes, delaminating, uncured resin or other visual defects in the liner. The liner surface shall be smooth and free of waviness throughout the pipe. No visible leakage through the liner or at manhole or service lateral connections will be allowed. Any defects located during the inspection shall be corrected by the contractor to conform to the requirements of the specifications and to the satisfaction of the County. The contractor shall not reactivate any section of lined sewer pipe until authorized to do so by the County.

3.09 INTERFACE SEAL INSTALLATION

A. The interface seal between the mainline and the lateral shall be installed by remote device from inside of the sewer main. The seal shall be properly expanded with air pressure to tightly fit the lateral interface.

B. Seal installation shall be installed in strict accordance with the manufacturer's written specifications, recommendations and these specifications.

C. The finished seal shall be continuous over the entire interface and be as free as commercially practical from visual defects such as foreign inclusions, dry spots and pinholes. The seal shall be homogeneous, impervious, and free of any leakage from the surrounding ground to the inside of the lined pipe. The interface seal shall not inhibit the post video televising of the mainline or the service lateral pipes.

D. During the warranty period, any defects which will affect the integrity or strength of the seal, collect solids, or reduce hydraulic flow capabilities of the product shall be repaired at the Contractor's expense in a manner mutually agreed upon by the County and the Contractor.

3.10 CLEANUP

A. After the installation work has been completed and all testing acceptable, the Contractor shall cleanup the entire project area. The Contractor shall dispose of all excess material and debris not incorporated into the permanent installation. The work area shall be left in a condition equal to or better than prior condition.

3.11 WARRANTY

A. The Contractor shall guarantee his work for a warranty period of one (1) year from the date of acceptance. If, at anytime during the warranty period, any leakage, cracking, loss of bond, or other discontinuity is identified, the Contractor shall make repairs acceptable and at no additional cost to the County.

The County shall conduct the warranty television inspection within one year after the date of acceptance. Any defective sections of liner located during the inspection shall be promptly repaired or replaced by the Contractor as directed by the County. In the event that a lateral liner or interface seal is found to be leaking during the inspection, the contractor shall be required to promptly replace it with a new section of pipe or liner or, if approved by the County, to eliminate the leak(s) by other means of repair.

END OF SECTION

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SECTION 02728

SANITARY SEWER MANHOLE REHABILITATION

PART 2 GENERAL

2.1 WORK INCLUDED

A. Sanitary sewer manhole rehabilitation including:
   1. Rehabilitation and leak-proofing of manholes by lining with spray applied or centrifugally cast lightweight structural reinforced concrete, or spray applied epoxy resin systems, or equal as determined by County.
   2. The repair and sealing of the manhole base, invert, walls, corbel/cone, and chimney of brick, block, or precast manholes, including the removal of any unsound material.
   3. The inspection and testing of the various types of work to insure compliance.

2.2 REFERENCES

A. Codes, Specifications, and Standards (NOT USED)

B. Testing and Materials Standards
   1. American Society of Testing and Materials (ASTM)

2.3 DEFINITIONS (NOT USED)

2.4 RESPONSIBILITY FOR OVERFLOWS AND SPILLS

A. It shall be the responsibility of the Contractor to schedule and perform his work so as to result in no overflows or spills of sewage or combined sewage from the system. If sewage flows are such that they interfere with the Contractor's ability to perform work, the Contractor shall be responsible for scheduling his work during low flow periods or provide bypass pumping. Bypass pumping shall be provided only with the specific written approval of the County.

B. In the event of overflows caused by the Contractor's work activities, the Contractor shall immediately take appropriate action to contain and stop the overflow, clean up the spillage, disinfect the area affected by the spill, and notify County in a timely manner.

C. Contractor will indemnify and hold harmless the County for any fines or third-party claims for personal or property damage arising out of a spill or overflow that is fully or partially the responsibility of the Contractor. Should fines subsequently be imposed as a result of any overflow for which the Contractor is fully or partially responsible, the Contractor shall pay all such fines and all of the County's legal, engineering, and administrative costs in defending such fines and claims associated with the overflow.

2.5 SUBMITTALS

A. Submit the following at least 14 days prior to starting manhole rehabilitation:

1. Manufacturers' Certificate of Compliance certifying compliance with the applicable specifications and standards. The certifications shall list all materials furnished under this Section.
2. Certified copies of test reports of factory tests required by the applicable standards, the manufacturer, and this Section.
3. Manufacturer's handling, storage, and installation instructions and procedures.
4. Recommended lining thickness design to withstand groundwater pressure as specified in Part 3 of this Section.

PART 3 PRODUCTS

3.1 GENERAL

A. Materials
   1. All materials furnished for this work shall be in accordance with the "APPENDIX D - LIST OF APPROVED PRODUCTS" as appended to these specifications.
   2. The materials used shall be designed, manufactured, and intended for sewer manhole rehabilitation and the specific application in which they are used. The materials shall have a proven history of performance in sewer manhole rehabilitation. The materials shall be delivered to the job site in original unopened packages and clearly labeled with the manufacturer's identification and printed instructions. All materials shall be stored and handled in accordance with recommendations of the manufacturer. All materials shall be mixed and applied in accordance with the manufacturer's written instructions.
   3. The Contractor shall warrant and save harmless the County against all claims for patent infringement and any loss thereof.
   4. Handle and store all materials and dispose of all wastes in accordance with applicable regulations.
   5. Each lining system shall be designed for application over wet surfaces (but not active running water) without degradation of the final product and/or the bond between the product and the manhole surfaces.

B. Stopping active leaks in concrete and masonry manholes:
   1. A premixed fast-setting, volume-stable waterproof cement plug consisting of hydraulic cement, graded silica aggregates, special plasticizing and accelerating agents. It shall not contain chlorides, gypsum's, plasters, iron particles, aluminum powder or gas-forming agents, or promote the corrosion of steel it may come in contact with. Set time shall be approximately 1 minute. Ten-minute compressive strength shall be approximately 500 psi.
   2. A siliconate-based liquid accelerator field mixed with neat Portland cement. The set time shall be approximately 1 minute.
   3. The elastomeric polyurethane resin-soaked method, using dry twisted jute oakum, or resin-rod with polyurethane resin (water activated).

C. Patching, repointing, filling, and repairing nonleaking holes, cracks, and spalls in concrete and masonry manholes:

1. A premixed nonshrink cement-based patching material consisting of hydraulic cement, graded silica aggregates, special plasticizing and accelerating agents, which has been formulated for vertical or overhead use. It shall not contain chlorides, gypsums, plasters, iron particles, aluminum powder, or gas-forming agents or promote the corrosion of steel it may come into contact with. Set time (ASTM C-191) shall be less than 30 minutes. One-hour compressive strength (ASTM C-109) shall be a minimum of 200 psi and the ultimate compressive strengths (ASTM C-882-Modified) shall be a minimum of 1700 psi.

D. Spray applied or centrifugally cast lightweight structural reinforced cement manhole lining (Level A):
   1. The material applied to the surface of the manhole shall be a cementitious blend of acid resistant binders, silicious aggregates, non-metallic fibers and other additives for constructing a liner that is impervious to the flow of water, is resistant to sulfide attack, and restores structural integrity to existing manhole walls.
   2. A monolithic liner shall be formed which covers all interior manhole surfaces and shall have the following minimum requirements at 28 days:

a.	Compressive Strength (ASTM C-579B)	3000 psi
b.	Tensile Strength (ASTM C-496)	300 psi
c.	Flexural Strength (ASTM C-293) (Modified)	600 psi
d.	Shrinkage (ASTM C-596)	0% at 90% R.H.
e.	Bond (ASTM C-321)	130 psi
f.	Density, when applied	105± pcf

E. Spray applied epoxy resin system manhole lining:
   1. The material sprayed onto the surface of the manhole shall be an epoxy resin system formulated for application within a sanitary sewer environment. The resin will exhibit suitable corrosion resistance and enhance the structural integrity of the existing manhole.
   2. The cured epoxy resin system shall conform to the following minimum structural standards:

Cured Product	**Test Method**	**Results**
Tensile Stress	ASTM D-638	7,000 psi
Flexural Stress	ASTM D-790	13,000 psi
Flexural Modulus	ASTM D-790	500,000 psi
Compressive Strength	ASTM D-695	13,000 psi

PART 4 EXECUTION

4.1 REHABILITATION OF MANHOLE STRUCTURE

A. General Procedures
   1. Safety: The Contractor shall perform all work in strict accordance with all applicable OSHA, State, local, and manufacturer's safety standards. Each method of manhole rehabilitation in this Section requires some degree of manhole entry by workers.

Particular attention is drawn to those safety requirements regarding confined space entry and respiratory protection from airborne particulate materials during cleaning and product mixing and application.

2. Cleaning: All concrete and masonry surfaces to be rehabilitated shall be clean. All grease, oil, laitance, coatings, loose bricks, mortar, unsound brick or concrete and other foreign materials shall be completely removed. Water blasting utilizing a 210° F steam unit and proper nozzles shall be the primary method of cleaning; however, other methods such as wet or dry sandblasting, acid wash, concrete cleaners, degreasers or mechanical means may be required to properly clean the surface. All surfaces on which these methods are used shall be thoroughly rinsed, scrubbed, and neutralized to remove cleaning agents and their reactant products. Debris resulting from cleaning shall be removed from the manhole and not discharged downstream.
3. Stopping Infiltration: After surface preparation and prior to the application of mortars and coatings, infiltration shall be stopped either by plugging with a water stop compound or chemical grout sealing.
4. Patching: All large holes or voids around steps, joints or pipes, all spalled areas and all holes caused by missing or cracked brick shall be patched and all missing mortar repointed using a nonshrink patching mortar. All cracked or disintegrated material shall be removed from the area to be patched or repointed, exposing a sound subbase. All cracks not subject to movement and greater than 1/16 inch in width shall be routed out to a minimum width and depth of 1/2 inch and patched with nonshrink patching mortar.
5. Flow Control: The Contractor shall be responsible for plugging or diverting the flow of sewage as needed for repair and lining of manhole inverts and benches. Sewer flow shall be maintained in accordance with Section SSR 10, Wastewater Flow Control of these Specifications.
6. Remove all loose grout and rubble from existing channel. Rebuild channel if required by reshaping, repairing slope of shelves or benches. Work shall include aligning inflow and outflow ports in such a manner as to prevent the deposition of solids at the transition point. All inverts shall follow the grades of the pipe entering the manhole. Changes in direction of the sewer and entering branch or branches shall have a true curve of as large a radius as the size of the manhole will permit, but will be shaped to allow easy entrance of maintenance equipment including buckets, T.V. camera, etc.
7. Each lining system shall be installed in accordance with the manufacturer's recommendation to withstand groundwater pressures. For manholes greater than 12 feet in depth, the lining shall withstand the pressures associated with a groundwater depth equal to the manhole depth. Linings for all other manholes shall withstand the pressures associated with groundwater depth of 12 feet. Measure groundwater depth from manhole bench to top of ground surface.
8. Application of products shall be by factory certified applicators.

4.2 SPRAY APPLIED LIGHTWEIGHT STRUCTURAL REINFORCED CEMENT

A. The surface prior to spraying shall be damp without noticeable free water droplets or running water. Materials shall be spray-applied to a minimum uniform thickness to insure that all cracks, crevices, and voids are filled and a somewhat smooth surface remains after light troweling. The light troweling is performed to compact the material into voids and to set the bond.

B. The first application shall have begun to take an initial set (disappearance of surface sheen, which could be 15 minutes to 1 hour depending upon ambient conditions) before the second application to assure a minimum total finished thickness of 1/2 inch. The final finished thickness may need to be greater than 1/2 inch as recommended by the manufacturer to withstand groundwater pressures. A depth gauge shall be used during application, at various locations, to verify the required thickness. The surface then shall be trowelled to smooth finish with care taken not to over trowel so as to bring additional water to the surface and weaken it. Manufacturer's recommendations shall be followed whenever more than 24 hours have elapsed between applications.

C. The bench covers used to catch debris shall be removed and the bench and invert sprayed such that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than 1/2 inch. The wall-bench intersection shall be rounded to a uniform radius the full circumference of the intersection.

D. No application shall be made to frozen surfaces or if freezing is expected to occur within the manhole for 24 hours after application. If ambient temperatures are in excess of 95° F, precautions shall be taken to keep the mix temperature at time of application below 90° F, using ice if necessary.

E. The final application shall have a minimum of four (4) hours cure time before being subjected to active flow.

4.3 CENTRIFUGALLY CAST STRUCTURAL REINFORCED CEMENT

A. The rotating casting applicator shall be positioned to evenly apply the material and be withdrawn at a rate to assure a final minimum thickness of 1/2-inch. The final finished thickness may need to be greater than 1/2-inch as recommended by the manufacturer to withstand groundwater pressures. A depth gauge shall be used during application, at various locations, to verify the required thickness.

B. The bench covers used to catch debris shall be removed and the bench and invert sprayed or hand applied so that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than 1/2-inch. The wall-bench intersection shall be rounded to a uniform radius the full circumference of the intersection.

C. No application shall be made to frozen surfaces or if freezing is expected to occur within the manhole for 24 hours after application. If ambient temperatures are in excess of 95° F, precautions shall be taken to keep the mix temperature at time of application below 90° F.

D. The final application shall have a minimum of one (1) hour cure time before being subjected to active flow.

4.4 SPRAYED APPLIED EPOXY RESIN SYSTEM

A. The epoxy resin shall be sprayed onto the surfaces of the manhole walls, the benches, and invert to produce a smooth coating and yield the required structural integrity and corrosion

resistance. A depth gauge shall be used during application at various locations to verify the required thickness.

B. The epoxy resin shall be applied to a minimum thickness of 0.125 inches at the top of the manhole and gradually thickened, in accordance with manufacturer's recommendations, to withstand groundwater pressures. The application shall have a minimum of three hours cure time before being subjected to active flow.

C. The sloped surface of the manhole bench shall be made non-skid by broadcasting aluminum oxide, or sand into the surface prior to gelatin/set.

4.5 MANHOLE REHABILITATION ACCEPTANCE

A. Test all rehabilitated manholes using the vacuum test method, following the manufacturer's recommendations for proper and safe procedures. Vacuum testing of manholes and structures shall be performed after curing of linings. Any visible leakage in the manhole or structure, before, during, or after the test shall be repaired regardless of the test results.

B. All pipes for vacuum testing entering the manhole shall be installed at the top access point of the manhole. A vacuum of 10 inches of mercury (Hg) (5.0 psi) shall be drawn on the manhole, and the time shall be measured for the vacuum to drop to 9 inches of mercury (Hg) (4.5 psi). Manholes will be considered to have failed the air test if the time to drop 1 inch of mercury is less than what is shown in the following table:

Vacuum Test Timetable
Manhole Diameter – Inches

Depth - feet	**48 inches**	**60 inches**	**72 inches**	**96 inches**
4	30 sec.	30 sec.	30 sec.	30 sec.
8	30 sec.	30 sec.	32 sec.	38 sec.
12	30 sec.	39 sec.	48 sec.	57 sec.
16	40 sec.	52 sec.	64 sec.	76 sec.
20	50 sec.	65 sec.	80 sec.	95 sec.
24	60 sec.	78 sec.	96 sec.	114 sec.
+ Each 2'	+5 sec.	+6.5 sec.	+8.0 sec.	+9.5 sec.

C. Manhole depths shall be rounded to the nearest foot. Intermediate values shall be interpolated. For depths above 24 feet, add the values listed in the last line of the table for each 2 feet of additional depth.

D. If the manhole or structure fails the vacuum test, the Contractor shall perform additional repairs and repeat the test procedures until satisfactory results are obtained.

E. After the manhole rehabilitation work has been completed, the manhole shall be visually inspected by the Contractor in the presence of the County and the work shall be accepted if found satisfactory to the County. The finished surface shall be free of blisters, "runs" or "sags" or other indications of uneven lining thickness. No evidence of visible leaks shall be allowed.

4.6 CLEANUP

A. After the installation work has been completed and all testing acceptable, the Contractor shall cleanup the entire project area. The Contractor shall dispose of all excess material and debris not incorporated into the permanent installation. The work area shall be left in a condition equal to or better than prior condition.

4.7 WARRANTY

A. The Contractor shall guarantee his work for a warranty period of one (1) year from the date of acceptance. If, at anytime during the warranty period, any leakage, cracking, loss of bond, or other discontinuity is identified, the Contractor shall make repairs at no additional cost to the County.

B. Furnish an extended warranty for manhole rehabilitation materials from the Contractor and liner manufacturer for a total of five (5) years from date of final completion.

END OF SECTION

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SECTION 02730

UTILITY RELOCATION SPECIALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included under this Section consists of furnishing all labor, materials, equipment and incidentals required to provide resolution of conflicts between existing utility lines, appurtenances and proposed work, both within this contract or under separate contract to be accomplished by others. Items addressed herein include:

1. Relocation of Existing Pipe in Place

2. Connection to Existing Pipes, Structure and Appurtenances

3. Thrust Collars

4. Conflict Transitions

5. Conflict Manholes

6. Relocation of Existing Fire Hydrant and Valve Assemblies

7. Relocation of Existing Valves

8. Relocation of Existing Water Meters

9. Relocation of Existing Backflow Prevention Devices

10. Existing Manhole Rim Adjustment

11. Existing Valve Box Adjustment

12. Temporary By-pass Connection

B. General Design: The equipment and materials specified herein is intended to be standard types of utility piping, fittings and appurtenances as specified in related sections of these specifications and as acceptable to the respective owner of the utility to be relocated.

1.02 QUALITY ASSURANCE

A. Qualifications: All of the new equipment and materials specified herein shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the

manufacture of the equipment and materials to be furnished. Equipment and materials shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

B. Standards:

1. Because many of the relocation projects are accomplished along with roadway improvements, many of the references in this section are made to the FDOT Standard Specifications for Road and Bridge Construction, Latest Edition (Standards). Where differences exist between standards, the more stringent shall apply.

2. All new materials and equipment for the utility work shall be in accordance with "Standards and Construction Manual, Orange County, Florida" and its latest revision of the “APPENDIX D - LIST OF APPROVED PRODUCTS” as appended to these specifications (Appendix D).

C. Quality Control (new material):

1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards.

2. In addition to the manufacturer's quality control procedures, the Utility Owner may select an independent testing laboratory to inspect the material at the manufacturing facility or compliance with these specifications. The cost of manufacturing facility inspection requested by the Utility Owner will be paid for by the Utility Owner.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. Shop drawings, including layouts, for all materials and equipment to be furnished under this section shall be submitted prior to placing orders. Shop drawings shall include dimensioning, methods and locations of supports and all other pertinent technical specifications. Shop drawings shall be prepared by the manufacturer.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage: Delivery and storage of the materials and equipment shall be in accordance with the manufacturer's recommendations.

B. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the materials and equipment and their respective interior and/or exterior coatings. Pipe, fittings and appurtenances shall not be rolled off the carrier or dropped. Unloading shall be done by lifting with a forklift or crane. All materials

and equipment shall be examined before installation, and no piece shall be installed which is found to be defective.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Ductile iron pipe and fittings are as specified in Section 15062 - Ductile Iron Pipe and Fittings.

B. Polyvinyl Chloride (PVC) pipe and fittings are as specified in Section 15064 - Polyvinyl Chloride (PVC) Pipe and Fittings.

C. Precast concrete structures and manholes are as specified in Division 3 - Concrete.

D. Concrete formwork, concrete reinforcement and cast-in-place concrete are as specified in Division 3 - Concrete.

E. Items related to potable water transmission or distribution systems, reclaimed water transmission or distribution systems and wastewater transmission and collection systems are as specified in the respective specifications herein.

PART 3 - EXECUTION

3.01 PREPARATION

A. Dewatering and excavation shall be in accordance with Sections 02032 respectively. Care shall be taken to avoid damage to items which are to remain in service or those which are to be reinstalled/relocated. Any damage shall be repaired by the Contractor, in a manner acceptable to the Utility Engineer, at no additional cost to the Utility Owner.

B. Materials and/or equipment removed under this contract and are found satisfactory to be reused shall be thoroughly pressure washed, inside and out, by the Contractor and inspected by the Utility Inspector prior to re-installation/relocation. Where items are found to be defective by the Utility Inspector, the Contractor shall furnish either a substitute item from another location on the project or new material and/or equipment meeting the specification herein. Where new materials and equipment is furnished by the Contractor, the Utility Owner shall reimburse the actual cost of the item purchased with no additional compensation for delays incurred by ordering, cost of delivery, or incidentals required for installation of the item.

C. As directed by the Utility Engineer or Utility Inspector, the Contractor shall replace components of the item to be re-installed/relocated including but not limited to:

1. Rubber gaskets, washers or O-rings.

2. M.J. follower glands, nuts, bolts and washers.

3. Restraining devices.

4. Support devices.

D. All items to be reinstalled above ground shall receive new paint in accordance with Division 9 - Finishes. Surface preparation and prime coats shall be in accordance with the manufacturer's recommendations to assure satisfactory adhesion of the finish coating.

E. Following preparation, the items shall be handled and stored as specified in the General Requirements. Items damaged or lost due to improper handling or storage shall be repaired or replaced by the Contractor at no expense to the Utility Owner. All valves, valve boxes, hydrants, hydrant tees, water meters, etc. removed, prepared and stored shall remain property of the Utility Owner whether used on this project or not, unless otherwise designated.

F. Where disruption of service is required for connection, removal, relocation or construction; the Contractor shall coordinate the disruption with the proper Utility Owner or division a minimum of 48 hours prior to the disruption of service. Except in an emergency, all service disruption, valve operation, pumping station operation shall be done by a representative of the respective Utility Owner or division. Unless otherwise authorized, each disruption shall be limited to a duration not to exceed two (2) hours.

3.02 INSTALLATION

A. Relocation of Existing Pipe in Place:

1. Where existing pipeline segments are identified to be relocated, raised or lowered in place, the Contractor shall remove and properly dispose of the contents of the pipe prior to beginning the relocation operations.

2. The Contractor shall observe caution when excavating around the segment to be relocated to avoid damage to the existing pipe. Any damage resulting from the Contractors excavation or handling of the pipe shall be repaired at no additional cost to the Owner. If in the opinion of the RPR, any pipe joint that has been pushed beyond the joint deflection as recommended by the manufacturer, the Contractor shall dismantle the joint and replace the gasket material and any restraining device on the subject joint.

3. Where the pipe is to undergo a change of material conveyance (i.e.: water main to force main or reclaimed water main), the Contractor shall provide the necessary cross connection control markings for the pipes intended use. This shall include repainting the marking stripe to the proper color coding for ductile iron pipe, adding the respective color coded stripe on PVC pipe and

replacing or providing the 10 gauge copper locating wire for the duration of the relocation.

B. Connection to Existing Pipes, Structures and Appurtenances:

1. Tapping Sleeve and Valve: Tapping sleeve shall be steel fusion epoxy coated body with stainless steel straps, bolts, nuts and washers. Tapping valve shall be standard resilient seat gate valve meeting the requirements of AWWA C509. Contractor shall determine the type and exact outside diameter of the existing main prior to ordering the sleeve.

a. Sufficient length of existing main shall be exposed to allow for installation of the tapping sleeve and valve and the operation of the tapping machinery. The main shall be supported on concrete pedestals or bedding rock at sufficient intervals to properly carry its own weight, plus the weight of the tapping sleeve valve and machinery. Any damage to the main due to improper or insufficient supports shall be repaired at the Contractor's expense.

b. For potable water systems, the inside of the tapping sleeve and valve, the outside of the existing main, and the tapping machine shall be cleaned and swabbed or sprayed with 10% liquid chlorine prior to beginning installation.

c. After the tapping sleeve has been mounted on the main, the tapping valve shall be bolted to the outlet flange, making a pressure tight connection. Prior to beginning the tapping operation, the sleeve and valve shall be pressure tested at 150 psi to ensure that no leakage will occur.

d. For pressure connections through 12" diameter or less the minimum diameter cut shall be 1/2" less than the nominal diameter of the pipe to be attached. For 14" through 20" installations, the minimum diameter shall be 1 1/2" less; for larger taps, the allowable minimum diameter shall be 2" to 3" less than the nominal diameter of the pipe being attached. After the tapping procedure is complete, the Contractor shall submit the coupon to the Utility Inspector.

e. For pressure connections to wastewater force mains, the tapping valve shall be placed horizontally. After the tapping procedure is complete, a plug valve shall be attached to the tapping valve. The tapping valve shall be left in the open position prior to backfilling.

2. Mechanical Joint Sleeve: Where new mains (sizes 4" and larger) are to join end to end with an existing pipe to remain in service, the connection shall be made with a ductile or cast iron mechanical joint solid or transition sleeve.

M.J. sleeve shall have a minimum pressure rating of 250 psi and meet all the requirements of Section 15062 - Ductile Iron Pipe and Fittings.

3. Compression Coupling: For connection of pipes less than 4 inches, a compression coupling suitable for the pipe material to be joined shall be installed. Where pipe sizes differ, reducing fittings may be required prior to coupling. Installation of the compression coupling shall include adequate restraining devices as recommended by the coupling manufacturer.

4. Connection to Existing Structures: Proposed pipelines shall be connected to existing structures by core drilling the proper size opening and installing a flexible boot type manhole coupling adapter, as manufactured by KOR-N-SEAL or an accepted equal. Fitting outside the structure shall be adequately restrained without connection into the structure wall. Where existing structures will not allow core drilling, the Contractor shall submit a connection plan to the Utility Engineer prior to connecting.

C. Thrust Collar (Only if approved by OCU RPR):

1. Where restraint of an existing line segment is required due to connection to a proposed fitting or main within the required restrained joint length, as specified, the Contractor shall construct a concrete thrust collar to counteract the vertical and/or horizontal thrust. Bearing area and tie rods shall be detailed on the Drawings.

2. Concrete and reinforcing shall be as specified in the Standards with a minimum 28-day compressive strength of 2500 psi. Thrust collars shall be cured a minimum of three (3) days prior to loading. All form boards shall be removed prior to backfilling.

3. Tie rods and tie bolts shall conform to the requirements of ASTM A 242, and rods shall be galvanized in conformance with ASTM A 123. Connections to mechanical joints shall be in strict accordance with the recommendations of the pipe or fitting manufacturer for the test pressure required.

4. Precast concrete thrust collars may be substituted if accepted by the Utility Engineer and all the requirements specified herein or detailed on the Drawings are met or exceeded.

D. Conflict Transition

1. General: The item "Conflict Transition" shall only be applicable for transitions of existing pipeline segments to remain in service. Where transitions are shown within new pipeline construction, the Contractor shall have the option of transitioning by joint deflection, thus eliminating the bends and respective thrust restraint as shown on the drawings, at no additional cost to the Utility Owner.

2. Conflict transitions shall be constructed in accordance with the detail as shown in the Drawings utilizing ductile iron pipe and fittings with mechanically restrained joints as specified in Section 15062 - Ductile Iron Pipe and Fittings.

3. Thrust restraint on each side of the existing main shall be provided by the use of concrete thrust collars as specified above (3.01 B) or by the installation of mechanical restraining devices, if approved by the RPR.

E. Conflict Manholes

1. General: Construction of Conflict Manholes shall only be allowed where the existing gravity sewer main or force main is a minimum of twelve inches (12") above the proposed storm sewer invert. Conflict manholes will not be allowed for potable water mains. The Contractor shall excavate the proposed Conflict Manhole location and verify the pipe size, alignment, joint spacing and elevation prior to ordering structures. Where shown on the Drawings as an alternative (construct Conflict Manhole or support existing pipe) the Contractor shall verify the location as indicated above and construct the proposed Conflict Manhole only where required to avoid a conflict with the proposed storm drain piping. If adequate clearance between the existing and proposed pipes exists, the Contractor shall provide temporary support to the existing pipe during FDOT construction of the storm piping in that location. No separate payment shall be made for temporary pipe support.

2. Conflict Manhole diameters shall be sized in accordance with the structure manufacturer and shall include consideration for structure stability during shipping, storage, installation and backfill, regardless of the pipe sizes, angles and elevations.

3. Conflict structures shall be placed in the location as shown on the Drawings and elevation to conform to the existing proposed pipes unless specific written directions are provided by FDOT, OC Public Works, the Utility Owner or the Utility Engineer. Conflict structures may be constructed jointly with the storm sewer construction if coordinated and agreed upon by all parties. All block-outs for pipes not being immediately installed shall be adequately plugged, capped or boarded up in a manner to exclude dirt, debris or excessive water from the interior of the structure.

F. Relocation of Existing Fire Hydrant and Valve Assemblies:

1. Where shown on the Drawings, Fire Hydrant and Valve Assemblies shall be removed and prepared as specified in Article 3.01 herein and reinstalled/relocated to another location within this project or stored for salvage by the Owner.

2. Reinstallation of the Fire Hydrant and Valve Assembly may be shown on the Drawings as follows:

   a. Furnish and install new M.J. Locking Hydrant Tee, and 6-inch ductile iron pipe to the proposed hydrant location as designated by the Owner (approximately shown on the Drawings), install the prepared hydrant and valve (with box), and furnish required height adjustment materials necessary to bring the hydrant and valve box to the proposed finish grade.

   b. Furnish and install 6-inch ductile iron pipe to the proposed hydrant location as designated by the Owner (approximately shown on the Drawings), install the prepared hydrant and valve (with box) and furnish required height adjustment materials necessary to bring the hydrant and valve box to the proposed finish grade.

   c. Install the prepared hydrant only, to the dead end location as shown on the Drawings. Furnish required height adjustment materials to bring the hydrant to the proposed finish grade.

3. Contractor shall furnish all necessary restraining devices, bedding rock, shear pad, valve collar and identification disc to provide a complete fire hydrant and valve assembly as detailed in the Drawings.

G. Relocation of Existing Valves

1. Where existing valves are designated on the Drawings for relocation or removal, each shall be prepared and reinstalled/relocated to another location within this project or stored for salvage by the Owner.

2. Reinstallation of the valve shall include all necessary restraint, valve box and height adjustment components, concrete collar and valve identification disc. Where valves reinstalled/relocated fall within the pavement or sidewalk area, valve box adjustment shall be accomplished as specified herein with no additional cost to the Owner.

H. Relocation of Existing Water Meters

1. Where existing water meters are located in the field, whether shown on the Drawings or not, the meter box and corporation stop shall be reinstalled to a location as designed by the Owner. The water service shall be extended to the appropriate location utilizing service piping as specified in Section 02662 - Potable Water Transmission/Distribution Mains.

I. Relocation of Existing Backflow Prevention Devices

1. Where backflow prevention devices are located in the field, whether shown on the drawings or not, the device in its entirety shall be reinstalled to a location as designated by the Owner.

J. Existing Manhole Rim Adjustment

1. Manholes under this item may include but not be limited to, sanitary manholes, conflict manholes and ARV manholes/structures and may be in various sizes, weights, shapes and condition. Manholes may be located in 1) proposed pavement, 2) existing pavement to be overlayed, 3) curb line or sidewalk or 4) open areas. It is the intent of this item to adjust the elevation of the manhole rim to the proposed surface elevation regardless of the type, height adjustment required or the location in the field.

2. Manholes that can be adjusted by the modification of the existing chimney section (brick or HDPE) will be considered Minor Adjustment. Because of the limitation of chimney height (2 courses of brick minimum, 4 courses of brick maximum OR 5" HDPE ring minimum, 10" HDPE ring maximum), manholes requiring removal of the corbel and modification of the wall or barrel sections, whether increasing or decreasing the elevation, will be considered Major Adjustment.

3. Minor Adjustment

   a. The Contractor shall make the necessary rim adjustment by raising or lowering the casting (ring and cover) and/or brick chimney to proposed finish grade. Manhole rims shall be adequately marked to avoid damage by subsequent construction operations.
   b. Adjustment of manholes located in pavement areas to be overlayed with no additional base work, shall be raised or lowered to proposed finish grade. All existing pavement and/or base damaged by adjustment of the manhole rim shall be repaired at no additional cost to the Utility Owner.
   c. Adjustment of manholes located in proposed curb or sidewalk areas (including track areas for machine pours) shall be coordinated with the Utility Engineer to determine the method of adjustment as described herein.
   d. Adjustment of manholes located in open areas shall be raised or lowered in a "single step" construction operation to proposed finish grade.

4. Major Adjustment:
   a. The Contractor shall make the necessary rim adjustment by removing the corbel section, raising or lowering the wall or barrel section of the manhole and final adjustment via the brick chimney to proposed finish grade.
   b. All existing pavement and/or base damaged by adjustment of the manhole rim shall be repaired at no additional cost to the Utility Owner.

c. All manhole joints shall be sealed and existing coating and/or lining shall be repaired.

6. Manholes proposed to be constructed under this project shall be adjusted utilizing the above requirements and methods as they are initially installed. No separate payment will be made for adjustment of new manhole rims.

K. Existing Valve Box Adjustment

1. Valve boxes under this item may be associated with but not be limited to, gate valves, butterfly valves, plug valves, service valves and hydrant valves and may be located in 1) proposed pavement, 2) existing pavement to be overlayed, 3) curb line or sidewalk or 4) open areas. It is the intent of this item to adjust the elevation of the valve box to the proposed surface elevation regardless of the height adjustment required or the location in the field.

2. The Contractor shall make the necessary valve box adjustment by raising or lowering the to proposed finish grade. Valve boxes shall be adequately marked to avoid damage by subsequent construction operations.

3. Adjustment of valve boxes located in pavement areas to be overlayed with no additional base work, shall be raised or lowered to proposed finish grade. All existing pavement and/or base damaged by adjustment of the valve box shall be repaired at no additional cost to the Utility Owner.

4. Adjustment of valve boxes located in proposed curb or sidewalk areas (including track areas for machine pours) shall be coordinated with the Utility Engineer to determine the method of adjustment as described herein.

5. Adjustment of valve boxes located in open areas shall be raised or lowered in a "single step" construction operation to proposed finish grade.

6. Following final adjustment of the valve box, the Contractor shall construct the required concrete collar (in open areas) and bronze identification disc (in the concrete collar or on the concrete past, in paved areas) as detailed on the Drawings.

7. Valve boxes proposed to be constructed under this project shall be adjusted utilizing the above requirements and methods as they are initially installed. No separate payment will be made for adjustment of new valve boxes installed on a proposed valve or relocated valve.

3.03 CLEANING

A. Prior to installation, items shall be thoroughly cleaned inside and out to remove dirt, stones, debris or other foreign material.

B. Items installed on or for potable water transmission, distribution or service shall be sprayed or swabbed with a 10% chlorine solution prior to installation.

C. Correction of Non-Conforming Work: All non-conforming work shall be repaired or replaced by the Contractor at no additional expense to the Utility Owner. Non-conforming work shall be defined as failure to adhere to any specific or implied directive of this Project Manual and/or the drawings, including but not limited to pipe not laid straight, true to the lines and grades as shown on the drawings, damaged or unacceptable materials, misalignment or diameter ring deflection in pipe due to bedding or backfilling, visible or detectable leakage and failure to pass any specified test or inspection.

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SECTION 02750

TRENCHLESS PIPE INSTALLATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish all material, equipment, transportation, tools, and labor to install pipe by jacking and boring method or directional drilling method, installing casing, carrier pipe within casing or direct trenchless pipe installation as required, and all related work for a complete installation.

1.02 JURISDICTION OF WORK

A. For casing pipe crossing under roadways, or other installations not within the jurisdiction of the Owner, the Contractor shall comply with regulations of the governing authority. State highway casing installations shall be as specified in the Florida Department of Transportation, "Utility Accommodation Manual."

1.03 SUBMITTALS

A. The Contractor shall submit shop drawings working drawings, schedules and samples in accordance with the General Conditions and General Requirements.

B. Submit certificates of inspection from the pipe manufacturer certifying that steel casing pipe supplied meets the requirements of these Specifications.

C. Submit shop drawings of each steel casing and carrier pipe installation prior to fabrication of piping, casing and appurtenances.

D. Submit laying schedule including length, diameter and thickness of casing and carrier piping for each crossing.

1.04 PERMITS

A. The Contractor shall have all applicable permits in hand prior to construction.

PART 2 - PRODUCTS

2.01 STEEL CASING PIPE

A. All casing pipe shall be new prime steel pipe conforming to ASTM A-139(straight seam pipe only) Grade “B” with minimum yield strength of 35,000 psi. Casing pipe shall be seamless or have not more than one (1) longitudinal weld. Minimum steel casing pipe size and wall thickness shall be as indicated in the following table, unless otherwise shown or specified. For Orange County utilities within a FDOT, Central Florida Railroad or CSX Railroad right-of-way, the most stringent (largest diameter with thickest wall) shall apply.

B. The joints of sections of casing shall be welded with a continuous circumferential weld. It shall be the Contractor's responsibility to provide stress transfer across the joints, which is capable of resisting the jacking forces involved.

C. Joints shall be welded in accordance with AISC Specifications, Section 1-7-2. All joint welds shall be full penetration. Joints shall be electric-fusion (arc) welded by operators qualified in accordance with American Welding Society Standard Procedure.

D. After welding, the Contractor shall wire brush the welded joints and apply Koppers Interol Quick-Drying Primer 626 or equal.

Carrier Pipe Diameter (Inches)	Steel Casing Pipe Diameter* and Wall Thickness					
	Orange County Roadway		FDOT Roadway		Central FL or CSX Railroad	
	Outside Dia. (Inches)	Wall Thick. (Inches)	Outside Dia. (Inches)	Wall Thick. (Inches)	Outside Dia. (Inches)	Wall Thick. (Inches)
4	16	0.250	12	0.188	14	0.250
6	16	0.250	14	0.188	16	0.250
8	18	0.250	16	0.188	18	0.250
10	20	0.250	24	0.250	20	0.250
12	24	0.250	30	0.312	22	0.250
14	24	0.250	36	0.375	24	0.250
16	30	0.312	42	0.500	30	0.312
18	30	0.312			30	0.312
20	36	.0375			34	.0375
24	42	0.500			36	0.375
30	48	0.500				
36	54	0.500				

* Note:The diameters as shown represent the minimum casing size required by the respective agency. This diameter shall be installed unless otherwise shown on the Drawings.

2.02 PVC CASING PIPE (for services/laterals only)

A. For service line crossings, where shown on the Drawings, PVC casing or PVC and PE carrier pipe may be installed by directional drilling methods as approved by the

Engineer. PVC casing pipe shall be in accordance with Section 15064 - Polyvinyl Chloride (PVC) Pipe and Fittings and shall have a minimum dimension ratio of DR 18.

2.03 CARRIER PIPE SUPPORTS

A. General: Carrier pipe shall be supported within the casing so that the pipe bell does not rest directly on the casing. The load of the carrier pipes shall be distributed along the casing-by-casing spacers.

B. Casing Spacers: Carrier pipe shall be installed within the steel casing pipe as shown on the Drawings and specified herein. Carrier pipes, inside of steel casing pipe, shall be supported by casing spacers at no more that 6-1/2 feet between spacers with double spacers on each end of the casing and spacers at a maximum of 2 feet behind the bell. Each spacer shall be a minimum 8-inches wide for pipe 12-inch diameter or less or minimum 12-inches wide for pipe 16-inch or greater and manufactured of minimum 14-gauge Type 304 stainless steel. All nuts, bolts and washers shall be 304 stainless steel and compatible with the respective 304 stainless steel shell/band. Each spacer shall have a minimum of four runner supports manufactured of an ultra-high molecular weight polyethylene or glass reinforced polymer. The runner supports shall be of adequate height to position the carrier pipe in the center of casing with a minimum top clearance of 1-1/2-inch. All casing spacers larger than 36-inch diameter (carrier pipe) shall be factory designed, taking in consideration the weight of the carrier pipe filled with water. All calculations and drawings shall be submitted to UTILITIES for review.

2.04 CASING END SEALS

A. Casing end seals shall be made of a synthetic rubber compound and be affixed to carrier and casing pipes using stainless steel bands and/or clamps. Continuous or wrap-around types may be used. Acceptable products are Pipeline Seal & Insulator, Inc., Model C or W, or equal.

2.05 PVC CARRIER PIPES

A. PVC pipe installed by directional drilling methods shall meet all requirements of AWWA C-900 (C905), with a maximum dimensional ratio of DR-18. The minimum inside diameter of the carrier pipe shall be as shown on the Drawings. Pipe shall be as specified in Section 15064 - Polyvinyl Chloride (PVC) Pipe and Fittings with exception of the pipe joints, which will be Certa-Lok as manufactured by Certainteed, or an approved equal.

2.06 HDPE CARRIER PIPES

A. HDPE pipe installed by directional drilling methods shall meet all requirements of AWWA C-906, with a maximum dimensional ratio of DR-11. The minimum inside diameter of the carrier pipe shall be as shown on the Drawings. Pipe shall be as specified in Section 15071 - High Density Polyethylene (HDPE) Pipe and Fittings.

PART 3 - EXECUTION

3.01 GENERAL

A. It shall be the Contractor's responsibility to perform the boring and jacking or directional drilling work in strict conformance with the requirements of the agency in whose right of way or easement the Work is being performed. Any special requirements of the agency such as insurance, flagmen, etc., shall be strictly adhered to during the performance of Work. The special requirements shall be performed by the Contractor at no additional cost to the Owner.

3.02 EXCAVATION

A. Required boring and jacking or directional drilling pits shall be excavated and maintained to minimum dimension. Said excavations shall be adequately barricaded, sheeted, braced and dewatered, as required, in accordance with the applicable portions of these Specifications. Dewatering through the casing during construction shall not be permitted.

B. Excavation adjacent to the road pavement shall be performed in a manner to adequately support these facilities.

3.03 BORING AND JACKING

A. The boring and jacking operations shall be done simultaneously, with continuous installation, until the casing pipe is in final position. Correct line and grade shall be carefully maintained. Add-on sections of casing pipe shall be full-ring welded to the preceding length, developing watertight total pipe strength joints. The casing installation shall produce no upheaval, settlement, cracking, movement, or distortion of the existing roadbed or other facilities. Following placement of the carrier pipe within the steel casing, flexible rubber boots shall be installed at each open end. Said boots shall be suitable for restraining the external earth and hydrostatic load. The casing shall have minimum 36 inches depth of cover between the top of the casing and the roadway surface or minimum 54 inches depth of cover between the top of the casing and the top of the respective railroad tracks.

B. Casing pipe holes shall be mechanically bored through the soil by a cutting head on a continuous auger mounted inside the pipe. The auger shall extend a minimum distance beyond the end of the casing pipe to preclude formation of voids outside of the pipe shell. Excavated materials shall be removed from the casing as the operation progresses, and no accumulation of such material within the casing will be permitted.

C. The casing pipe shall be adequately protected to prevent crushing or other damage under jacking pressures. Backstops shall be provided for adequately distributing the jack thrust without causing deformation of the soil or other damage. Should the casing pipe be damaged, such damaged portion, if abandoned in place, shall be

suitably plugged, and an alternate installation made, after approval is obtained from the RPR.

D. Extreme care shall be exercised by the Contractor to maintain line and grade during jacking operations, and the Contractor may be required to modify the manner in which he is conducting his jacking operation to correct any deviation when deemed necessary by the Engineer. A maximum tolerance of 0.12 foot per 100 linear feet of jacked casing is permitted. Realignment or replacement work shall in no way result in extra cost to the Owner.

E. If voids are formed during the jacking operation, they shall be satisfactorily filled with grout by pumping.

F. Synthetic rubber end seals are to be installed at each open end of the casing; Seals shall be suitable for restraining the earth load while allowing drainage of the casing.

G. Upon completion of jacking operations, the reaction blocks, braces, and all other associated construction materials shall be completely removed from the site.

3.04 INSTALLATION OF CARRIER PIPE

A. The carrier pipes shall be supported within the casing pipes so that the pipe bells do not rest directly on the casing. The load of the carrier pipes shall be distributed along the casing spacers. Casing spacers shall be bolt on style split shells made of T-304 Stainless Steel. All nuts and bolts shall be high strength, low allow meeting AWWA C111. Runners shall be made of high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction.

B. Adjust the pipe grade, as required, by changing the casing spacers to compensate for any grade variations of the casing, and to maintain carrier pipelines, grades, and dimensions, as shown on the Drawings.

3.05 DIRECTIONAL DRILLING OPERATIONS (See Section 36000 – Directional Drilling)

A. Pipe shall be handled, stored and joined in accordance with these specifications.

B. Pre-excavate pipe entry and receiving areas to provide a gradual entry of the pipe without stress to the pipe or joints and to allow free movement into the borehole at an acceptable depth. Carefully guide pipe in such a manner as to avoid deformation of, or damage to, the pipe.

C. If unexpected subsurface conditions are encountered during the bore, the procedure shall be stopped. The installation shall not continue until the Owner has been consulted.

D. The drilling mud shall be bentonite slurry or equal and contained and disposed of in accordance with state/federal regulations and/or permit conditions. The

Design/Builder shall install erosion and sedimentation control measures including, but not limited to, straw bales to prevent drilling mud from inadvertently spilling out of the entrance/exit pit.

E. The carrier pipe shall be pulled back through using the wet insertion construction technique. At the Contractor's option, the pipe may be installed full of water. The limits of the directional bore construction and plan view length of pipe are shown on the construction plans.

F. Every effort shall be made to maintain pipe installation to a minimum depth of 36". Where deeper installations are shown on the plans, or required by the Right-of-way Owner, the Contractor shall make such adjustments without additional cost to the Owner.

G. The pipe shall be installed in a manner that does not cause upheaval, settlement, cracking, movement or distortion of surface features.

H. The system must be remotely steerable and permit electronic monitoring of tunnel depth and location. The system must be able to control the depth and direction of the pipe and must be accurate to a window of $\pm$ 2 inches.

I. Equipment must be fitted with a permanent alarm system capable of detecting an electrical current. The system must have an audible alarm to warn the operator if the drill head contacts electrified cables.

END OF SECTION

SECTION 02934

SOLID SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

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

1.02 SUBMITTALS

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

PART 2 - PRODUCTS

2.01 GRASS SOD

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

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

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

2.02 FERTILIZER

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

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

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

2.03 WATER FOR GRASSING

A. The water used in the sodding operations shall be obtained as provided for in Division 1.

PART 3 - EXECUTION

3.01 PREPARATION OF GROUND

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

3.02 APPLICATION OF FERTILIZER

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

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

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

3.03 PLACING SOD

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

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

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

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

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

3.04 WATERING

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

3.05 MAINTENANCE

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

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

END OF SECTION

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SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work included in this section consists of providing all labor, materials and equipment necessary for providing and installing formwork for concrete unless specified elsewhere herein.

B. Related Work Described Elsewhere:

1. Section 03200 - Concrete Reinforcement

2. Section 03300 - Cast-in-Place Concrete

C. General Design: The Contractor shall be responsible for the design of all formwork and for safety in its construction, use and removal.

1.02 QUALITY ASSURANCE

A. Qualifications: Formwork shall be constructed in accordance with the specified standards, as well as all pertinent codes and regulations. Where provisions of pertinent codes conflict with the requirements of this section of these specifications, the more stringent provisions shall govern.

B. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

1. Standard Building Code

2. ACI 347 "Recommended Practice for Concrete Formwork".

3. Local codes and regulations

1.03 SUBMITTALS

A. Materials: Submit manufacturer's literatures on form ties, spreaders, corner formers, form coatings and bond breakers.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Form Lumber: Use form lumber when in contact with exposed concrete, conforming to one of the following, a combination thereof, or equivalent as accepted by the Engineer.

1. Lumber: Douglas Fir-Larch No. 2 grade, seasoned, surfaced on four sides.

2. Plywood: "Plyform", Class I or II, bearing the label of the Douglas Plywood Association. (Minimum 3/4-inch thickness)

B. Form Ties: Use form ties which do not leave an open hole through the concrete and which permit neat and solid patching at every hole. Use embedded rods with integral waterstops and cones to provide a 1-inch breakback. Wire ties and wood spreaders will not be permitted.

C. Form Coatings: Form release coating shall be a paraffin base oil or mineral oil coating which effectively prevents absorption of moisture, prevents bonding with concrete, is non-staining to concrete and leaves the concrete with a paintable surface.

D. Chamfer Strips: Chamfer strips shall be polyvinyl strips or acceptable equal, designed to be nailed in the forms to provide a 1-inch chamfer (unless indicated otherwise) at exposed edges of concrete members.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Construction of Formwork: Forms shall be sufficiently strong to withstand the pressure resulting from the placement and vibration of concrete and shall be sufficiently rigid to maintain specified tolerances. Forms shall be sufficiently tight to prevent loss of mortar, and shall be adequately braced against lateral, upward or downward movement.

B. Coating of Forms: Apply form coating to board forms prior to placing reinforcing. Keeps form coatings off steel reinforcing, items to be embedded and previously placed concrete.

C. Form Erection:

1. Provide a means of holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects of the finished concrete. Insure that forms may be removed without injury to the surface of the finished concrete.

2. Provide a positive means of adjustment of shores and struts. Insure that all settlement is taken up during concrete placing.

3. Temporary openings shall be provided in wall forms to limit the free fall of concrete to a maximum of 6 feet unless an elephant trunk is used. Such openings shall be located to facilitate placing and consolidation and shall be spaced no more than 8 feet apart. Temporary openings shall also be provided in the bottom of wall and column forms and elsewhere as necessary to facilitate cleaning and observation immediately prior to placing.

4. Do not embed any form-tying device or part thereof other than metal in concrete.

5. Form surfaces of concrete members except where placement of the concrete against the ground is shown on the drawings. The dimensions of concrete members shown on the drawings apply to formed surfaces, except where otherwise indicated.

D. Form Reuse: Reuse only forms which maintain a uniform surface texture on exposed concrete surfaces. Apply light sanding between uses to obtain such a uniform texture. Plug unused tie rod holes with corks, shave flush, and sandpaper on the concrete surface side.

E. Removal of Forms:

1. Forms and shoring for elevated structural slabs, girders, and/or beams shall remain in place until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Do not remove supports and reshore. The following table indicates the minimum allowable time after the last concrete is placed before forms, shoring, and/or bracing may be removed.

Structural Item	Minimum Allowable Time
Bottom side of slabs, girders, beams	when concrete reaches specified 28-day compressive strength
Vertical sides of girders, beams	48 hours
Walls not supporting vertical or Horizontal loads	48 hours
Walls supporting vertical or Horizontal loads	when concrete reaches specified 28-day compressive strength
Footings, pipe encasements, Pipe supports	24 hours

2. Do not remove forms from concrete, which have been placed with outside air temperature below 50EF without first determining if the concrete has properly set without regard for time. Do not apply heavy loading on green concrete.

Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.

F. Formed Openings: Openings shall be of sufficient size to permit final alignment of the items within it without deflection or offsets of any kind and to allow space for packing where the items pass through the wall to ensure water tightness around openings so formed. Provide openings with continuous keyways with waterstops where required, and provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with reinforcement as indicated and specified. Reinforcing steel shall be at least 2 inches clear from the opening.

G. Embedded Items: Set anchor bolts and other embedded items accurately and hold securely in position in the forms until the concrete is placed and set. Check all special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after concreting. Check all nailing, blocks, plugs and strips necessary for the attachment of trim, finish and similar work prior to concreting.

H. Pipes and Wall Spools Cast in Concrete:

1. Install wall spools, wall flanges and wall anchors before placing concrete. Do not weld, tie or otherwise connect the wall spools to the reinforcing steel.

2. Support pipe and fabricated fittings to be encased in concrete on concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement will be possible during construction.

I. Form Tolerances:

1. Failure of the forms to produce the specified concrete surface tolerance shall be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced at no cost to the Owner.

2. The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

a.

	Maximum Tolerance
Sleeves and Inserts	+1/4" to -1/4"
Projected ends of anchors	+1/4" to -0.0"
Anchor bolt setting	+1/4" to -1/4"
Finished concrete, all locations	+ 1/4" to -1/4" in 10-feet of length

3. The planes or axes from which the above tolerances are to be measured shall be as follows:

Sleeves and Inserts	Centerline of sleeve or insert
Projected ends of anchors	Plane perpendicular to the end of the anchor as located on the drawings
Anchor bolt setting	Centerline of anchor bolts
Finish concrete	the concrete surface as located on the drawings

4. Where equipment is to be installed, comply with manufacturer's tolerances if more severe than above.

END OF SECTION

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SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included in this Section consists of providing reinforcing steel and welded wire mesh for cast-in-place or precast concrete structures.

B. Related Work:

1. Concrete Formwork: Section 03100

2. Cast-In-Place Concrete: Section 03300

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall meet all requirements of the current editions of the following standards:

1. Standard Building Code.

2. ACI 318 Building Code Requirements for Reinforced Concrete.

3. ACI 315 Details and Detailing of Concrete Reinforcement.

4. CRSI Manual of Standard Practice, MSP-2.

1.03 SUBMITTALS

A. Complete shop drawings shall be submitted for comment, including bar lists and placing drawings. Drawings shall show the type, spacing and location of metal bar supports, the grade of the reinforcing and the name of the manufacturer. The type of coupler splice devices shall be designated.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 60, deformed bars of a USA manufacturer.

B. Welded Wire Fabric: ASTM A185, galvanized.

C. Metal Bar Supports: CRSI MSP-2, Chapter 3, Class 2, Type B, Stainless Steel Protected Bar Supports.

D. Coupler Splice Devices: Cadweld, tension couplers capable of developing the ultimate strength of the bar, as manufactured by Erico Products, Incorporated, Solon, Ohio, or equal and where accepted by the Engineer.

E. Fibermesh Reinforcement: Fibermesh reinforcement fibers shall be ½" to ¼" collated polypropylent fibers. Fibers shall be in strict accordance with the manufacturer recommendations and within the time as specified in ASTM C94, Type III 4.13 and with applicable building codes.

2.02 FABRICATION

A. Fabrication shall not begin until the shop drawings have been reviewed by the Engineer and no exception taken or other favorable comment has been returned. Fabrication shall meet all requirements of the specified standards. Unless otherwise indicated, the following shall apply:

1. Hooks shall be standard hooks.

2. Bottom bars shall extend a minimum of 6 inches into supporting members.

3. Cover is to the outermost stirrup, tie or bar.

4. Splices are permitted only where indicated on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Supporting Reinforcing: Bar supports shall be provided as required by CRSI MSP-2 and AC1315. Top and bottom bars in slabs formed on earth shall be supported on precast concrete block supports except where such bars are properly supported from formwork. Precast concrete block supports are not required in slabs formed on tremie concrete but may be used at the Contractor's option.

B. Placing Reinforcing: Placing of reinforcing and welded wire fabric shall be as indicated on the Drawings and as recommended by CRSI MSP-2 and ACI 315. Reinforcing shall be securely tied and supported to prevent displacement during concrete placement.

C. Welded Wire Fabric: Splices in welded wire fabric shall be such that the overlap between outermost cross wires of each fabric sheet is not less than the spacing of the cross wires, plus 2 inches. Fabric shall not be extended through expansion joints or construction joints in slabs on grade except as otherwise indicated.

D. Coupler Splice: Unless indicated on the Drawings or where conventional lap splices cannot be achieved, full positive tension connections shall be provided. Such devices shall be installed in accordance with the recommendations of the manufacturer.

E. Dowels: Dowels shall be wired in position prior to placing concrete.

F. Field Bending: Heat shall not be used to bend bars. Bars shall not be bent after being embedded in concrete.

G. Welding: Welding of reinforcing will not be permitted.

H. Place reinforcement a minimum of 2 inches clear of any metal pipe or fittings.

END OF SECTION

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SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included in this Section consists of providing cast-in-place concrete.

B. Related Work Described Elsewhere:

1. Concrete Formwork: Section 03100

2. Concrete Reinforcement: Section 03200

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the requirements of the following standards:

1. Standard Building Code

2. Local Codes and Regulations

3. ACI 318-83, Building Code Requirements for Reinforced Concrete

B. Plant Qualification: Plant equipment and facilities shall meet all requirements of the Check List for Certification of Ready Mixed Concrete Production Facilities of the National ready Mixed Concrete Association and ASTM C 94.

C. Evaluation and Acceptance of Concrete: Evaluation and acceptance of concrete will be in accordance with ACI-318, Chapter 4.

1.03 SUBMITTALS

A. Materials and Shop Drawings: The following information shall be submitted for review. No concrete shall be furnished until Submittal has been reviewed by the Engineer and no exceptions taken or other favorable response has been returned.

1. Plant Qualification: Satisfactory evidence shall be submitted indicating that the plant and operators have sufficient experience in providing the applicable design mix.

2. Materials: Satisfactory evidence shall be submitted indicating that materials to be used, including cement, aggregates and admixtures meet the specified requirements.

3. Design Mix: The design mix to be used shall be prepared by qualified persons and submitted for review. Submit affidavit as to design mix performance over the preceding six months. The design of the mix is the responsibility of the Contractor subject to the limitations of the Specifications. Acceptance of this submission will be required only as minimum requirements of the Specifications have been met. Such acceptance will in no way alter the responsibility of the contractor to furnish concrete meeting the requirements of the Specifications relative to strength and slump.

4. Ready Mix Concrete: Provide delivery tickets or weighmasters certificate per ASTM C 94, including weights of cement and each size aggregate, amount of water in the aggregate, and amount of water added at the plant. Write in the amount of water added on the job.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement:

1. Cement for all concrete shall be domestic Portland cement that conforms to the requirements of ASTM Designation C 150 Type I, Type II or Type III. All sanitary sewer manholes, wet wells, pumping stations, tanks and structures exposed to wastewater shall be constructed with Type II cement. Type III cement for high early strength concrete shall be used only for special locations and only with the review and acceptance of the Engineer. Type I cement may be used for buildings and tremie concrete.

2. Only one brand of cement shall be used in any individual structure unless accepted by the Engineer. Cement which has become damaged, partially set, lumpy or caked shall not be used and the entire contents of the sack or container which contains such cement will be rejected. No salvaged or reclaimed cement shall be used.

3. Flyash shall not be used in either Class A or Class B concrete.

B. Aggregates:

1. ASTM C 33. Coarse aggregates shall be size No. 57. Block cell fill shall be size No. 89.

2. In addition to requirements of ASTM C 33 for structures exposed to wastewater, the following shall apply:

    a. Soft particles: 2.0 percent
    b. Chert as a soft impurity (defined in Table 3 of ASTM C 33): 1.0 percent
    c. Total of soft particles and chert as a soft impurity: 2.0 percent
    d. Flat and elongated particles (long dimension > 5 times short dimension): 15.0 percent

C. Water: Clean and free from injurious amounts of deleterious materials.

D. Air Entraining Admixture: ASTM C 260.

E. Water Reducing and Retarding Admixture: ASTM C 494, Type D. Admixture shall not contain calcium chloride.

F. Epoxy Bonding Agent: Sikastix 370, Sikadur Hi Mod, Concresive 1001-LPL or approved equal.

2.02 MIXES

A. General Requirements:

1. Mix Design: Proportioning shall be on the basis of field experience and/or trial mixtures as specified in ACI 318, Section 4.3. Data on consecutive compression tests and standard deviation shall be submitted. Proportioning for small structures may be by the water/cement ratio under special review and acceptance by the Engineer. Concrete mix design shall comply with the Standard Building Code requirements.

2. Air Content: 1 to 6 percent

3. Slump: 4 inches plus or minus 1 inch.
   8 inches plus or minus 1 inch for tremie concrete.

4. Water cement ratio = 0.45 maximum (all concrete exposed to hydrostatic loading), 0.50 maximum (all other concrete).

5. Minimum Compressive Strength at 28 days:

    a. Class A, 4,000 psi
    Wastewater structures inclusive of tanks, ditches, pumping stations, tremie concrete and other structures in contact with treated waters.

    b. Class B, 3,000 psi

Building structures, curb and gutters, slabs, walks, encasements, thrust blocks, and pipe supports, etc. not in contact with treated waters.

B. Production of Concrete:

1. General: Concrete shall be ready mixed and shall be batched, mixed and transported in accordance with ASTM C 94, except as otherwise indicated.

2. Air Entraining Admixture: Air entraining admixture shall be charged into the mixture as a solution and shall be measured by means of an accepted mechanical dispensing device. The liquid shall be considered a part of the mixing water.

3. Water Reducing and Retarding Admixture: Water reducing and retarding admixture shall be added and measured as recommended by the manufacturer. The addition of the admixture shall be separate from the air entraining admixture. The addition of the admixture shall be completed within one minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first. Admixtures shall be stored, handled and batched in accordance with the recommendations of ACI 68.

C. Delivery Tickets: In addition to the information required by ASTM C 94, delivery tickets shall indicate the cement content and the water/cement ratio.

D. Temperatures: The temperature of the concrete upon delivery from the truck shall not exceed 90□F.

E. Modifications To The Mix: No modifications to the mix shall be made in the plant or on the job which will decrease the cement content or increase the water-cement ratio beyond that specified. No modifications of any kind shall be made except by a qualified and responsible representative of the concrete producer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Preparations Before Placing: No concrete shall be placed until the review and acceptance of the Engineer has been received. Acceptance will not be granted until forms are thoroughly clean, and reinforcing and all other items required to be set in concrete have been placed and thoroughly secured. The Engineer shall be notified a minimum of 24 hours before concrete is placed.

B. Conveying:

1. General: Concrete shall be handled from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete. No concrete shall be placed more than 90 minutes after mixing has begun for that particular batch.

2. Buckets and Hoppers: Buckets and hoppers shall have discharge gates with a clear opening equal to no less than one-third of the maximum interior horizontal area, or five times the maximum aggregate size being used. Side slopes shall be no less than 60 degrees. Controls on gates shall permit opening and closing during the discharge cycle.

3. Runways: Extreme care shall be exercised to avoid displacement of reinforcing during the placing of concrete.

4. Elephant Trunks: Hoppers and elephant trunks shall be used to prevent the free fall of concrete for more than 6 feet.

5. Chutes: Chutes shall be metal or metal lined, and shall have a slope not exceeding one vertical to two horizontal, and not less than one vertical to three horizontal. Chutes more than 20 feet long and chutes not meeting the slope requirements, may be used only if they discharge into a hopper before distribution.

6. Pumping Equipment: Pumping equipment and procedures, if used, shall conform to the recommendations contained in the report of ACI Committee 304 on "Placing Concrete by Pumping Methods," ACI 304.2R-71. The specified slump shall be measured at the point of discharge. The loss of slump in pumping shall not exceed 1-1/2 inches.

7. Conveying equipment Construction: Aluminum or aluminum alloy pipe for tremies or pump lines and chutes, except for short lengths at the truck mixer shall not be permitted.

8. Cleaning: Conveying equipment shall be cleaned at the end of each concrete operation.

3.02 APPLICATION

A. Placing:

1. General: Concrete shall be deposited continuously, or in layers of such thickness (not exceeding 2 feet in depth) that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness.

2. Supported Elements: At least two hours shall elapse after depositing concrete in columns or walls before depositing in beams, girders, or slabs supported thereon.

3. Segregation: Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to procedures which will cause segregation.

4. Concrete Under Water: All concrete, except that indicated on the Drawings as Tremie concrete, shall be placed in the dry.

B. Seals and Tremie Concrete:

1. General:

   a. Wherever practicable, all foundation excavations shall be dewatered and the concrete deposited in the dry. Where conditions are encountered which render it impracticable to dewater the foundation before placing concrete, a concrete foundation seal shall be placed. The foundation shall then be dewatered, and the balance of the concrete placed in the dry.

   b. When seal concrete is required to be placed, the satisfactory performance of the seal in providing a watertight excavation for placing structural concrete shall be the responsibility of the Contractor. Seal concrete placed by the Contractor, which subsequently fails to perform properly, shall be repaired as necessary to perform its required function, at the expense of the Contractor.

2. Method of Placing: Concrete deposited under water shall be carefully placed in the space in which it is to remain by means of a tremie, a closed-bottom dump bucket of not less than one cubic yard capacity, or other approved method, and shall not be disturbed after it is deposited. All seal concrete shall be deposited in one continuous pour. No concrete shall be placed in running water. All form work designed to retain concrete under water shall be watertight, and the design of the form work and excavation sheeting shall be by a Professional Engineer, registered in the State of Florida.

3. Use of Tremie: The tremie shall consist of a tube having a minimum inside diameter of ten inches, and shall be constructed in sections having tight joints. No aluminum parts which have contact with the concrete will be permitted. The discharge end shall be entirely seated at all times, and the tremie tube kept full to the bottom of the hopper. When a batch is dumped into the hopper, the tremie shall be slightly raised (but not out of the concrete at the bottom) until the batch discharges to the bottom of the hopper, after which the flow shall be stopped by lowering the tremie. The means of supporting the tremie shall be such as to permit the free movement of the discharge end over

the entire top surface of the work, and shall permit it being lowered rapidly when necessary to choke off or retard the flow. The flow shall preferably be continuous, and in no case shall be interrupted until the work is completed. Special care shall be exercised to maintain still water at the point of deposit.

4. Use of Bottom-dump Bucket: When the concrete is placed by means of a bottom-dump bucket, the bucket shall be lowered gradually and carefully until it rests upon the concrete already placed. The bucket shall then be raised very slowly during the discharge travel; the intent being to maintain, as nearly as possible, still water at the point of discharge and to avoid agitating the mixture. Aluminum buckets will not be permitted.

5. Time of Beginning Pumping: Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure, and in no case earlier than 72 hours after placement of the concrete.

C. Consolidating Concrete:

1. General: Concrete shall be consolidated by means of internal vibrators operated by competent workmen.

2. Vibrators: Vibrators shall have a minimum head diameter of at least 2 inches, a minimum centrifugal force of 700 pounds and a minimum frequency of 8,000 vibrators per second.

3. Vibrators for Confined Areas: In confined areas, the specified vibrators shall be supplemented by others having a minimum head diameter of 1-1/2 inches, a minimum centrifugal force of 300 pounds and a minimum frequency of 9,000 vibrations per second.

4. Spare Vibrator: One spare vibrator for each three in use shall be kept on the site during all concrete placing operations.

5. Use of Vibrators: Vibrators shall be inserted and withdrawn at points approximately 18 inches apart. The duration of each insertion shall be from 5 to 15 seconds. Concrete shall not be transported in the forms by means of vibrators.

D. Protection: Rainwater shall not be allowed to increase the mixing water, nor to damage the surface finish. Concrete shall be protected from construction overloads. Design loads shall not be applied until the specified strength has been attained.

3.03 CONCRETE FINISHING AND CURING

A. All slabs exposed to view shall receive a steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.

B. All other slabs and footings shall receive a smooth steel trowel finish.

C. All walls of structures or parts of buildings exposed to view shall receive the following finish. Repair defective concrete, remove fins, fill depressions 1/4-inch or deeper, and fill tie holes. In addition, any surface not receiving a special applied finish, shall receive a slurry finish consisting of one part cement and one and one-half parts sand by damp loose volume. Dampen surfaces and then apply the slurry with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap. Surfaces which will receive a special applied finish shall be of even color, have no pits, pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff bristle fiber brush shall produce no dusting or dislodging of cement or sand.

D. All concrete shall be wet cured a minimum of 7 days; or if not to receive special finishes, coatings or concrete toppings, an Engineer accepted curing compound may be utilized.

E. All surface defects shall be repaired by removing defective concrete down to sound concrete and repairing with patching mortar. Finished repair shall match adjacent concrete and be cured as specified.

3.04 TESTING

A. A testing laboratory accepted by the Owner will make such tests as are deemed advisable. The Contractor shall pay for all tests indicating a failure to comply with the Specifications. The Contractor shall keep the laboratory informed of his schedule.

B. Standard laboratory compressive test cylinders will be obtained by the laboratory when concrete is discharged at the point of placing (i.e., discharge end of pumping equipment), and cylinders will be made and cured in accordance with the requirements of ASTM Designation C 31. A set of 4 cylinders will be obtained for each 50 cubic yards or fraction thereof placed each day, for each type of concrete. The cylinders will be cured under laboratory conditions and will be tested at 7 and 28 days of age, respectively, in accordance with the requirements of ASTM Designation C 39.

C. The testing laboratory will make slump tests of Class A and Class B concrete as it is discharged from the mixer at the point of placing. Slump tests will be made for each 25 cubic yards or "pour" of concrete placed. Slump tests may be made on any batch, and failure to meet specified slump requirements will be sufficient cause for rejection of that batch.

END OF SECTION

SECTION 03410

PRECAST CONCRETE STRUCTURES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all materials, labor and equipment and construct manholes, wetwells, valve vaults, meter boxes and all other precast concrete structures, as shown on the Drawings and as specified herein.

B. The manholes shall have an invert channel shaped to correspond with the lower half of the pipe. The top of the shelf shall be at the elevation indicated and shall be sloped to drain toward the flowing-through channel. Every effort shall be made by the Contractor to construct watertight structures.

C. The forms, dimensions, concrete, and construction methods shall be accepted by the Engineer in advance of construction.

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards.

1. Standard Building Code

2. Local Codes and Regulations

3. ACI Building Code Requirements for Reinforced Concrete

1.03 SUBMITTALS

A. The Contractor shall submit to the Engineer, as provided in Section 01001 - General Requirements, shop drawings, showing all details of construction, reinforcing and joints.

B. Submit manufacturer's data on joint mastic, gaskets, grout material and admixtures to be used.

1.04 INSPECTION

A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and acceptance by the Engineer/Project Manager, or other representatives of the Owner. Such inspection may be made at the place of manufacture or at the site after delivery, or at both places, and the sections shall be

subject to rejection at any time because of failure to meet any of the specification requirements; even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All sections which have been damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if authorized by the Engineer, or removed and replaced, entirely at the Contractor's expense.

B. At the time of inspection, the sections will be carefully examined for compliance with the ASTM designation specified in these specifications, and with the accepted manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch- strength", blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

C. Imperfections may be repaired, subject to the review and acceptance of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final review and acceptance. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi at the end of 28 days, when tested in 3-inch by 6-inch cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the review and acceptance of the Engineer.

PART 2 - PRODUCTS

2.01 PRECAST CONCRETE SECTIONS

A. Precast concrete manhole barrel and eccentric top sections shall conform to specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C478, except as otherwise specified below or as shown on the drawings. The method of construction shall conform to the detailed Drawings appended to these specifications and the following additional requirements:

1. The minimum wall thickness for the various size barrel sections shall be 5 inches.

2. Barrel sections shall have tongue and groove joints. Joints shall be sealed with cold adhesive preformed plastic gaskets set in double rows on the tongue and in the groove prior to setting the next section.

3. Type II cement shall be used except as otherwise accepted.

4. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section. Each section of the manhole must be inspected and stamped by an accredited testing laboratory.

5. Sections shall be cured by an accepted method for at least 28 days prior to painting and shall not be shipped until at least 2 days after having been painted.

6. Top sections shall be eccentric except that precast concrete slabs shall be used where cover over the top of the pipe is less than 4 feet for all manholes.

7. Precast concrete slabs over top section, where required, shall be capable of supporting the overburden plus a live load equivalent to ASHTO H-20 loading.

8. The tops of bases shall be suitably shaped to mate with the precast barrel section.

9. Interior and exterior coatings and/or linings, or waterproofing admixtures shall be as per the associated section for specific structure use as specified on the drawings or herein.

10. Precast leveling rings for setting cast iron frames over manholes shall be 2-inch thick and have one No 2 continuous reinforcing steel bar.

A. Precast concrete wetwells, valve vaults and air release valve vaults shall be constructed to the dimensions as shown on the Drawings, and conform to specifications as per ASTM Designation C478, except as otherwise specified below or as shown on the drawings. The method of construction shall conform to the detailed Drawings appended to these specifications and the following additional requirements:

1. Type II cement shall be used except as otherwise accepted.

2. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section. Each section must be inspected and stamped by an accredited testing laboratory.

3. Sections shall be cured by an accepted method for at least 28 days prior to painting and shall not be shipped until at least 2 days after having been painted.

4. Precast concrete slabs over top section, where required, shall be capable of supporting the overburden plus a live load equivalent to ASHTO H-20 loading.

5. Joint sealer material for precast structures shall be preformed flexible plastic conforming to Federal Specification SS-S-00210 (GSA-FSS), "Ram-Nek," as manufactured by K. T. Snyder Co., Inc. or accepted equal. Seal all exterior joints with Portland Type II cement after setting of "Ram-Nek" and placement of section to form a watertight joint.

6. Interior and exterior coatings and/or linings, or waterproofing admixtures shall be as per the associated section for specific structure use as specified on the drawings or herein.

2.02 WATERPROOFING AND CORROSION RESISTANCE ADMIXTURE

A. For all precast structures exposed to wastewater, an approved concrete waterproofing admixture (with tracer) shall be added to the concrete during the batching operation. The recommended percentage of the required weight of Portland Cement shall be added as waterproofing admixture (i.e.: 3.5% minimum for Xypex). The amount of cement shall remain the same and not be reduced. A colorant shall be added to verify the admixture was added to the concrete. Colorant shall be added at the admixture manufacturing facility, not at the concrete batch plant. The admixture must be added to the concrete at the time of batching. It is recommended that the admixture powder be added first to the rock and sand and blended thoroughly before adding cement and water.

B. Acceptable products (or approved equal):
Comply with manufacturer's product data regarding installation, including technical bulletins, product catalogue, installation instructions and product packaging labels.

Xypex Admix C-1000R (with red dye)
Michael Kendig, President
Florida Protective Coatings Consultants, Inc.
407-322-1243 mkendig@tnemec.com www.tnemec.com www.xypex.com

Kryton – Krystol Internal Membrade (KIM) with color or UV tracer
Alan Wantroba, Regional GM
The Crystal Group, LLC
919-359-2432 ext 105, alan@thecrystalgroupllc.com www.thecrystalgroupllc.com

Penetron Admix with tracer.
Christopher A. Chen, Director, North American Sales & Marketing
ICS PENETRON INTERNATIONAL LTD.
631-941-9700, cchen@penetron.com www.penetron.com

C. Dosing Rate: The waterproofing additive shall be added to the concrete mix per the manufacturer's recommendations or at the following minimum rates:
1. Xypex Admix C-1000R (with red dye) at **3.5**% by weight of Portland Cement.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All manholes and other precast structures shall be set in the dry.

B. Manholes and other precast structures shall be constructed to the dimensions as shown on the Drawings and as specified herein.

C. The base shall be placed on the required crushed stone base as shown in the Drawings over a dry subbase of structural fill compacted to 95% of the maximum dry density as determined by the modified proctor, ASTM D1557. The tops of the cast-in-place bases shall be shaped to mate with the precast barrel section, and shall be adjusted in grade so that the top of the dome section is at the approximately correct elevation.

D. Precast bases, conforming to all requirements of ASTM C478 and other requirements for precast sections, may be used, and shall be set on a subbase as described above.

E. Lift rings or non-penetrating lift holes shall be provided for handling pre-cast manhole sections. Non-penetrating lift holes shall be filled with non-shrink grout after installation of the manhole sections.

F. Where holes must be cut in the precast sections to accommodate pipes, cutting shall be done prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.

F. Cast iron frames shall be placed over precast concrete leveling rings, shimmed, and set in Portland cement mortar to the required grade. No more than three courses of leveling rings shall be used.

END OF SECTION

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SECTION 03600

GROUTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The scope of work involves the grouting of the space left void in the abandonment of the existing pipelines and structures. The work consists of furnishing all labor, equipment and materials and performing all work connected with the placement of the cementaceous grout to fill the void.

1.02 QUALITY ASSURANCE

A. Grouting shall be performed by a crew under the direct supervision of a superintendent that has experience in grouting of this nature.

B. Storage, mixing, handling and placement shall be in accordance with manufacturer's instructions and specifications.

1.03 SUBMITTALS

A. Shop Drawings: Shop drawings shall be submitted in accordance with the General Conditions and Section 01001 - General Requirements of these specifications. In addition, the following shall be submitted to the Engineer for review and acceptance prior to construction.

1. A detailed description of equipment and operational procedures to accomplish the grouting operation, including grout mixture design, grout mixer type, grout samples, and test data.

2. A detailed description of the grouting time schedule.

PART 2 - PRODUCTS

2.01 GROUT MATERIAL

A. The grout shall be a "flowable fill" consisting of a mixture of Type 1 Portland Cement, Type "F" Flyash (ASTM 618), sand and water.

B. The mixture shall contain a minimum of 50 pounds cement and minimum of 400 pounds flyash per cubic yard of grout.

2.02 EQUIPMENT

A. All grout shall be mixed with a high shear, high energy colloidal type mixer to achieve the best uniform density.

B. The grout shall be pumped with a non-pulsating centrifugal or tri-plex pump.

C. The mixer shall be capable of continuous mixing. Batch mixing shall not be permitted.

PART 3 - EXECUTION

3.01 GROUTING

A. Grouting of the annular space due to the abandonment of the existing sewer pipe will be allowed in continuous individually bulkheaded segments of up to 300 linear feet.

B. Grout shall be placed in a maximum of three stages, with the initial stage volume equal to or greater than 50% of the total volume for that section of pipe being grouted. The maximum time wait between grouting stages shall be 24 hours.

C. For each stage, mix and pump the material in one continuous process so as to avoid partial setting of some grout material during that stage, thus, eliminating voids and possible subsequent surface damage due to "cave-ins".

D. Each section shall be grouted by injecting grout from the lowest point and allowing it to flow toward the highest point to displace water from the annulus and assure complete void-free coverage. Grout shall be placed through tubes installed in the bulkheads at the insertion pits or manholes. Grout tubes shall be at least 2-inch nominal diameter.

E. After the ends of each section of pipe are exposed, the entire space, not to exceed 300 linear feet end to end, shall be sealed by controlled pumping of grout until it flows from the pipe at the opposite end of the grouting. **Grouting shall be carried out until the entire space is filled.**

F. Grout pressure in the void space is not to exceed five (5) psi above maximum hydrostatic groundwater level. An open ended, highpoint tap or equivalent vent must be provided and monitored at the bulkhead opposite to the bulkhead through which grout is injected. This bulkhead will be blocked closed as grout escapes to allow the pressuring of the annular space.

3.02 FIELD QUALITY CONTROL

A. The quality of the grout, application of the equipment, and installation techniques are the responsibility of the Contractor. The review and acceptance or approval of specific mix design, equipment or installation procedures shall in no way relieve the Contractor of his obligation to provide the final product as specified herein.

END OF SECTION

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SECTION 05500

MISCELLANEOUS METAL

PARTS 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install covers, grates, frames, hatches, manhole rungs, catch basin castings and other miscellaneous metals as shown on the Drawings and specified herein.

1.02 COORDINATION

A. The work in this section shall be completely coordinated with the work of other Section. Verify at the site both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

1.03 SHOP DRAWINGS AND SAMPLES

A. Detail drawings, as provided for in the General Conditions, showing sizes of members, method of assembly, anchorage, and connection to other members shall be submitted to the Engineer for approval before fabrication.

B. Samples shall be submitted at the request of the Engineer for concurrent review with shop drawings.

1.04 FIELD MEASUREMENTS

A. Field measurements shall be taken at the site to verify or supplement indicated dimensions and to insure proper fitting of all items.

1.05 REFERENCE SPECIFICATIONS

A. Unless otherwise specified, materials shall conform to the following:

Structural Steel	ASTM A36
Welded and Seamless Steel Pipe	ASTM A53
Gray Iron Castings	ASTM A48, Class 30
Galvanizing, general	ASTM A123
Galvanizing, hardware	ASTM A153
Galvanizing, assemblies	ASTM A386
Aluminum (Extruded Shapes)	6061-T6 (Alum. alloy)

Aluminum (Extruded Pipe)	6063-T6 (Alum. alloy)
Aluminum Bar Structural	6061-T6 (Alum. alloy)
Bolts and Nuts	ASTM, A307
Stainless Steel Bolts, Fasteners	AISI, Type 316
Stainless Steel Plate and Sheet, Wire	AISI, Type 316
Welding Rods for Steel	AWS Spec. for Arc Welding

PART 2 - PRODUCTS

2.01 ANCHORS, BOLTS, AND FASTENING DEVICES

A. Anchors, bolts, etc. shall be furnished as necessary for installation of the work of this Section.

B. Compound masonry anchors shall be of the type shown or required and shall be equal to Star Slug in compounded masonry anchors manufactured by Star Expansion Industries, equal by Phillips Drill Co., Rahplug, or approved equal. Anchors shall be minimum "two unit" type.

C. The bolts used to attach the various members to the anchors shall be the sizes shown or required. Stainless steel shall be attached to concrete or masonry by means of stainless steel machine bolts and iron or steel shall be attached with steel machine bolts unless otherwise specifically noted.

D. For structural purposes, unless otherwise noted, expansion bolts shall be Wej-it "Ankr-Tite", Phillips Drill Co. "Wedge Anchors", Hilti "Kwik-Bolt", or approved equal. When length of bolt is not called for on the Drawings, the length of bolt provided shall be sufficient to place the wedge portion of the bolt a minimum of 1-inch behind the reinforcing steel within the concrete. Material shall be as noted on the Drawings. If not listed, hot dipped galvanized steel.

2.02 ALUMINUM ITEMS

A. Aluminum gratings shall be of serrated I-Bar Aluminum Alloy 6061-T6, fabricated to the depths and thicknesses shown on the Drawings and shall be Reliance Steel Products Company, I-Lok Type 7/8 R4 Aluminum Grating; IKG Borden, Aluminum Swaged-Locked I-Bar Grating Type IB, or approved equal. All openings 2 inches and greater in diameter shall be banded with a bar of the same depth and thickness as the main bearing bars of the grating, or furnished with continuous cross bridges. Each cut bar shall be welded to the band if banding is utilized. The ends of all grating sections shall be likewise banded. Clamps and bolts used for attaching grating to supporting members shall be stainless steel. All grating shall be clamped unless noted otherwise. Clamps shall be as recommended by the manufacturer.

B. Stair treads shall be as specified above for grating and shall have abrasive no slip nosing.

C. Aluminum nosing at concrete stairs shall be an extrusion of 4-inch minimum width with abrasive filled and shall be Wooster Products, Inc., Alumogrit Treads, Type 116; equal by Barry Pattern and Foundry Co; Andco; or approved equal. Embedded anchors shall be furnished with a minimum of three anchors per tread.

D. Aluminum ladders shall be fabricated to the dimensions and details and install as shown on the Drawings. Treads to be of cast aluminum by Dixie Metals, Inc. of Fort Lauderdale, Florida or approved equal.

E. Aluminum Handrails, Mechanically Fastened Type:

1. All aluminum mechanically fastened type pipe handrails and guardrails shall be clear anodized aluminum finish and installed as specified herein and indicated on the Drawings. Handrails shall be made of nominal 1-1/2 inches inside diameter pipe (Schedule 40) fabricated of seamless 6063-T6 alloy. The supplier of the handrail system shall supply all necessary fittings, rackets, transition, corner and connector pieces, toe boards, protective gaskets, etc., for a complete job at the locations, indicated on the Drawings. All mounting hardware including bolts, studs, nuts, etc., shall be stainless steel Type 316. Bends shall be smooth and accurate to the details shown. Railings shall be the "Rigid Rail System" as manufactured by Julius Blum & Co., Inc., Carlstadt, New Jersey, or approved equal. The handrail system shall comply with all OSHA and 1207.2 of the Standard Building Code.

2. Spacing of posts where posts are required shall be as noted on shop drawings, but in all cases shall be uniform and shall not exceed the requirements of OSHA and Section 1207.2 of the Standard Building Code. Shorter spacing may be used where required to maintain the maximum spacing. The fabricator of the aluminum handrail and guardrail system shall be responsible for the design and preparation of shop drawings and design calculations (signed and sealed By Florida Registered Engineer) to meet OSHA requirements and Section 1207.2 of Standard Building Code.

3. All railings shall be erected in line and plumb. Field splicing and expansion compensation shall be accomplished using internal splice sleeves. Make provisions for removable railing sections as detailed and where shown on the Drawings.

4. Where handrail or guardrail posts are set in concrete as per the manufacturer's requirements the posts shall be set into aluminum sleeves cast in the concrete and firmly cemented with 1651 epoxy resin by E-bond Epoxies, Oakland Park, Florida, or Molded Reinforced Plastics, Inc., Fort Lauderdale, Florida or approved equal. Collars shall be placed on the posts and fastened in place, as shown and as detailed on approved shop drawings.

5. Where handrail is supported from structural members, it shall be done by the use of approved sockets, flanges, brackets, or other approved means which will provide neat and substantial support for the pipe railing.

6. All railing shall be properly protected by paper or by an approved coating or by both against scratching, splashes or mortar, paint, or other defacements during transportation and erection and until adjacent work by other trades has been completed.

F. Toe boards

1. Contractor shall furnish and install aluminum toe boards conforming to latest OSHA requirements on all railings and other locations where indicated on the Drawings.

2. Toe boards shall consist of an extruded 6063-T6 aluminum shape bolted by means of a pipe clamp to the railing posts without requiring any drilling or welding of the toe board to the railing posts as manufactured by Reynolds Aluminum, Julies Blum & Company, Thompson Fabricating Company, or approved equal. Toe boards shall have pitched top and tear drop bottom to prevent accumulation of dirt, or other material.

3. Toe boards shall be aluminum alloy 6063-T6. All fastening hardware shall be Type 316 stainless steel.

G. Kick plates, if required, shall be fabricated and installed as shown on the drawings.

H. Aluminum safety gate shall be fabricated of extruded aluminum.

I. Prefabricated checker plate aluminum floor hatches shall be Type "JD", or "KD" as manufactured by Bilco Co., equal by Babcock-Davis Associates, Inc.; Type "AM" Inland-Ryerson Construction Products Co., Milcor Division; or approved equal, sized as shown. Hatches with either dimension over 3 feet-6 inches shall be double leaf type. Hatches shall be designed for a live load of 300 pounds per square foot. Hatches shall be watertight.

J. Ship ladders shall be of all aluminum construction as detailed. Treads shall have abrasive nosing as manufactured by Reliance Steel Products Co., IKG Industries, or approved equal.

K. Check plate aluminum cover plates shall be fabricated to the details shown and installed at the locations shown.

L. Structural aluminum angle and channel door frames shall be provided as shown on the Drawings and shall be anodized. Frames shall be fabricated with not less than three anchors on each jamb.

M. Miscellaneous aluminum shapes and plates shall be fabricated as shown. Angle frames for hatches, beams, grates, etc., shall be furnished complete with welded strap anchors attached. Furnish all miscellaneous aluminum shown but not otherwise detailed. Structural shapes and extruded items shall conform to the detail dimensions or the plans within the tolerances published by the American Aluminum Association.

2.03 STEEL ITEMS

A. Sleeves shall be steel or cast iron pipe in walls and floors with end joints as shown on the Drawings. All pipe sleeves shall have center anchor around circumference as shown.

B. Structural steel angle and channel door frames shall be provided as shown on the Drawings and shall be galvanized. Frames shall be fabricated with not less than three anchors on each jamb.

C. All miscellaneous lintels and closures not shown on the Drawings shall be galvanized steel and shall be provided as a part of this Section.

D. Miscellaneous steel pipe for sleeves and lifting attachments and other uses as required shall be Schedule 40 pipe fabricated according to the details as shown on the Drawings.

E. Frames, covers and grates for manholes, catch basins and inlets shall be of good quality, strong, tough even grained cast iron except as otherwise specified below. Castings shall be as manufactured by the U.S. Foundry, Neenah Foundry, Mechanics Iron Foundry, or approved equal. Sizes shall be as shown on the Drawings. Covers to have letters "WATER", "SEWER", or "DRAIN", as applicable, embossed on top.

F. Provide solid manhole and hand hole covers and frames for electrical and telephone underground systems. (Covers to have letters "HIGH VOLTAGE", "LOW VOLTAGE", "SIGNAL, and “TELEPHONE", as applicable, embossed on top).

G. Steel support channels for chemical hose shall be of the dimensions and slope shown on the Drawings, conform to ASTM spec A-36 and shall include all stainless steel hardware as required or specified herein.

H. Wheel guards shall be ductile case iron thirty inches in height. All Wheel guards shall be Model R-4982, Type A (for doorways) as manufactured by Neenah Foundry Company or approved equal.

I. Miscellaneous steel shall be fabricated and installed in accordance with the Drawings and shall include: beams, angles, support brackets, closure angles in roof at edge of T-beam; base plates to support ends of T-beams; door frames; splice plates, anchor bolts (except for equipment furnished in Divisions 11, 13, 14 and 15, where applicable); lintels and any other miscellaneous steel called for on the Drawings and not otherwise specified.

J. Exterior ventilation hoods shall be fabricated with angle reinforcing designed to meet the requirements of the Southern Building Code Conference International. The covering shall be 18 gauge galvanized steel sheet. The reinforcing frame shall be bent to form the radius or straight to support the bird screen and shall use galvanized steel angles that are a minimum of 1-1/4-inch. The opening shall be covered with a framed stainless steel bird screen that has a 1/2-inch square mesh. Details of the hood shall accommodate dampers where indicated on the heating, ventilating, and air conditioning Drawings. Frames shall be fastened to the structure with stainless steel fasteners.

2.04 CAST IRON ITEMS

A. Outside pipe clean-out frames and covers shall be heavy duty, R-6013-R-6099 series as manufactured by Neenah Foundry Co., or approved equal. All outside pipe clean-outs shall be 6-inch diameter.

B. Trench drain shall be of length shown on the Drawings and shall be heavy duty, cast iron, open grate lid type, Series R-4990 Type A as manufactured by Neenah Foundry Col., or approved equal.

C. Electric and telephone manhole frames and covers shall be ductile iron castings conforming to all requirements of ASTM A536. The covers shall be watertight and shall have the work "ELECTRIC" cast into the top in letters 2 inches high. The clear opening shall be 36 inches.

PART 3 - EXECUTION

3.01 FABRICATION

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability.

B. Connections and accessories shall be of sufficient strength to safely withstand stresses and strains to which they will be subjected. Steel accessories and connections to steel or cast iron shall be steel, unless otherwise specified. Threaded connections shall be made so that the threads are concealed by fitting.

C. Welded joints shall be rigid and continuously welded or spot welded as specified or shown. The face of welds shall be dressed flush and smooth. Exposed joints shall be close fitting and jointed where least conspicuous.

D. Welding of parts shall be in accordance with the Standard Code for Arc and Gas Welding in Building Construction of the AWS and shall only be done where shown, specified, or permitted by the Engineer. All welding shall be done only by welders certified as to their ability to perform welding in accordance with the requirements of

the AWS code. Component parts of built-up members to be welded shall be adequately supported and clamped or held by other adequate means to hold the parts in proper relation for welding.

E. Welding of aluminum work shall be on the unexposed side as much as possible in order to prevent pitting or discoloration.

F. All aluminum finish exposed surfaces, except as specified below, shall have manufacturers' standard mill finish. Aluminum handrails shall be given an anodic oxide treatment in accordance with the Aluminum Association Specification AA-C22-A41. A coating of methacrylate lacquer shall be applied to all aluminum before shipment from the factory.

G. Castings shall be of good quality, strong, tough, even-grained, smooth, free from scale, lumps, blisters, sand holes, and defects of any kind which render them unfit for the service for which they are intended. Castings shall be thoroughly cleaned and will be subjected to a hammer inspection in the field by the Engineer. All finished surfaces shown on the Drawings and/or specified shall be machined to a true plane surface and shall be true and seat at all points without rocking. Allowances shall be made in the patterns so that the thickness specified or shown shall not be reduced in obtaining finished surfaces. Castings will not be acceptable if the actual weight is less than 95 percent of the theoretical weight computed from the dimensions shown. The Contractor shall provide facilities for weighing castings in the presence of the Engineer showing true weights, certified by the supplier.

H. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust, and foreign matter before shipment and shall be given one shop coat of primer compatible with finish coats specified in Painting Section after fabrication but before shipping. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces. Abrasions in the field shall be touched up with primer immediately after erection. Final painting as per the manufacturer.

I. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Following all manufacturing operations, all items to be galvanized shall be thoroughly cleaned, pickled, fluxed, and completely immersed in a bath of molten zinc. The resulting coating shall be adherent and shall be the normal coating to be obtained by immersing the items in a bath of molten zinc and allowing them to remain in the batch until their temperature becomes the same as the bath. Coating shall be not less than 2 oz. per sq. ft. of surface.

3.02 INSTALLATION

A. Install all items furnished except items to be imbedded in concrete or other masonry which shall be installed under Division 3 and Division 4 respectively., Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted. All dimensions shall be verified at the site before fabrication is started.

B. All steel surfaces to come in contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.

C. Where aluminum is embedded in concrete, apply a heavy coat of approved bitumastic troweling mastic in accordance with the manufacturer's instructions prior to installation.

D. Where aluminum contacts masonry or concrete, provide a 1/32-inch neoprene gasket between the aluminum and the concrete or masonry.

E. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer and provide a 1/32-inch neoprene gasket between the aluminum and the dissimilar metal.

F. Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.

END OF SECTION

SECTION 09910

PAINTING
(FOR UTILITY SYSTEMS)

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. These specifications pertain to the painting of all above ground assets included but not limited to steel, ductile iron pipe, ductile iron fittings, valves, hydrants, hardware and all appurtenances. Brass, bronze and 316 stainless steel shall not be painted.

B. The terms "paint" or "painting" as used in this section, includes the use of emulsions, enamels, paints, scalers and other coatings, organic or inorganic whether used as prime, intermediate, or finish coats.

C. Unless otherwise specified in the detailed equipment specifications, shop painting shall conform to the requirements of this section.

D. It is the intent of these Specifications to field paint the following:

1. All fire hydrants.

2. All exposed piping and appurtenances.

3. Work under this section shall also include touch-up or repair of any damaged or defective painted surface.

4. Pipe identification markings.

E. The omission of minor items in the schedule of work shall not relieve the Contractor of his obligation to include such items where they come within the general intent of the Specifications.

1.02 QUALITY ASSURANCE

A. All work shall be proved to be in first class condition and constructed in accordance with the drawings and specifications. All defects disclosed by tests and inspections shall be remedied immediately by the Contractor at no expense to the COUNTY.

B. Holiday Testing: Each coat shall be holiday tested at the recommended 100-125 volts DC per mil in accordance with the latest edition of the following standards: NACE SP0188-2006, NACE Standard RP0490, ASTM G62.

C. All materials shall be delivered to the job in original sealed and labeled containers of the coating manufacturer, and shall be subject to inspection by the Engineer. Labels shall show name of manufacturer, type of coating, formulation, date, color and manufacturers recommendations. Coatings manufacturer date shall not exceed the manufacturers recommendations for storage and useful life and coating manufactured in excess of 1 year prior to application shall be rejected.

D. Oil and grease shall be completely removed in accordance with SSPC-SP1 before beginning any other surface preparation method. Surfaces of welds shall be scraped and ground as necessary to remove all slag and weld spatter.

E. All components of equipment that can be properly prepared and coated after installation shall be installed prior to surface preparation. Components that will be inaccessible after installation shall have the surfaces prepared and coated before installation.

F. All ferrous metal surfaces shall be free of all defects and have all sharp edges, welds, slag, defects and weld spatter ground smooth in accordance with NACE Standard RPO178, Appendix C

G. Edges, corners, crevices, welds, and bolts shall be given a brush coat (stripe coat) for each coating. The stripe coat shall be applied by a brush and worked in both directions. Special attention shall be given to filling all crevices with coating.

H. Coating shall be applied in a neat manner that will produce an even film of uniform and proper thickness, with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be careful examined and faulty material, poor workmanship, holidays, damaged areas and other imperfections shall be touched up prior to applying succeeding coats. Each coat shall be thoroughly dry and hard before the next coat is applied in accordance with the coating manufacturer's recommendations for drying time between coats. In no case shall coating be applied at a rate of coverage greater than the maximum rate recommended by the coating manufacturer. Each coat shall be uniform in coverage and color. Successive coats shall perceptibly vary in color.

I. Coating failures will not be accepted and shall be entirely removed down t the substrate and the surface recoated. Failures include but are not limited to holidays, sags, checking, cracking, teardrops, fat edges, fisheyes, or delamination.

J. Surfaces not required to be coated: Brass, Bronze, Stainless Steel (Not including SS bolts and nuts)

1.03 SUBMITTALS

A. Product data and samples shall be submitted in accordance with the General Requirements. The submissions shall include, but not be limited to the followings:

1. A painting schedule listing the manufacturer, type of paint, and the manufacturer’s recommendations for surface preparations, application and dry mil thickness.

2. A complete specification for each component used.

B. Submit the following operation and maintenance data:

1. Product name and number

2. Name, address and telephone of the manufacturer and the local distributor.

3. Detailed procedures for routine maintenance and cleaning

4. Detailed procedures for light repairs, such as dents, scratches, and straining.

1.05 JOB CONDITIONS

A. The Manufacturer's recommendations concerning environmental conditions under which a material can be applied shall be strictly followed. No finishes shall be applied in areas where dust is being generated.

1.06 TESTING EQUIPMENT

A. The Contractor shall furnish and make available to the Project Manager the following items of testing equipment for use in determining if the requirement of this section is being satisfied. The specified items of equipment shall be available for use at all times when field painting or surface preparation is in progress.

1. Surface thermometer.

2. Set of National Association of Corrosion Engineers (NACE) visual standards.

3. Dry Film Gauge

4. Holiday (pin hole) detector.

5. Sling-psychrometer.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The paints and paint products shall be as manufactured by Carboline, Tnemec Company, or PPG/Ameron as shown in the following table:

Table 09910-1 Color Codes

Generic Name	Application	Tnemec	Carboline	PPG/Ameron
Safety Blue	Water Master Meters	True Blue/Safety 11SF	9122	BL Safety Blue
Safety Green	Pump Station Piping	Hunter Green 08SF	V358	GN Safety Green
Pantone Purple 522C	Reclaimed Master Meters	Purple Rain/Safety 14 SF	7528	PL Safety Purple
Safety Green	Hydrant Bonnet & Caps	Hunter Green 08SF	V358	GN Safety Green
Safety Orange	Hydrant Bonnet & Caps	Tangerine Orange/Safety 04 SF	1420	OR 2 Safety Orange
Safety Red	Hydrant Bonnet & Caps	Candy Apple Red/Safety 06 SF	7573	RD 2 Safety Red
TBD	Hydrant Barrel	TBD	TBD	TBD

C. The painting schedule lists competitive brands of paint and other finishes acceptable for use in the work. The schedule is for identification as to type and quality of materials, and shall be strictly followed unless the Contractor submits an alternate schedule to the Engineer for review. A painting schedule shall be submitted for review. Paint applied contrary to the specified schedule shall be corrected as directed by the Engineer. All rejected paint shall be removed from the job, and surfaces shall be repainted in strict accordance with the schedule and such other directions, as deemed necessary by the Engineer. Unless noted otherwise, each coat of paint shall be applied by appropriate methods to obtain the minimum dry film thickness recommended by the manufacturer for the intended use. The submitted schedule shall contain the manufacturer's recommendations for film thickness.

2.02 LEAD BASED PAINTS

A. Applicants must comply with Lead Based Paints Poisoning and Prevention Act and National Consumer Health Information and Health Promotion Act of 1976.

2.03 PAINTING SCHEDULE

A. The following paint systems are intended to include all surfaces to be painted. Any surface or item not specifically named herein but obviously required to be painted, shall be included under the system selected by the Owner or otherwise painted as

directed by the Project Manager. The minimum dry film thicknesses shall be within the limits indicated in parenthesis adjacent to the manufacturer's products. Surface preparation shall be as specified herein and in accordance with the manufacturer's recommendations.

B. Prime and Finish Coatings

1. Primer: Prime coat all surfaces in the factory with a product compatible with the below specified finish coats. Prime coating shall be as specified by the manufacturer of the finish coating.

2. Finish: Finish coat all surfaces as specified by the Owner.

3. Piping and Appurtenances Color Code/Identification Markings: Color shall be in accordance with the policies and practices of Orange County Fire and Rescue Division, and Orange County Utilities Department.

C. Piping installed below ground or in a casing pipe:

1. All ductile iron pipe shall be marked with a continuous stripe located within the top 90 degrees of the pipe. Said stripe shall be a minimum 2 inches in width and shall be color-coded as per the pipelines intended use (as described below). Backfill shall not be placed for a minimum of 30 minutes following paint application.

2. All polyvinyl chloride (PVC) pipe shall be solid color. Backfill shall not be placed for a minimum of 30 minutes following paint application.

3. Piping color:
   a. Raw Wastewater: Safety Green
   b. Treated Wastewater: Safety Green
   c. Reclaimed Water: Pantone Purple 522C
   d. Raw Water: Safety Green
   e. Potable Water: Safety Blue

D. Piping and appurtenances installed above ground:

1. Color:
   a. Raw Wastewater: Safety Green
   b. Treated Wastewater: Brown
   c. Reclaimed Water: Pantone Purple 522C
   d. Raw Water: Safety Green
   e. Potable Water: Safety Blue

2. Appurtenances:
   a. Fire Hydrants: Silver
   b. Backflow Prevention Devices: Blue

2.04 MAINTENANCE MATERIAL

A. The Contractor shall provide the Owner at final inspection one gallon of each type and final color of paint used on the project.

PART 3 - EXECUTION

3.01 FERROUS METAL SURFACES (Inclusive of Steel and DIP, Hydrants, Fittings and Appurtenances)

A. Cleaning, surface preparation, coating application, and thickness shall be as specified herein and shall meet or exceed the coating manufacturer's recommendations. When the manufacturer's minimum recommendations exceed the specified requirement, the Contractor shall comply with the manufacturers minimum recommendations. All cleaning, surface preparation, coating application, thickness, testing and coating materials (where applicable) shall be in accordance with the referenced standards of the following: AWWA, ANSI, NACE, SSPC, NSF, and ASTM. Color coding shall be Safety Blue, Safety Green, and Pantone Purple 522-C for water, wastewater, and reclaimed water, respectfully. Surfaces shall be holiday detected in accordance with ASTM G62. Areas found to have holidays shall be marked and repaired in accordance with the paint manufacturer's instructions. The county shall be notified of time of testing so that he might be present to witness testing.

B. Procedures for Coating Exterior of DIP, Hydrants, Fittings and Appurtenances

1. Surface Preparation. Do not abrasive blast or prepare more surface area than can be coated in the same day; prepare surfaces and apply prime coatings within an 8-hour period.

a. Steel: Shall require NACE-1/SSPC-SP5 White Metal Blast Cleaning minimum angular anchor profile of 1.5 mils. White metal blast cleaning removes all of the coating, mill scale, rust, oxides, staining, corrosion products, and other foreign matter from the surface.

b. DIP, DIP with asphaltic seal coat, Hydrants, FBE (valves and appurtenances): Shall require NACE-3/SSPC-SP6 Commercial Blast Cleaning minimum angular anchor profile 1.5 mils. Commercial blast cleaning removes all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter from all surfaces and allows stains to remain on 33 percent of each unit area of surface.

Note: Primer Option – Hydrants, FBE (valves and appurtenances), existing factory coatings: Where specifically called out in the Coating System Table below, NACE-4/SSPC-SP7 may be substituted for the commercial blast for hydrants and factory applied FBE (valves and appurtenances) where the coating manufacturer has specifically provided compatible coatings with existing coatings including urethane, epoxy, alkyd and water-based coatings. Under no circumstances shall DIP with asphaltic seal coat be over-coated. NACE-4/SSPC-SP7 Brush-Off Blast Cleaning shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose coating. Tightly adherent mill scale rust and coating may remain on the surface. Mill scale, rust and coating are considered tightly adherent if the cannot be removed by lifting with a dull putty knife after abrasive blast cleaning has been performed

2. Contaminants: remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating in accordance with SSPC-SP1for the substrate and between each coating layer

3. Temperature: Surface Temperature of substrate shall be a minimum of 5 degrees above the dew point and rising and generally between 40°F to 100°F. Temperatures shall not exceed manufacturer's recommendations.

4. Stripping: Edges, corners, crevices, welds, and bolts shall be given a brush coat/ stripe coat for each material/layer. The stripe coat shall be applied by a brush and worked in both directions.

5. Coating Systems: Two options for coating systems are provided. Each Coat shall be a distinctive color or shade to verify each coating in the system.

6. Prime Coat: DIP, DIP with asphaltic seal coat, Hydrants, FBE (valves and appurtenances) prime coat shall be zinc-rich. Zinc-rich shall only be used on bare metal. Factory applied FBE/Asphaltic/Mastic Coatings on valves and appurtenances shall be completely removed per NACE-3/SSPC-SP6.

   Note: Where specifically called out in the Coating System Table for factory applied FBE (valves and appurtenances) surface preparation may be NACE-4/SSPC-SP7 and the prime coat shall be an **Inorganic Water Based Epoxy**.

7. Intermediate Coat: Varies per coating system.

8. Final Coat: Varies per coating system.

9. Holiday Testing: Each coating layer shall be holiday tested at the recommended 100-125 volts DC per mil in accordance with the latest edition of the following standards: NACE SP0188-2006, NACE Standard RP0490, ASTM G62 and per the manufactures recommendations. All low voltage holiday testing shall be performed using a Tinker & Rasor model M-1 Holiday Detector or approved equal.

10. Coating Systems – Either System 1 or System 2 shall be used for above ground, non-immersion ferrous metal surfaces (Inclusive of Steel, DIP, Hydrants, Fittings and Appurtenances)

Table 09910-2 System 1 – Zinc/Urethane/Fluoropolymer

Description	Generic Coating Name	Tnemec DFT Mils	Carboline DFT Mils
Prime Coat all materials. Surface Prep NACE-1 or NACE-3	Zinc-rich	Zinc Series 90-97 2.5-3.5	Carbozinc 621 3.0-8.0
Prime Coat – option for FBE or Hydrants only. Surface prep NACE-4	Inorganic water based epoxy – overcoat existing coatings	Typoxy Series 27WB 4.0-14.0	N/A N/A
Intermediate Coat	Aliphatic Acrylic Polyurethane	Endura – Shield Series 73 2.0-3.0	Carbothane 133 HB 3.0-5.0
Final Coat	Advanced Thermoset Fluoropolymer Polyyrethane	Hydroflon Series 700 2.0-3.0	Carboxane 950 2.0-3.0

Table 09910-3 System 2 – Zinc/Epoxy/Urethane

Description	Generic Coating Name	Tnemec DFT Mils	Carboline DFT Mils	PPG/Amero DFT Mils
Prime Coat all materials. Surface prep NACE-1 or NACE-3	Aromatic Urethane, Zinc-rich	Zinc Series 90-97 2.5-3.5	Carbozinc 621 3.0-8.0	Amercoat 68HS 3
Prime Coat option for FBE, Hydrants. Surface prep NACE-4	Inorganic water based epoxy – overcoat existing coatings	Typoxy Series 27WB 4.0-14.0	N/A N/A	N/A N/A
Intermediate Coat	Polyamidoamine Epoxy	Color Hi-Build Epoxoline II Series N69 4.0-10.0	Carboguard 60 4.0-6.0	Amerlock 2/400 2.0-3.0
Final Coat	Aliphatic Acrylic Polyurethane	Endura-Shield Series 73 2.0-3.0	Carboxane 950 2.0-3.0	Americoat 450H 2.0-3.0

C. Procedures for Coating Interior of DIP and Fittings

1. Wastewater DIP and Fittings
   a. Interior coatings shall be Protecto 401 (amine cured novalic epoxy containing at least 20% by volume of ceramic quartz pigment) for all fittings. All ductile iron pipe and fittings shall be delivered to the manufacturer certified applicator without asphalt, cement lining, or any other lining on the interior surface and no coating shall have been applied to the first six inches of the exterior of the DIP spigot ends. Minimum surface preparations shall be SSPC-SP1 Solvent Cleaning method to remove oil and grease followed by NACE-4/SSPC-SP7 Brush-Off Blast Cleaning. Protecto 401 shall be applied within 12 hours of surface preparation to the interior of the pipe/fittings so as to obtain a continuous and relatively uniform and smooth integral lining with a total minimum dry film thickness of 40 mils for the complete system. No lining shall take place when the substrate or ambient temperature is below 40°F. The lining shall not be used on the face fo the flange of fittings or flanged pipe. The system shall be holiday free and holiday testing (Minimum 2000 volts) shall be conducted and pinhole repaired prior to shipping.
   b. Exterior buried fittings shall be asphaltic coated. Exterior flanged fittings shall be specified per 09910 3.01 B.

2. Water and Reclaimed Fittings. Interior coating shall be FBE or Cement mortar Lined
   a. FBE for Fittings – Fittings shall be supplied with a fusion applied epoxy coating (FBE), both inside and outside for total protection including flanged and buried fittings. The exterior of flange fittings for above ground assemblies shall adhere to final exterior coating requirements per 09910 3.01 B. The FBE coating system shall meet or exceed ANSI/AWWA C-550 and C116/A21.116 requirements and shall have NSF 61 certification. FBE coatings thickness shall be 6 to 8 mils dry film thickness and shall be applied for secure adhesion and shall have a smooth surface and shall be holiday free.
   b. Cement-mortar lining for ductile iron pipe and ductile and grey iron fittings for water service shall be in accordance with ANSI/AWWA C104/A21.4 and the exterior surface of buried DIP shall be asphaltic coating.
   c. Exterior flanged fittings shall be specified per 09910 3.01 B.

3.02 CLEAN-UP

A. All materials and debris shall be removed and the site of the work left in a clean condition so far as this work is concerned.

3.03 FINAL INSPECTION

A. The Contractor shall protect all painted surfaces against damage until the date of final acceptance of the work. The Engineer will conduct a final inspection of all work and the Contractor will be required to repaint or retouch any areas found which do not comply with the requirements of this section.

END OF SECTION

SECTION 15062
DUCTILE IRON PIPE AND FITTINGS

PART 7 - GENERAL

7.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install, all ductile iron piping, ductile iron fittings, and appurtenances as shown on the Drawings and as specified herein.

B. General Design: The equipment and materials specified herein are intended to be standard types of ductile iron pipe and cast or ductile iron fittings for use in transporting wastewater, potable water, and reclaimed water.

7.02 QUALITY ASSURANCE

A. Qualifications: All of the ductile iron pipe and ductile or cast iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

B. Standards:
   1. ANSI A 21.50/AWWA C150
   2. ANSI A-21.51/AWWA C151
   3. ANSI A-21.41/AWWA C104

C. Factory Tests: The manufacturer shall perform the factory tests described in ANSI A-21.51/AWWA C151.

D. Quality Control:
   1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards. All pipe on this Project shall be supplied by a single manufacturer unless otherwise accepted in writing by the County.
   2. In addition to the manufacturer's quality control procedures, the County may select an independent testing laboratory to inspect the material at the foundry for compliance with these specifications. The cost of foundry inspection requested by the County will be paid for by the County.

7.03 SUBMITTALS

A. Materials and Shop Drawings
   1. Submit shop drawings and piping layouts, including areas within and under buildings and structures. Shop drawings shall include dimensioning, methods and locations of supports and all other pertinent technical specifications. Show locations of all field cuts. Shop drawings shall be prepared by the pipe manufacturer. Shop drawings for piping within and under buildings and structures shall be submitted within 30 days of Execution of Contract.

B. Operating Instructions: Submit Operation and Maintenance Manuals in accordance with Section 01001 "General Work Requirements".

C. Manufacturer's Certification

1. Submit manufacturer's sworn certification of factory tests and test results.

7.04 PRODUCT DELIVERY, STORAGE AND HANDLING

The Contractor shall be responsible for all materials furnished and stored until the date of project completion. The Contractor shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The Contractor shall, if requested by the County, furnish certificates, affidavits of compliance, test reports, samples or check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer's recommendations. Stored pipe shall be covered for protection against contamination and UV light. Joint gaskets shall be stored in clean, dark and dry location until immediately before use.

B. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe and fittings and their respective coatings. Pipe or fittings shall not be rolled off the carrier or dropped. Pipe shall be unloaded by lifting with a forklift or crane. All pipe or fittings shall be examined before installation and no piece shall be installed which is found to be defective. Pipe shall be handled to prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of the County or be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on level ground, graded to eliminate all rock points and to provide uniform support along the full pipe length. When being transported, the pipe shall be supported at all times in a manner which will not permit distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of the County, is damaged beyond repair by the Contractor shall be removed from the site.

PART 8 - PRODUCTS

8.01 MATERIALS

A. Ductile Iron Pipe
   1. Standards: ANSI A-21.50, AWWA C150 and ANSI A-21.51, AWWA C151
   2. Thickness/Pressure Class:
      a. Below ground piping: Class 350 (4-inch-12-inch), Class 250 (16-inch-24-inch) and Class 200 (30-inch-64-inch) unless otherwise noted or specified.
      b. Above ground piping: Flanged, Class 350 (Minimum) unless otherwise noted or specified.
   3. Joints:
      a. Push-on or Mechanical Joints (below ground piping):
         (1) Standards: ANSI A21.11, AWWA C111
         (2) Class: 350 psi working pressure rating
         (3) Gaskets:
            (a) Potable and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) ring type.
            (b) Wastewater Service: Neoprene rubber ring type.
      b. Flanged (above ground or inside below ground vaults):
         (1) Standards: ANSI A21.15, ANSI B16.1
         (2) Class: 125 lb factory applied screwed long hub flanges, plain faced without projection.
         (3) Gaskets:
            (a) Spans less than 10 feet: full-face 1/8-inch thick neoprene rubber
            (b) Spans greater than 10 feet: Toruseal gaskets as manufactured by American Cast Iron Pipe or acceptable equal.
      c. Restrained Joints:
         (1) Manufacturers: Lok-Ring system (all sizes) or locking type gasket systems (for 16-inchdiameter and smaller) as manufactured by American Ductile Iron Pipe; MEGALUG System as manufactured by EBBA Iron; or acceptable equal.
         (2) Class: 250 psi minimum design pressure rating.
         (3) Standard mechanical joint retainer glands shall not be acceptable.
      d. Joint Accessories:
         (1) Mechanical joint bolts, washers and nuts: Ductile iron or Corten steel.
         (2) Flanged joint bolts, washers and nuts: 316 stainless steel with bolts and nuts conforming to ASTM A193 Grade B8M.
      e. Pipe Length (below ground installation): 20 feet maximum nominal length.
   4. Pipe Identification:
      a. Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant, and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel. Pipe which is not clearly marked is subject to rejection. The Contractor shall remove all rejected pipe from the project site within five NORMAL WORKING DAYS.

B. Fittings
   1. Ductile iron fittings 4-inch through 24-inch shall be pressure rated at 350 psi minimum, except flanged joint type fittings which shall be rated at 250 psi minimum. All 30-inch and larger fittings shall be pressure rated to 250 psi minimum. All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron only. All fittings shall be cast and machined allowing the bolt holes to straddle the vertical centerline. All fittings shall be designed to be capable to withstand, without bursting, hydrostatic tests of three times the rated water working pressure. All fittings shall have a date code cast (not printed or labeled) with identification of date, factory, and the factory unit from which it was cast and machined. Fittings shall have the pressure rating, nominal diameter of openings, manufacturer's name, the country where cast, and number of degrees or fraction of the circle distinctly cast on them. Ductile iron fittings shall have the letter "DI" or "Ductile" cast on them.
   2. Joints shall be as described for ductile iron pipe for above ground/exposed and buried service.
   3. All potable water main fittings shall have NSF 61 certification, and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications.

8.02 COATINGS, LININGS AND IDENTIFICATION MARKINGS

A. Exterior Coatings
   1. Below ground/buried or in a casing pipe:
      a. Type: Asphaltic coating, 1.0 mil DFT in accordance with ANSI/AWWA A21.51/C151.
      b. Markings: (continuous 3-inch wide strip within top 90 degrees of pipe - min. drying time 30 minutes before backfill).
      c. Color:
         (1) Raw Wastewater: Safety Green
         (2) Reclaimed Water: Purple (Pantone 522C)
         (3) Potable Water: Safety Blue
   2. Above ground/Exposed/In vaults:
      a. Coatings and coating testing for ductile iron pipe and fittings for above ground/exposed applications shall be accordance with Division 9. Primer, intermediate and final coats whether shop or field applied shall be compatible and applied in accordance with the coating system manufacturer's recommendations. Refer to Appendix D "List of Approved Products" for approved coating system suppliers. Asphaltic seal coat applied to the exterior of above ground piping and fittings shall be blasted and completely removed prior to coating per NACE-3/SSPC-SP6 commercial blast cleaning minimum angular anchor profile of 1.5 mils.
      b. Color:
         (1) Raw wastewater: Safety Green
         (2) Reclaimed Water: Purple (Pantone 522C)
         (3) Potable Water: Safety Blue
   3. Inside Wetwell:

a. All piping inside of wastewater wetwell shall be 316 stainless steel.

B. Interior Lining (Applied by pipe manufacturer):
   1. Wastewater: Interior coating shall be Protecto 401 (amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment) for all pipe and fittings. All ductile iron pipe and fittings shall be delivered to the manufacturer certified applicator without asphalt, cement lining, or any other lining on the interior surface and no coating shall have been applied to the first 6-inches of the exterior of the DIP spigot ends. Minimum surface preparation shall be SSPC-SP 1 Solvent Cleaning method to remove oil and grease followed by NACE-4 / SSPC-SP7 Brush-Off Blast Cleaning. Protecto 401 shall be applied within 12 hours of surface preparation to the interior of the pipe and fittings so as to obtain a continuous and relatively uniform and smooth integral lining with a total minimum dry film thickness of 40 mils for the complete system. No lining shall take place when the substrate or ambient temperature is below 40°F. The lining shall not be used on the face of the flange of fittings or flanged pipe. The system shall be holiday free and holiday testing (minimum 2000 volts) shall be conducted and pinholes shall be repaired prior to shipping.
   2. Potable Water and Reclaimed Water: Interior coating shall be fusion bonded epoxy (FBE) or Cement Mortar lined with asphaltic seal coat.
      a. FBE for Fittings - Fittings shall be supplied with a FBE coating, both inside and outside for total protection including flanged and buried fittings. The exterior of flanged fittings for above ground assemblies shall adhere to final exterior coating requirements per 3119 2.04 A. The FBE coating system shall meet or exceed ANSI/AWWA C-550 and C116/A21.116 requirements and shall have NSF 61 certification. FBE coating thickness shall be 6 to 8 mils dry film thickness, shall be applied for secure adhesion, shall have a smooth surface and shall be holiday free.
      b. Cement mortar lining with a seal coat of asphaltic material shall be in accordance with ANSI/AWWA A21.4/C104.

C. Polyethylene Encasement is required when pipe is within 10 feet of a gas main or as indicated on the Drawings:
   1. Standard: ANSI A 21.5/AWWA C105, 8 mil minimum thickness.

8.03 LOCATION MARKERS AND LOCATION WIRE

A. Electronic Markers and Locator System (for reclaimed water and wastewater ONLY)

1. Markers: Markers shall consist of a passive device capable of reflecting a specifically designated repulse frequency tuned to the utility (service) being installed. Markers shall be color coded in accordance with American Public Works Association's "Utility Locating and Coordinating Council Standards". Colors shall be: Wastewater and Reclaimed Water - #1404 Green. Markers shall be full range. Markers shall be installed directly above the centerline of the respective pipeline at intervals not to exceed 100', at each fitting (tees, wyes, crosses, reducers, plugs, caps and bends) or change in horizontal direction and at each valve along the pipeline. Markers shall be hand backfilled to one (1) foot above the pad and have a finished depth of burial of not less than two (2) feet nor more than six (6) feet. No separate payment shall be made for furnishing and installing the respective frequency and color-coded electronic pad type marker.
2. Locator System: Marker locator set shall be the Scotch Mark EM II Electronic Marker Locator Path Tracing Receiver, or acceptable equal. The Contractor shall furnish one (1) locator set for each type of service piping installed on the project (i.e.: reclaimed water, wastewater) to the County. Each unit shall incorporate the following features and accessories:
    a. Unit(s) shall be tuned to the proper frequency for each type (service) of piping.
    b. Field strength meter that provides visual indication of the return signal.
    c. Function switch for selection of operation mode.
    d. Sensitivity control to adjust the receiver gain.
    e. Audio speaker for signal response.
    f. Battery access panel containing condensed operating instructions.
    g. Auxiliary headset and heads set jack.
    h. Permanently attached shoulder straps.
    i. Rugged shockproof and weatherproof storage/carrying case.
3. Manufacturer: System shall be Scotch Mark Locator System, or acceptable equal.

B. Location Detection Wire
1. Materials: Continuous, insulated 10-gauge copper wire (color to match pipe identification).
2. Installation: Directly above (1-inch maximum) centerline of pipe terminating at top of each valve box collar and be capable of extending 12-inches above top of box (stored inside the 2-inch brass pipe through the valve box collar) in a manner so as not to interfere with valve operation. For direction drilling installations, a minimum of two (2) 10-gauge wires shall be pulled along with the pipe.
3. Continuity: Continuity of wire to be tested using Metrotech 810/9860 or acceptable equal.

PART 9 - EXECUTION

9.01 INSTALLATION

A. Ductile iron pipes shall be installed in accordance with AWWA C600 and AWWA Manual M-42. When a restraining type gasket is used, the bell shall be painted red.

B. Underground Ductile Iron Pipe and Fittings.

1. Bedding firm, dry and even bearing of suitable material. Blocking under the pipe will not be permitted.
2. Placement:
    a. Alignment: In accordance with lines and grades shown on the Drawings. Deflection of joints shall not exceed 75% of the values recommended by the pipe manufacturer.
    b. The Contractor shall provide line and grade stakes at a 100-foot maximum spacing and at all line and/or grade change locations. The Contractor shall provide temporary bench marks at a maximum of 1,000-foot intervals. The minimum pipe cover shall be 30-inches below the finished grade surface or 30-inches below the elevation of the edge of pavement of the road surface whichever is greater.
    c. All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken or otherwise defective materials are being used. All homing marks shall be checked for the proper length so as to not allow a separation or over homing of connected pipe. Homing marks incorrectly marked greater than 1-inch shall result in rejection of pipe and removal from site. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.
    d. Proper implements, tools and facilities shall be used for the safe and proper protection of the Work. Pipe shall be lowered into the trench in such a manner as to avoid any physical damage to the pipe. Pipe shall not be dropped or dumped into trenches under any circumstances.
    e. Trench Dewatering and Drainage Control: Contractor shall prevent water from entering trench during excavation and pipe-laying operations to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.
    f. Pipe Laying in Trench: Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and re-laid. Pigging of pipe may be used to remove foreign materials in lieu of flushing. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by the County to ensure absolute cleanliness inside the pipe. The pipe shall be installed with the color stripe and pipe text on the top of pipe.
3. Cutting: When required, cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of the pipe to be used with a push-on bell shall be beveled. Bare metal exposed at ends of the pipe shall be field coated in accordance with pipe manufacturer's recommendations. Cut pipe for wastewater service shall have exposed bare metal ends repaired with Protecto 401 using the coating system manufacturer’s field repair kit.
4. Joints:
    a. Joint Placement:
        (1) Push on joints: Pipe shall be laid with the bell facing upstream. The gasket shall be inserted and the joint surfaces cleaned and lubricated prior to placement of the pipe. After joining the pipe, a metal feeler shall be used to verify that the gasket is correctly located.
        (2) Mechanical Joints: Pipe and fittings shall be installed in accordance with the "Notes on Method of Installation" under ANSI A21.11/AWWA C111. The gasket

shall be inserted and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.

C. Thrust Restraint:
   1. General: Thrust restraint shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein.
   2. Length of Restrained Joints: In accordance with the lengths listed in the table as shown on the Drawings.

D. Installation of Pipes on Curves:
   1. Maximum deflections at pipe joints, fittings and laying radius for the various pipe lengths shall not exceed 75 percent of the pipe manufacturer's recommendation.

9.02 CLEANING AND FIELD TESTING

A. General: At the conclusion of the Work, the Contractor shall provide all associated cleaning and field testing as specified in other related sections of these specifications.

END OF SECTION

SECTION 15064

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install and test all polyvinyl chloride (PVC) piping, fittings and appurtenances as shown on the Drawings and specified herein.

B. General Design: The equipment and materials specified herein is intended to be standard types of polyvinyl chloride (PVC) pipe and cast or ductile iron fittings for use in transporting sewage, sludge, and water.

1.02 QUALITY ASSURANCE

A. Qualifications: All of the polyvinyl chloride (PVC) pipe and cast or ductile iron fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe and fittings shall be designed, constructed, installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

B. Standards:

1. AWWA C900/C905

2. ASTM D1784/D1785/D2241/D2466/D2564/D2729/D2774/D3034/D3139/-D3212

3. NSF 14

4. UNI-B-1 through 5

C. Factory Tests: The manufacturer shall perform the factory tests described in Section 3 - AWWA C900/C905.

D. Quality Control:

1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards.

2. In addition to the manufacturer's quality control procedures, the Owner may select an independent testing laboratory to inspect the material at the foundry for compliance with these specifications. The cost of foundry inspection requested by the Owner will be paid for by the Owner.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. Submit shop drawings to the Engineer in accordance with the conditions of the Contract and Section 01001. The location of all pipes shall conform to the Contract Drawings. In some cases, however, a certain amount of flexibility in pipe position will be allowed where new pipes connect to existing piping or when avoiding potential conflicts.

B. Operating Instructions: Submit Operation and Maintenance Manuals in accordance with Section 01001.

C. Manufacturer's Certification

1. Submit sworn certification of factory tests and their results.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer's recommendations.

B. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe or fittings and their respective coatings. Pipe or fittings shall not be rolled off the carrier or dropped. Unloading shall be done by lifting with a forklift or crane. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Polyvinyl Chloride (PVC) Pipe

1. Standards: AWWA C900/C905/ASTM D1784/D3034 (Gravity Sewer)

2. Compounds: Class 12454-A or Class 12454-B.

3. Dimension Ratio/Thickness: (unless otherwise shown on the Drawings)
   a. Raw Wastewater:
      1) Pressure Systems: DR 18 and DR 21 (for 30” and larger pipes)
      2) Gravity Systems: DR 35 or SDR 32.5
   b. Treated Wastewater: DR 21
   c. Reclaimed Water: DR 18
   d. Raw Water: DR 18
   e. Potable Water: DR 18
   f. Irrigation Piping: Sch 40 or SDR 21

4. Joints:
   a. Push-on integral bell (nominal diameter four (4) through twelve (12) inches):
      1) Standards: ASTM D3139 and F477/UNI-B-1
      2) Gaskets: Water Service - Styrene Butadine Rubber (SBR) ring type.
         Wastewater Service - Neoprene rubber ring type.

   b. Solvent weld (nominal diameter less than four (4) inches):
      1) Standards: ASTM D2466/D2564
      2) Type: Slip Fitting Socket (tapered)
      3) Exclusions: Plastic saddle and flange joints will not be used.

   c. Restrained Joints:
      1) Manufacturers: Uni-flange mechanical joint restraints and bell restraints (for all sizes); Meg-a-lug system as manufactured by EBBA Iron (sizes 12" or less), or approved equal.
      2) Design pressure rating equal to or above test pressure as specified herein.

5. Pipe Length:
   a. Pressure systems: 20 feet maximum nominal length.

B. Fittings - Pressure Systems (nominal diameter four (4) through twelve (12) inches)

1. Materials:
   a. Ductile iron or gray cast iron

2. Joints:
   a. Mechanical Joint, Minimum 250 psi pressure rating.

3. Gaskets:
   a. Potable Water and Reuse Water Service - Styrene Butadine Rubber (SBR) ring type.
   b. Wastewater Service - Neoprene rubber ring type.

4. Compact Fittings: ANSI/AWWA A21.53/C153 (4-inch through 12-inch diameter)

5. Exclusions: Standard double bell couplings will not be accepted where the pipe will slip completely through the coupling.

C. Fittings - Pressure Systems (nominal diameter less than four (4) inches)

1. Material: Polyvinyl Chloride (PVC)

2. Joints: Slip fitting tapered socket with solvent weld

3. Solvent: Sure Guard 12 or approved equal.

4. Exclusions: Plastic saddle and flange joint fittings will not be used.

2.02 LOCATION MARKERS, LOCATION WIRE AND IDENTIFICATION MARKINGS

A. Electronic Markers and Locator System

1. Markers: Markers shall consist of a passive device capable of reflecting a specifically designated repulse frequency tuned to the utility (service) being installed. Markers shall be color coded in accordance with the American Public Works Association's "Utility Locating and Coordinating Council Standards". Colors shall be: Water #1403 Blue, Wastewater #1404 Green and Reuse #5226 Pantone Purple. Markers shall be full range. Markers shall be installed directly above the centerline of the respective pipeline at intervals not to exceed 100', at each fitting (tees, wyes, crosses, reducers, plugs, caps and bends) or change in horizontal direction and at each valve along the pipeline. Markers shall be hand backfilled to one (1) foot above the ball or pad and have a finished depth of burial of not less than two (2) feet or more than six (6) feet. No separate payment shall be made for furnishing and installing the respective frequency and color coded electronic ball or pad type marker.

2. Locator System: Marker locator set shall be the EMS II "EMS Marker Locator" Path Tracing Receiver, or approved equal. The Contractor shall furnish one (1) locator set for each type of service piping installed on the project (i.e.: potable water, reuse water, wastewater...). Each unit shall incorporate the following features and accessories:
   a. Unit(s) shall be tuned to the proper frequency for each type (service) of line.
   b. Field strength meter which provides visual indication of the return signal.
   c. Function switch for selection of operation mode.
   d. Sensitivity control to adjust the receiver gain.
   e. Audio speaker for signal response.
   f. Battery access panel containing condensed operating instructions.
   g. Auxiliary head set and head set jack.
   h. Permanently attached shoulder straps.
   i. Rugged shock-proof and weather-proof storage/carrying case.

3. Manufacturer: System shall be Scotch Mark Locator System for balls and Metro Tech for wire, or approved equal.

B. Location Detection Wire

1. Materials: Continuous, insulated 10 gauge copper wire (color to match pipe identification).

2. Installation: Directly above (1" maximum) centerline of pipe terminating at top of each valve box collar and be capable of extending 18 inches above top of box (stored inside the 2" brass pipe through the valve box collar) in a manner so as not to interfere with valve operation. For direction drilling installations, a minimum of two (2) 10 gauge wires shall be pulled along with the pipe.

3. Continuity: Continuity of wire to be tested using Metrotech 810/9860 or accepted equal.

C. Identification Markings:

1. Pipe furnished in solid color or white with color lettering as indicated below.
   a. Lettering along top 90º of pipe, minimum 3/4" in height with appropriate wording appearing one or more times every 21 inches along the entire length of the pipeline.
      1) Raw Wastewater: Green
      2) Treated Wastewater: Green
      3) Reclaimed Water: Purple
      4) Raw Water: Green
      5) Potable Water: Blue

PART 3 - EXECUTION

3.01 INSTALLATION

A. Standards: AWWA C900/C905/UNI-B 3 and 4

B. Underground Polyvinyl Chloride (PVC) Pipe and Fittings

1. Bedding: Firm, dry and even bearing of suitable material. Blocking under the pipe will not be permitted.

2. Placement/Alignment: In accordance with lines and grades shown on the Drawings. Changes in horizontal and vertical alignment of PVC pipe may NOT be achieved through pipe or joint deflection.

3. Cutting: When required, cutting shall be done leaving a smooth cut at right angles to the axis of the pipe. Cut ends of the pipe to be used with a push-on bell shall be beveled.

4. Joints:
   a. Joint Placement:
      1) Push on joints: Pipe shall be laid with the bell ends facing upstream. The gasket shall be inserted and the joint surfaces

cleaned and lubricated prior to placement of the pipe. After joining the pipe, a metal feeler shall be used to verify that the gasket is correctly located.

2) Mechanical Joints: Pipe and fittings shall be installed in accordance with the "Notes on Method of Installation" under ANSI A21.11/AWWA C111. The gasket shall be inserted and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.

D. Thrust Restraint

1. General: Thrust restraint shall be accomplished by the use of mechanical restraining devices unless specifically identified otherwise on the Drawings or herein.

2. Length of Restrained Joints: In accordance with the lengths listed in the table as shown on the Drawings.

3.02 CLEANING AND FIELD TESTING

A. General: At the conclusion of the work, the Contractor shall provide all associated cleaning and field testing as specified in associated sections of these specifications.

END OF SECTION

SECTION 15071

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Furnish all labor, materials, equipment and incidentals required and install and test all high density polyethylene (HDPE) piping, fittings and appurtenances as shown on the Drawings and specified herein. This section includes materials and testing of PE4710 high density, very high molecular weight polyethylene pipe and fittings of sizes up to 36 inches for use in so-called "trenchless" installation and selected services and having a hydrostatic design basis of 1,600 psi at an operating temperature of 74 F. Pipe diameter basis is cast iron equivalent outside diameter (OD). With standard dimension ratio (SDR) and pressure class as specified herein.

B. General Design: The equipment and materials specified herein is intended to be standard types of high density polyethylene (HDPE) pipe and fittings for use in transporting sewage, sludge's, reclaimed and potable water.

C. The location of all pipes shall conform to the Contract Drawings. In some cases, however, a certain amount of flexibility in pipe position will be allowed where new pipes connect to existing piping or when avoiding potential conflicts.

1.02 QUALITY ASSURANCE

A. Qualifications: All of the high density polyethylene (HDPE) pipe and fittings shall be furnished by manufacturers who are fully experienced, reputable, and qualified in the manufacture of the materials to be furnished. The pipe shall be extended from precompounded resin. In-plant blending of resin is unacceptable. The pipe and fittings shall be designed, constructed, installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

B. References:

1. AWWA C901 (Pipe 2 inches through 3 inches)
2. AWWA C906 (Pipe 4 inches and larger)
3. Plastics Pipe Institute (PPI) Handbook of Polyethylene Pipe
4. AWWA Manual M-55
5. ASTM F 2164 for hydrostatic testing

C. Factory Tests: The manufacturer shall perform the factory tests described in Section 3 - AWWA C906.

D. Quality Control:

1. The manufacturer shall establish the necessary quality control and inspection practice to ensure compliance with the referenced standards.
2. In addition to the manufacturer's quality control procedures, the Owner may select an independent testing laboratory to inspect the material at the foundry for compliance with these specifications. The Owner will pay for the cost of foundry inspection requested by the Owner.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. Submit shop drawings to the Engineer in accordance with the conditions of the Contract and Section 01001. Submit manufacturer's recommended methods for butt-fusing joints and connections between dissimilar materials.

B. Operating Instructions: Submit Operation and Maintenance Manuals in accordance with Section 01001.

C. Manufacturer's Certification

1. The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific product. Certification shall include a stress life curve per ASTM D2837.
2. Provide certification that the Plastic Pipe Institute in PPI TR-4 lists the material with a 73°F. Hydrostatic design stress rating of 800psi. The PPI listing shall be in the name of the pipe manufacturer and shall be based on ASTM D3350 and PPI TR-3 testing and validation of samples of the pipe manufacturer's production pipe.
3. The manufacturer's certification shall state that the pipe was manufactured from one specific resin in compliance with these specifications.
4. Submit certified lab data to verify specified physical properties. Certify that tests are representative of pipe supplied for this project.
5. Submit affidavit of compliance with referenced standards (e.g., AWWA C901, C906, etc.).
    1. Submit qualification certificates for operators of heat fusion equipment.
6. Submit schedule for placement of and removal of test bulkheads.
    1. Submit certification that materials intended to contact potable water are listed under NSF 61.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage: Delivery and storage of the materials shall be in accordance with the manufacturer's recommendations.

B. Inspection: All materials furnished are subject to the inspection by the RPR.

1. Handling: Care shall be taken in loading, transporting and unloading to prevent damage to the pipe or fittings. Pipe or fittings shall not be rolled off

the carrier or dropped. Lifting with a forklift or crane shall do unloading. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective.

PART 2 - PRODUCTS

2.01 MATERIALS

A. High density polyethylene (HDPE) Pipe

1. Standards: AWWA C901 & C906 / ASTM D3350

2. Dimension Ratio: Pipe shall have a nominal ductile iron pipe size (DIPS) OD with a minimum standard dimension ratio of SDR 11 for water mains and SDR 11 for wastewater force mains.

3. Pressure Class Rating: Pipe shall have a minimum Pressure class 160 for water mains and 100 for force mains with hydrostatic design basis (HDB) of 1,600 psi, as determined in accordance with ASTM D2837.

4. Pipe Materials:
   a. Materials used for the manufacture of polyethylene pipe and fittings shall be very high molecular weight, high density ethylene/hexene copolymer PE 4710 polyethylene resin meeting the physical property and pipe performance requirements listed in the following table:

Property	Specification	Units	Minimum Values
Material Designation	PPI/ASTM	---	PE4710
Cell Classification	ASTM D3350	---	445474C
Hardness	ASTM D2240	Shore D@	62
Compressive Strength (Yield)	ASTM D695	psi	1,600
Tensile Strength @ Yield (Type IV Spec.)	ASTM D638 (2"/min)	psi	3,500
Elongation @ Yield	ASTM D638	%, min.	8
Tensile Strength @ Break (Type Iv Spec)	ASTM D638	psi	3,500
Elongation @ Break	ASTM D638	%, min.	800
Modulus of Elasticity	ASTM D638	psi	175,000

ESCR: (Cond A, B, C Mold. Slab) (Compressed Ring)	ASTM D1693 ASTM F1248	Fo, Hrs F50, Hrs	Fo>5,000 F50>1,000
Slow Crack Growth	Battelle Method	Days to Failure	Fo>32
Impact Strength (IZOD) (.125" THK)	ASTM D256 (Method A)	in-lb/in Notch	42
Linear Thermal Expansion Coef..	ASTM D696	in/in/EF	1.0 x 10-4
Thermal Conductivity	ASTM C177	BTU, $in/Ft^2/hrs/EF$	2.7
Brittleness Temp.	ASTM D746	EF	<-180
Vicat Soft. Temp.	ASTM C1525	EF	+257
NSF Listing	Standard 61	---	AListed@

B. Fittings:

1. Materials: Fittings shall be made from material meeting the same requirements as the pipe. Fittings shall be fabricated by the manufacturer of the pipe.
2. Fittings shall meet the appropriate AWWA standard for the size involved (C901 or C906).
3. Molded fittings shall be manufactured in accordance with ASTM C3261 and shall be so marked.
4. Mechanical fittings, when used, shall be specifically designed for, or tested and found to be acceptable for use with HDPE pipe.
5. Fittings used to connect with dissimilar pipe materials shall be provided as per the manufacturer.

C. Joints:

1. Sections of polyethylene pipe shall be foiled into continuous length on the job site above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures shall be capable of meeting all conditions recommended by the pipe manufacturer.
2. Butt fusion foiling shall result in a joint weld strength equal to or greater than the tensile strength of the pipe. Socked fusion shall not be used. Extrusion welding or hat has welding of HDPE shall not be used.. Flanges, unions, grooved couplers, transition fittings, and some mechanical couplers may be used to connect HDPE pipe mechanically without butt fusion only where shown in the drawings.

D. Nipples and Flanged Stub Ends

1. Short nipples and stub end shall be the same material as the HDPE.

2.02 LOCATION WIRE AND IDENTIFICATION MARKINGS

A. Location Detection Wire

1. Materials: Continuous, insulated 10 gauge copper wire (color to match pipe identification).

2. Installation: Directly above (1" maximum) centerline of pipe terminating at top of each valve box collar and be capable of extending 18 inches above top of box (stored inside the 2" brass pipe through the valve box collar) in a manner so as not to interfere with valve operation. For direction drilling installations, a minimum of two (2) 10 gauge wires shall be pulled along with the pipe.

3. Continuity: Continuity of wire to be tested using Metrotech 810/9860 or accepted equal.

B. Identification Markings:

1. Pipe furnished in solid color or white with color lettering as indicated below.

a. Lettering along top 90 of pipe, minimum 3/4" in height with appropriate wording appearing one or more times every 21 inches along the entire length of the pipeline.

1) Raw Wastewater: Green
2) Treated Wastewater: Green
3) Reclaimed Water: Purple (Pantone 522C)
4) Raw Water: Green
5) Potable Water: Blue

PART 3 - EXECUTION

3.01 QUALIFICATION OF FUSION OPERATORS

Each operator performing fusion joining shall be qualified in the use of the manufacturer’s recommended fusion procedure(s) by the following:

A. Appropriate training or experience in the use of the fusion equipment and procedure.

B. Making a sample joint according to the procedure that passes the following inspections and tests:

1. The joint shall be visually examined during and after joining and found to have the same appearance as a photograph or sample of an acceptable joint that was joined in accordance with the manufacturer's procedure.

2. The joint shall be tested or examined by one of the following methods:
   a. Pressure and tensile test as described in 49 CRF 192.283.
   b. Ultrasonic inspection and found to be free of flaws that would cause failure.
   c. Cut into at least three longitudinal straps, each of which is:
      (1) Visually examined and found to be free of voids or unbonded areas on the cut surface of the joint.
      (2) Deformed bending, torque, or impact and if failure occurs, it must not initiate in the joint area.

3. Each operation shall be requalified under the procedure, if, during any 12-month period he:
   a. Does not make any joints under the procedure.
   b. Has three joints or three percent of the joints he has made, whichever is greater, that are found unacceptable by testing under 49 CFR 192.513.

3.02 DELIVERY AND TEMPORARY STORAGE OF PIPE AT SITE

A. Limit on site pipe storage to a maximum of one day.

B. Transport individual pipe lengths to the job site on padded bonds with nylon tie down straps or padded bonding to protect the pipe. Coiled HDPE pipe shall be stored in a manner to ensure safety. Protect the pipe from sharp objects. Anchor pipe securely to prevent slippage. Store individual pipe lengths on earth beams or timber cradles into the numerical order of installation. Stack the heaviest series of pipe at the bottom. Do not stack pipe in excess of 20 rows high.

C. Protect the pipe from stones and sharp objects.

D. Store fitting in their original cartons.

3.03 HANDLING OF PIPES

A. Lift pipes with handling beams or wide belt slings near the middle of joints as recommended by the pipe manufacturer. Do not use cable slings, chains, or hooks. Before installation, check pipe and fittings for cuts, scratches, gouges, buckling, kinkling, or splitting. Remove any pipe section containing defects by cutting out the damages section in a complete cylinder.

3.04 SANITATION OF PIPE INTERIOR

A. During fusion operations and laying operations, do not place tools, clothing, or other materials in the pipe.

B. When pipe laying is not in progress, including the noon hour, close the ends of the pipe by a vermin proof plug.

3.05 HEAT FUSION

Use fusion equipment specially designed for heat fusion of HDPE such as offered by McElroy Manufacturing, Inc., Tulsa, Oklahoma. The equipment utilized shall be regulated for the different melt strength materials. Compatibility fusion techniques shall be used when polyethylenes of different melt indexes are fused together.

A. Use the following procedure to butt fuse HDPE pipe. If an operation contradicts manufacturer's directions, follow the manufacturer's recommendation. Maintain the proper temperature of the heater plate as recommended by the pipe manufacturer. Check it with a tempilstik or pyrometer for correct surface temperature. Clean pipe ends inside and outside with a clean cotton cloth to remove dirt, water, grease, and other foreign materials. Square (face) the pipe ends using facing tools of the fusion machine. Remove all burrs, chips and fillings before joining pipe or fittings.

B. Check line-up of pipe ends in fusion machine to see that pipe ends meet squarely and completely over the entire surface to be fused. Make sure the clamps are tight so that the pipe does now slip during the fusion process. Insert clean heater plate between aligned ends and bring ends firmly in contact with plate but do not apply pressure while achieving melt pattern. Allow pipe ends to heat and soften. Carefully move the pipe ends sway from the heater plate and remove the plate (if the softened material sticks to the heater plate, discontinue the joint, clean heater plate, resquare pipe ends, and start over). Bring melted ends together rapidly. Do not slam. Apply enough pressure to form a double roll-back bead to the body of the pipe around the entire circumference of the pipe about 1/8-inch to 3/16-inch wide. Pressure is necessary to cause the heated material to flow together. Allow the joint to cool and solidify properly. Remove the pipe from the clamps and inspect the joint appearance.

3.06 SIDEWALL FUSION

Side fusion procedure for HDPE shall be accomplished in the field using 2-inch through 12 inch McElroy (or equal) fusion units and proper heater plate adapters. Where branch outlets are larger than 12 inches in outside diameter, sidewall fusion shall be accomplished in a fitting fabrication shop. Use the following procedure to side fuse the HDPE pipe. If an operation contradicts manufacturer's directions, follow manufacturer's recommendation.

A. Clean the pipe with a clean cotton cloth. Prepare surface of pipe (main) by roughing with 60 grit or coarser utility cloth.

B. Prepare the base of the branch by roughing with 60 grit or coarser utility cloth.

C. Align branch on the main and tighten clamp.

Check branch for square alignment on main.

D. Retract moveable clamp, roll in, and center heater plat with adapter between base branch and main.

For all sizes, apply a strong, firm, continuous pressure until complete melt bead can be seen on main. Release pressure to light pressure. Continue heat soak cycle on branch and main. Watch base of branch for:

Main Sizes (Inches)	Heat Soak Cycle Fitting Base Bead
2	1/8" Melt Bead
3 and Larger	1/8" to 3/16" Melt Bead

E. Retract moveable clamp and cleanly remove heater plate. Bring melted surface together rapidly. Do not slam. Apply continuous progressive pressure until proper fusion bead is formed. Maintain pressure until joint has cooled.

3.07 OPERATIONS INCIDENTAL TO JOINT COMPLETION

A. Install identification wire where detailed in the drawings.

B. Plan joint completion to accommodate temporary test bulkheads for hydrostatic testing on the day of installation.

3.08 FLANGED CONNECTIONS

A. Mechanical joining to other piping materials (fittings, valves, tanks, pumps, etc.) Shall be accomplished as follows:

1. Ductile Iron to HDPE Connections

a. Connections between ductile iron pipe or fittings and PVC pipe or fitting shall use ductile iron mechanical joint glands conforming to AWWA C111 and AWWA C 153. Gaskets, bolts and hexagonal nuts shall be standard rubber gaskets conforming to AWWA C111. Follower gland shall match class 350 compact fittings. HDPE pipe stiffeners shall be constructed of stainless steel and shall be flanged on one end to prevent over-insertion into the receiving pipe. Install mechanical joints in accordance with AWWA C600 and manufacturer's recommendations.

b. When connection is being made to HDPE pipe or fitting, insert pipe stiffener into connection end of HDPE pipe until flared end seats against cut face.

2. PVC to HDPE Connections

a. The joining end of the HDPE pipe shall have a butt-fused flange piece attached in accordance with manufacturer's recommendations. Connection to PVC shall use a fully-restrained ductile iron mechanical

joint conforming to the requirements of AWWA C111 to C153. Butt-fuse flange end piece to connection end of HDPE pipe in accordance with manufacturer's recommendation. Install fully restrained mechanical joint on PVC connection end in accordance with AWWA C600 and manufacturer's recommendation.

B. Flange adapters shall be pressure rated the same as the pipe. Flange adapters shall be heat fused to the pipe as outlined in the heat fusion section. Gaskets shall be used between the polyethylene flange adapters when recommended by the HDPE pipe manufacturer. Sufficient torque shall be applied evenly to the bolts to prevent leaks. After initial installation and tightening of flanged connections, allow the connections to set for a few hours. Then conduct a final tightening of the bolts. Lubricate nuts and bolts with oil or graphite prior to installation. Check operation of valves connected to molded stub end flange adapters. Insert polyethylene spacer if recommended by pipe manufacturer for clearance.

3.02 CLEANING AND FIELD TESTING

A. General: At the conclusion of the work, the Contractor shall provide all associated cleaning and field testing as specified in associated sections of these specifications.

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SECTION 15180

BURIED PIPELINE LOCATION & IDENTIFICATION MARKERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to install the location and identification marking system(s) for buried utility mains.

B. The cost of furnishing and installing pipe location tape and electronic marker balls shall be included in the pipeline construction bid price. No separate payment will be made for these items.

PART 2 - PRODUCTS

2.01 MANUFACTURER/SUPPLIER

A. All products shall be furnished by a manufacturer with proven product history and service representation. All materials and equipment shall be new.

2.02 PIPE LOCATION TAPE/IDENTIFICATION

A. See appropriate sections in these specifications regarding pipe identification and locating aid requirements. Electronic marker balls and/or pads are to be installed in addition to locating aids and pipe identification requirements.

B. Measurement and Pavement

1. There is no separate pay item for pipe location wire. The price for this pay item shall be included in the price per linear foot of water reuse or sewer line items.

2.03 ELECTRONIC MARKER AND LOCATOR SYSTEM

A. Marker shall consist of a passive device capable of reflecting a specifically designated repulse frequency tuned to the utility being installed. Marker shall be color coded in accordance with American Public Works Association's Utility Location and Coordinating Council Standards and shall be as manufactured by Scotch Mark Locator System for balls and Metro Tech for wires or equal. Colors shall be: Water # 1403 Blue, Wastewater #1404 Green and Reclaimed Purple (Pantone 522C).

B. The Contractor shall furnish to the Owner one (1) Scotch Mark marker locator set device compatible to the buried markers placed as described in these specifications.

1. Marker locator set shall be EMS II "EMS Marker Locator" Path Tracing Receiver. Each unit shall incorporate the following features and accessories.

a. Units shall be tuned to the proper frequency for each type of line.
b. Field Strength Meter, which provides visual indication of the return signal.
c. Battery Access Panel containing condensed operating instructions.
d. Function Switch for selection of operation mode.
e. Sensitivity Control to adjust the receiver gain.
f. Auxiliary Head Set and Head Set Jack.
g. Audio Speaker for signal response.
h. Permanently attached shoulder straps.

C. Marker shall be full range marker.

D. Measurement and Payment

1. There is no separate pay item for electronic marker balls and/or pads. The price for this item shall be included in the price per linear foot of water, reuse water, or sewer line items.

2. Locator marker set(s) as described above in 2:03 B will be paid per unit price in bidding schedule.

PART 3 - EXECUTION

3.01 PIPE LOCATION TAPE

A. See appropriate sections in these specifications regarding execution of pipe identification and locating aid requirements. Electronic marker balls/pads are to be installed in addition to locating aids and pipe identification requirements.

3.02 ELECTRONIC MARKER AND LOCATOR SYSTEM

A. A suitable number of electronic markers shall be furnished so that a marker can be installed at one hundred foot (100') intervals along the pipeline length.

B. Additional markers shall be placed at tees, valves or other points of connection and as directed by the Owner and/or Engineer.

C. Additional markers shall be placed at points of horizontal pipe deflection to provide accurate indication of pipeline location as directed by the Owner and/or Engineer.

D. Markers shall be laid in a position directly above pipe and hand backfilled one foot (1') above marker to prevent damage or movement during subsequent backfilling. Depth of burial shall not be less than two feet (2') or more than eight feet (8').

E. Contractor shall install all wire and markers as specified by the manufacturer. Contractor shall demonstrate the electronic marker locator set and deliver the set to the Owner's representative in a Alike-new@ condition.

On gravity sewer systems, a locator ball shall be placed on all tees or wyes and on all pipe bends as well as the terminal end of the service lead.

On reuse water mains, potable water mains and sanitary force mains marker balls/pads shall be placed to indicate the location of plugs, caps or other terminal pipe locations, as directed by Orange County Personnel.

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Appendix A

Report of Subsurface Exploration and Geotechnical Engineering Evaluation

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Nadic Engineering Services, Inc.

Preliminary Soil Survey Report
International Drive
(South Westwood Boulevard to North Westwood Boulevard)
Orange County, Florida
NES Project No: R10003

Prepared for:

AVCON, Inc
5555 East Michigan Street, Suite 200
Orlando, Florida 32801

Prepared by:

Nadic Engineering Services, Inc.
601 N. Hart Blvd
Orlando, Florida 32818
407-521-4771

Consultants in: Civil · Environmental · Geotechnical Engineering
Offices in: Orlando · Miami

NADIC ENGINEERING SERVICES, INC.
Civil, Environmental, and Geotechnical Consultants

September 15, 2010

AVCON, Inc
5555 East Michigan Street, Suite 200
Orlando, Florida 32801

Attention: Mr. Brian J. Flynn, P.E.
Transportation Manager

Re: Preliminary Soil Survey Report
International Drive (South Westwood Boulevard to North Westwood Boulevard)
Orange County, Florida
NES Project No. R10003

Dear Mr. Flynn:

Nadic Engineering Services, Inc. (NES) is pleased to submit this Preliminary Soil Survey Report for the above referenced project. The purpose of this exploration was to evaluate the soil and groundwater conditions along International Drive from South Westwood Boulevard to North Westwood Boulevard and to provide geotechnical recommendations for the proposed improvements. This Soil Survey was authorized through a subconsultant agreement between AVCON and **NES**. This report is presented to support the development of Roadway Plans.

NES appreciates the opportunity to be of service to AVCON and Orange County Public Works Department on this project. We look forward to a continued association. Please contact us if you have any questions, or if we may be of further assistance to you as this project proceeds.

Sincerely,
NADIC ENGINEERING SERVICES, INC.
Engineering Business No. 8214

Mohan R. Killada, M.S., P.E.
Project Engineer

Godwin N. Nnadi, Ph.D., P.E.
Principal Engineer
FL Registration No: 50637

GNN: mrk\R10003 (International Drive)(091510)

NES	**Email: nadic@nadicinc.com**	
Office:	**601 N. Hart Boulevard, Orlando, Florida 32818**	**15291 NW 60th Avenue, Suite 106 Miami Lakes, Florida 33014**
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APPENDIX D

Check List

1.0 PROJECT LOCATION AND DESCRIPTION

This project is located on International Drive (I-Drive) from South Westwood Boulevard to North Westwood Boulevard...consists of widening International Drive from four (4) to six (6) lanes.

This project is located on International Drive (I-Drive) from South Westwood Boulevard to North Westwood Boulevard. The project consists of widening International Drive from four (4) to six (6) lanes. The approximate length of the improvements is 2.2 miles. The project site is located in Sections 7, 12, 13 and 18, Township 24 South, Range 28 and 29 East in Orange County, Florida.

This report presents the findings of our subsurface exploration, and provides geotechnical recommendations for the proposed roadway improvements. The site location map is shown in **Figure 1** in **Appendix A**. Existing pavement condition and evaluation survey of this section of roadway is presented in a separate report submitted by **NES**.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to obtain information on the general subsurface conditions including soil and groundwater conditions along the roadway alignment in order to make geotechnical engineering assessments and recommendations to guide the proposed roadway improvements.

Our services for this project are in general accordance with the Florida Department of Transportation (FDOT), "Soils and Foundation Manual." The services include review of geologic and topographic information, field reconnaissance, groundwater table measurements, roadway soil survey, and laboratory classification testing. Others include engineering analyses, evaluation, and engineering design recommendations.

3.0 REVIEW OF AVAILABLE DATA

3.1 USGS Topographic Map

The "Lake Jessamine, Florida" USGS topographic map issued in 1953 (photo revised in 1980) were reviewed. The map shows the ground surface elevation in the project vicinity to range from about +74 to + 89 feet, North American Vertical Datum of 1988 (NAVD). The project alignment is shown on an excerpt of the USGS topographic map presented in **Figure 2** in **Appendix A**.

3.2 USDA, SCS Soil Survey

The "Soil Survey of Orange County, Florida" published by the United States Department of Agriculture (USDA), Soil Conservation Service (SCS) was reviewed. Refer to **Figure 3** in **Appendix A** for a reproduction of the SCS map for the project area. Soils found in the project vicinity are listed below.

Soil Unit	Depth (inches)	Soil Description	AASHTO	USDA SHGWT(feet)*
Basinger (3)	0-7	Fine sand	A-3	+2.0-1.0
	7-32	Sand, fine sand	A-3, A-2-4	
	32-47	Sand, fine sand	A-3, A-2-4	
	47-80	Sand, fine sand	A-3, A-2-4	
Sanibel (42)	0-11	Muck	A-8	+1.0-1.0
	11-15	Sand, fine sand, mucky fine sand	A-3	
	15-80	Sand, fine sand	A-3	
Smyrna (44)	0-17	Fine sand	A-3	0-1.0
	17-27	Sand, fine sand, loamy fine sand	A-3, A-2-4	
	27-80	Sand, fine sand	A-3	

- SHGWT: Seasonal High Groundwater Table.

The soils classified as A-3 and A-2-4 are appropriate for use as embankment fill; however, A-8 soils (muck) which are encountered at the northern end of project limits should be treated in accordance with FDOT Standard Specifications and Index Nos. 500 and 505. This soil is unsuitable for support of roadways and should be over-excavated and replaced if encountered within the project limits.

.....A-3 and A-2-4 are appropriate for use as embankments fill…A-8 …should be treated…

Soil survey also indicates the seasonal high groundwater table to be within one (1) foot below the ground surface. Information contained in the SCS Soil Survey is very general and may be outdated due to recent development in the site vicinity. These developments may have modified soil condition or surface/ subsurface drainage.

3.3 Potentiometric Surface Map

Based on the review of May, 2009 "Potentiometric Surface Map of the Upper Floridan Aquifer" published by the St. Johns River Water Management District (SJRWMD), the elevation of the potentiometric surface in the vicinity of the project roadway alignment appears to be approximately +40 feet, NAVD. A portion of this map is presented in **Figure 4** in **Appendix A**.

3.4 Area Geology

The geology of Central Florida area is characterized by sedimentary strata formed during three distinct geologic periods. The surficial stratum is composed of undifferentiated Holocene/ Pleistocene/Pliocene age sands containing varying amounts of silt and clay, which extend typically to depths on the order of 40 to 60 feet below the ground surface. This upper, mostly sandy zone contains the surficial aquifer (water table). A Miocene age deposit, the Hawthorn Formation, frequently underlies the surficial sands and is typically composed of clay, clayey sands and sandy

limestone sometimes containing appreciable amounts of phosphate. This stratum extends to, typically, a depth of 80 to 120 feet beneath the existing ground surface and serves as the confining layer for the underlying Floridian Aquifer.

The Eocene age Ocala and Avon Park limestone formations are contained in the Floridian Aquifer, which is one of the most productive aquifers in the world. The extremely high productivity of this aquifer is directly related to its numerous cavities and interconnected channels. The deepest formation of the Eocene age is the Avon Park limestone. The Avon Park limestone consists mostly of hard brown dolostone and tan, granular limestone. In Orange County, the Avon Park limestone formation is approximately 300 to 350 feet thick. Above the Avon Park limestone is the Ocala limestone. The Ocala limestone is a loose to moderate well cemented mass of very small to large microfossils with much less dolostone than the Avon Park limestone. Typically, the Ocala limestone contains almost pure limestone with no dolostone, although the lower few feet can be partly dolomitized in some areas.

4.0 FIELD EXPLORATION

4.1 General

To evaluate the subsurface conditions along the proposed roadway widening, several field visits were conducted to establish drilling equipment access, layout and stake boring locations, and coordinate underground utility locations and markings. The subsurface conditions along the project alignment were evaluated by performing a series of 5-foot and 20-foot deep Auger Borings below existing grade. A total of 127 roadway auger borings were completed: 105 borings to a depth of five (5) feet and 22 to a depth of 20 feet below ground surface.

All borings were backfilled upon completion and after groundwater measurement for safety. All borings were staked and located in the field by **NES** by taping the distances from the edge of the existing pavement. Although the boring locations were therefore given only approximately, the methods used to locate the borings are, in **NES**'s opinion sufficient to meet the intent of our study.

The results of soil classification and groundwater measurement of each boring program are shown in **Sheets 2** through **8** in **Appendix B**.

4.2 Hand Auger Borings

Hand auger borings were performed to a general depth of five (5) feet below natural grade by manually twisting and advancing a bucket auger into the ground in 4 to 6-inch increments. These borings were performed in general accordance with the American Society of Testing and Material (ASTM) Testing Designation D-1452. As each soil type was revealed, representative samples were placed in air-tight jars and returned to our laboratory for visual examination and classification by a geotechnical engineer. These boreholes were backfilled after groundwater level measurement.

4.3 Power Auger Borings

Power Auger borings were performed by advancing a 4-inch diameter continuous flight auger slowly into the ground in a "corkscrew" fashion in 5-foot increments. Additional flights are added until the desired termination depth was achieved. These borings were performed in general accordance with the ASTM test designation D-1452. The flight auger was then retrieved and representative samples were obtained. The soil samples were visually classified in the field and placed in air-tight jars for transportation to our laboratory for further classification and testing. After performing the auger borings and groundwater level measurement, the boreholes were backfilled.

5.0 LABORATORY TESTING

Representative soil samples were retrieved from the borings and returned to **NES**'s laboratory for further visual classification, stratification and selective soil testing. Laboratory classification tests consist of sieve analysis, moisture content, organic content, and Atterberg Limits. The results of these tests are presented in **Table 1** in **Appendix C**. In addition to the classification testing, Limerock Bearing Ratio (LBR) tests were performed on selected soil samples. The results of LBR testing are presented in **Tables 2** and **3** in **Appendix C,** and **Figure 5** in **Appendix C**. Results of all roadway laboratory tests are summarized on the Roadway Soil Survey Sheet (**Sheet 1** in **Appendix B**). The types of tests performed with their associated test designations are presented below.

Test Type	FDOT	ASTM
Grain Size Analysis	FM 1-T 088	D-422
Moisture Content	FM 1-T 265	D-2216
Organic Content	FM 1-T 267	D-2974
Atterberg Limits	FM 1-T 089 and FM 1-T 090	D-4318
Limerock Bearing Ratio	FM 5 – 515	--

6.0 SUBSURFACE CONDITIONS

6.1 General

The soils encountered were classified using the AASHTO Soil Classification System. Soil classification and stratification are based on visual examination of the recovered soil samples, laboratory testing, and interpretation of field boring logs by geotechnical engineer. The stratification lines represent approximate boundaries between soil types of significantly different engineering properties; however, the actual transition between layers may be gradual. Based on the soil boring and laboratory test results, the soils encountered along the project alignment have been grouped into seven strata. Each stratum exhibits a range of engineering properties related to application for roadway construction as outlined by FDOT Standard Indices 500 and 505. Included with the soil profiles in **Sheets 2** through **8** in **Appendix B** are the groundwater levels measured at the time the borings were performed and the estimated seasonal high groundwater levels.

6.2 Roadway Boring Results

Majority of the borings along the project alignment encountered fine sand, occasional trace silt/clay (Stratum 1) to the boring termination depths. Borings HA-6 and HA-80 encountered silty fine sand (Stratum 2). Several borings encountered clayey fine sand (Stratum 3) soils intermittently at various depths. Stratum 3 thickness ranges from one (1) to nine (9) feet. Borings HA-20, HA-32, HA-74, HA-86 and HA-103 encountered fine sand with organics (Stratum 4) soils at depths ranging from one (1) to 15 feet below existing grade. Sandy clay (Stratum 5) was encountered in boring HA-63 at a depth ranging from 11 to 20 feet below grade. Limerock with sand (Stratum 6) was encountered in borings HA-102, HA-108 and HA-117 at depths ranging from one (1) to five (5) feet below existing grade. Fine sand with limerock fragments (Stratum 7) was encountered in borings HA-111 through HA-113, HA-115, HA-116, and HA-119 at depths ranging from one (1) to five (5) feet below existing grade.

The soil strata encountered, soil descriptions, AASHTO classifications and FDOT 505 Embankment Soil Utilization designations are summarized below:

Stratum	Soil Description	AASHTO	Index 505 Classification
1	Light gray to dark brown fine SAND, trace silt/clay	(A-3)	Select (S)
2	Gray to brown silty fine SAND	(A-2-4)	Select (S)
3	Gray to brown clayey fine SAND	(A-2-6)	Plastic (P)
4	Dark brown fine SAND with organics	(A-8)	Muck (M)
5	Gray sandy CLAY	(A-7)	Plastic (P)
6	Dark gray to brown LIMEROCK with fine sand	(A-1)	Select (S)
7	Gray fine SAND with limerock fragments	(A-3)	Select (S)

The above subsurface conditions are only general descriptions. For details refer to the boring profiles in **Sheets 2** to **8** in **Appendix B**.

6.4 Groundwater

Groundwater was encountered in some of the roadway borings at depths ranging from 4.0 to 14.0 feet below the existing grade at the time of field exploration (June & July 2010). However, most of the 5-foot borings did not encounter ground water. Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences, such as swales, drainage ponds, underdrains, and areas of covered soil (roadways, sidewalks, etc.).

For the purposes of this report, estimated seasonal high groundwater levels are defined as groundwater levels that are anticipated at the end of the wet season of a "normal rainfall year" under current site conditions. "Normal rainfall year' is defined as a year in which rainfall quantity and distribution were at or near historical rainfall averages. Based upon our observations at the sites and in the borings performed by **NES**, a review of the Orange County Soil Survey, and rainfall data of the area, it is our opinion that the seasonal high groundwater level would be about two (2) to five (5) feet, below the existing grade in the project area. The estimated seasonal high groundwater levels presented next to the boring profiles (**Sheets 2** through **8** in **Appendix B**) are based on the soil stratigraphy, measured groundwater levels, USDA/SCS information, review of roadway plans, and past experience with similar soil conditions. In general, the estimated seasonal high groundwater level is not intended to define a limit or ensure future seasonal fluctuations in groundwater levels will not exceed the estimated levels. Post-development groundwater levels could exceed the seasonal high groundwater level estimates as a result of a series of rainfall events, changed conditions at the site which alter surface water drainage characteristics, or variations in the duration, intensity, or total volume of rainfall.

7.0 EVALUATION AND RECOMMENDATIONS

7.1 General

The evaluation and recommendations contained in this report are based in part on the data obtained from a limited number of soil samples and groundwater measurements obtained from widely spaced borings. The exploration methods used indicate subsurface conditions at specific boring locations, only at the time they were performed and to the depths penetrated. Borings cannot be relied upon to accurately reflect the variations that usually exist between boring locations and these variations may not become evident until construction. If variations from the conditions described in this report become evident during the course of construction, or project characteristics described in this report change, **NES** should be retained to re-evaluate the conclusions and recommendations contained in this report in light of such changes.

7.2 Roadway Construction

The results of our geotechnical exploration indicate that the subsurface soils encountered along roadway alignment are generally suitable for support of the proposed roadway improvement after proper subgrade preparation. Non select soils, muck, clays or debris, if encountered within the limits, should be removed and replaced with selected soils in accordance with FDOT Index Nos. 500 and 505. Site preparation and roadway construction should be in accordance with the latest version of

the FDOT Standard Specifications for Road and Bridge Construction and FDOT Standard Specification and Index Nos. 500 and 505.

…Strata Nos. 1, 2, 6 and 7 should be treated as Select (S) materials in accordance with Index No. 505. Stratum No. 2 soils may retain excess moisture…

The soils encountered in our borings classified as Strata Nos. 1, 2, 6 and 7 should be treated as Select (S) materials in accordance with Index No. 505. Strata Nos. 3 and 5 soils should be treated as Plastic (P) and Stratum No. 4 soils should be treated as Muck (M), in accordance with Index No. 505. Stratum No. 2 soils may retain excess moisture and may be difficult to dry and compact. If plastic and/or organic material is encountered along the project alignment during construction, at locations that were not indicated in this report or where soil borings were not performed, these materials should be removed in accordance with Index Nos. 500 and 505 unless shown "to remain" in the plans.

All fill soils placed for the roadway improvement should be selected in accordance with Index No. 505. In-place density tests should be performed on the fill soils to verify the specified degree of compaction. The minimum test frequency should be in accordance with the FDOT Materials, Sampling, Testing, and Reporting Guide.

7.3 Groundwater Control

Groundwater table fluctuates seasonally depending upon intensity and duration of rainfall and presence and proximity of any artificial drainage facilities. Depending upon groundwater levels at the time of construction, some form of dewatering may be required at some locations to achieve the required compaction. Based on the encountered groundwater, the existing groundwater may be controlled by a drainage system consisting of swales, cross drains and storm trenchline sewers.

One of the most critical influences on pavement performance in Central Florida is the relationship between pavement subgrade and the seasonal high groundwater level. Many roadways have been destroyed as a result of deterioration of the base and the base/surface course bond. It is our opinion that at least two feet of clearance be provided between the bottom of the proposed pavement base course and the estimated seasonal high groundwater levels along the roadway alignment. Based on the results of our borings, our estimation of the seasonal high groundwater levels leads us to conclude that the relatively high SHGWT and water intrusion into the existing base may have contributed to the deterioration of the existing pavement.

7.4 Pavement Design

Limerock Bearing Ratio (LBR) tests were performed on representative soil samples encountered in the project area. A total of 10 LBR tests were performed within the project limits. Presented below is a table of LBR samples, locations, stratum, and LBR values.

Boring ID	Station	Offset (ft)	Baseline	Depth (feet)	Stratum No.	LBR Value (%)
HA-4	14+00	15, LT	I-Drive	1-2	1	28
HA-25	42+00	15, RT	I-Drive	1-2	1	37
HA-46	65+00	15, LT	I-Drive	1-2	1	51
HA-63	90+00	CL	Cent Fl Pkwy	1-2	1	20
HA-71	98+00	CL	Cent Fl Pkwy	1-2	1	20
HA-86	90+00	20, RT	I-Drive	1-2	3	41
HA-102	111+00	5, RT	I-Drive	1-2	6	71
HA-106	114+25	150, LT	I-Drive	1-2	1	47
HA-115	123+00	20, RT	I-Drive	1-2	7	50
HA-122	126+40	410, LT	I-Drive	1-2	1	18

Note: I-Drive – International Drive, Cent Fl Pkwy – Central Florida Parkway

The LBR test results were evaluated using the FDOT Mean Method and FDOT 90 Percent Method, with the results of our analysis presented in **Tables 2** and **3** respectively, in **Appendix C**. The Mean Method yielded a design LBR value of 26 and the FDOT 90 Percent Method resulted in a design LBR value of 20. For pavement design of filled roadway sections, we recommend an LBR of 20. The individual LBR results are also presented in **Appendix C**.

For pavement design of filled roadway sections, we recommend an LBR of 22.

After proper subsoil preparation, the pavement subgrade, base and surface courses should be constructed in accordance with current FDOT Standard Specifications for Road and Bridge Construction.

8.0 CONSTRUCTION CONSIDERATIONS

8.1 General

The ground surface within the limits of construction should be cleared or stripped of all vegetation, roots, topsoil, debris, surficial muck and other deleterious material in accordance with the FDOT Standard Specifications for Road and Bridge Construction.

Roadway construction should be performed in accordance with the appropriate sections of the FDOT current edition of the Standard Specifications for Road and Bridge Construction. If needed, backfill should generally consist of select materials (A-3) and (A-2-4) compacted in accordance with the FDOT Standard Specification for Road and Bridge Construction. Removal of organic materials and plastic soils within the project limits should be accomplished in accordance with the FDOT Index 500 unless otherwise shown on the plans.

In-place density tests should be performed on the fill soils to verify the specified degree of compaction. The minimum test frequency should be in accordance with the FDOT Materials, Sampling, Testing, and Reporting Guide.

8.2 Excavation

Excavation should be performed in accordance with Section 125 and 455 D of the current FDOT Standard Specifications for Road and Bridge Construction.

All excavation and below grade construction activities should be in accordance with the Occupational Safety and Health Administration (OSHA). The side slopes of all excavation greater than four feet deep should be sloped at a maximum of 1.5 horizontal to 1 vertical (1.5H: 1V) as required by OSHA. Steeper slopes can be established by a "competent person" (as defined by OSHA) and supported with a system designed by a registered Professional Engineer.

For temporary excavation support system, we recommend the following.

Saturated unit weight	120 pcf
Angle of soil friction	30 degree
Cohesion	0
Surcharge load	250 psf

REPORT LIMITATIONS

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. We are not responsible for the conclusions, opinions or recommendations made by others based on these data.

The scope of the exploration was intended to evaluate soil and groundwater conditions within the influence of roadway improvement. The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated and does not reflect any variations which may occur among these borings. If any variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had the opportunity to observe the characteristics of the conditions encountered. The applicability of the report should be reviewed in the event significant changes occur in the design, nature or location of the proposed structures.

The scope of services of this project, included herein, did not include any environmental assessment for the presence or absence of hazardous or toxic materials in the soil, surface water, and groundwater, air on the site, below and around the site. Any statements in this report or on the boring logs regarding odors, colors, unusual or suspicious items and conditions are strictly for the information of the client.

APPENDIX A

Figure 1	Site Location Map
Figure 2	Topographic Map
Figure 3	Soil Map
Figure 4	Potentiometric Surface Map

PROJECT	BORING LOCATION	U.S.G.S QUADRANGLE MAP	ISSUED	PHOTOREVISED
BEGINS-ENDS	S7,12,13&18 T24S R28&29E	LAKE JESSAMINE	1953	1980

NES

Civil
Geotechnical
Environmental
Consulting Engineering

SCALE: NTS
DATE: 09-15-2010

DRAWN: MRK
CHECKED: GNN

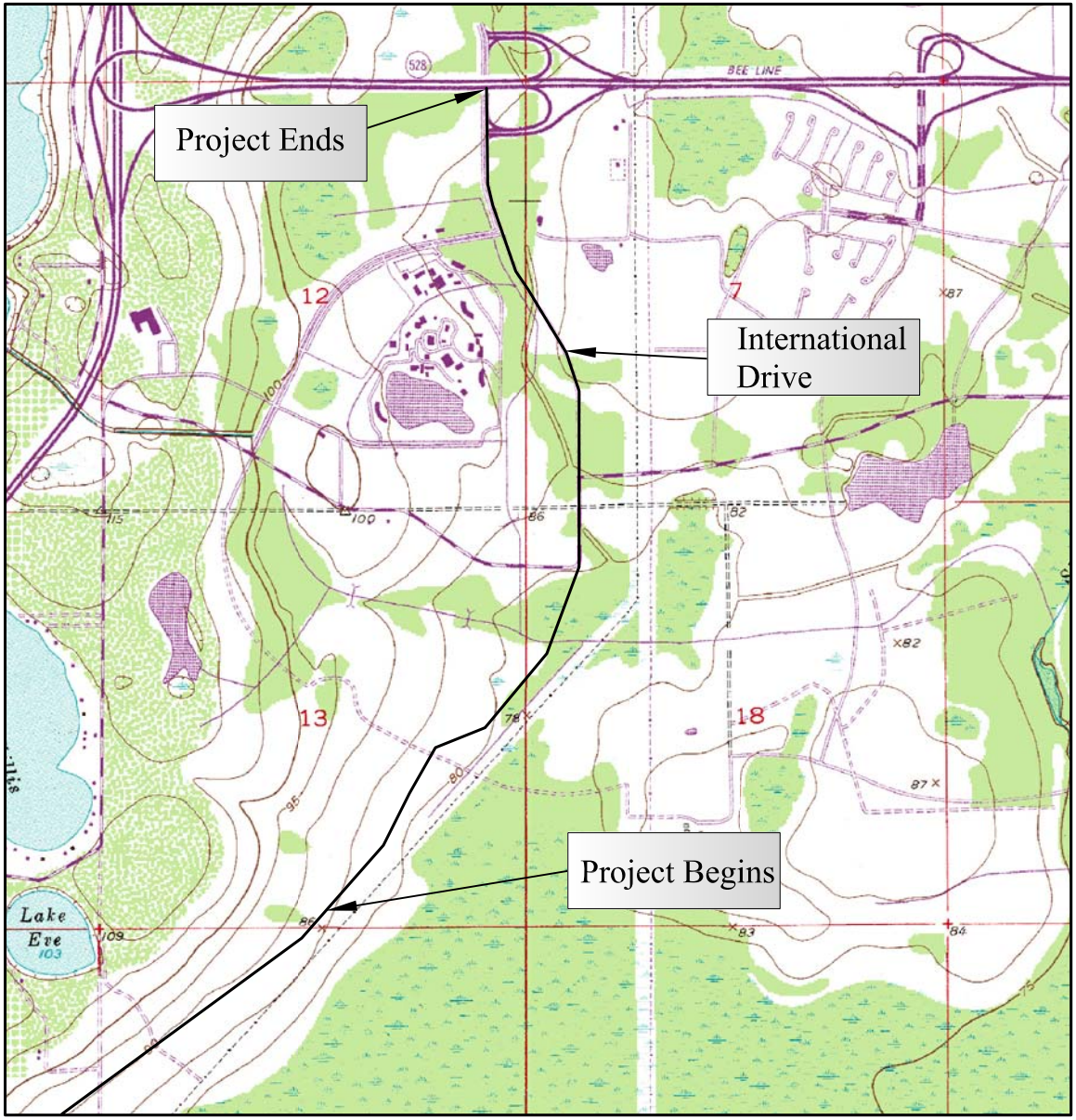
ORANGE COUNTY
PUBLIC WORKS
FLORIDA

PROJECT NAME:
SITE LOCATION MAP
INTERNATIONAL DRIVE
(S. Westwood Blvd to N. Westwood Blvd)

NES PROJECT NO.
R10003

COUNTY	PROJECT NO.
ORANGE	--

FIGURE 1



PROJECT	BORING LOCATION	U.S.G.S QUADRANGLE MAP	ISSUED	PHOTOREVISED
BEGINS-ENDS	S7,12,13&18 T24S R28&29E	LAKE JESSAMINE	1953	1980

NES
Civil
Geotechnical
Environmental
Consulting Engineering

SCALE: NOT TO SCALE
DATE: 07-14-2010

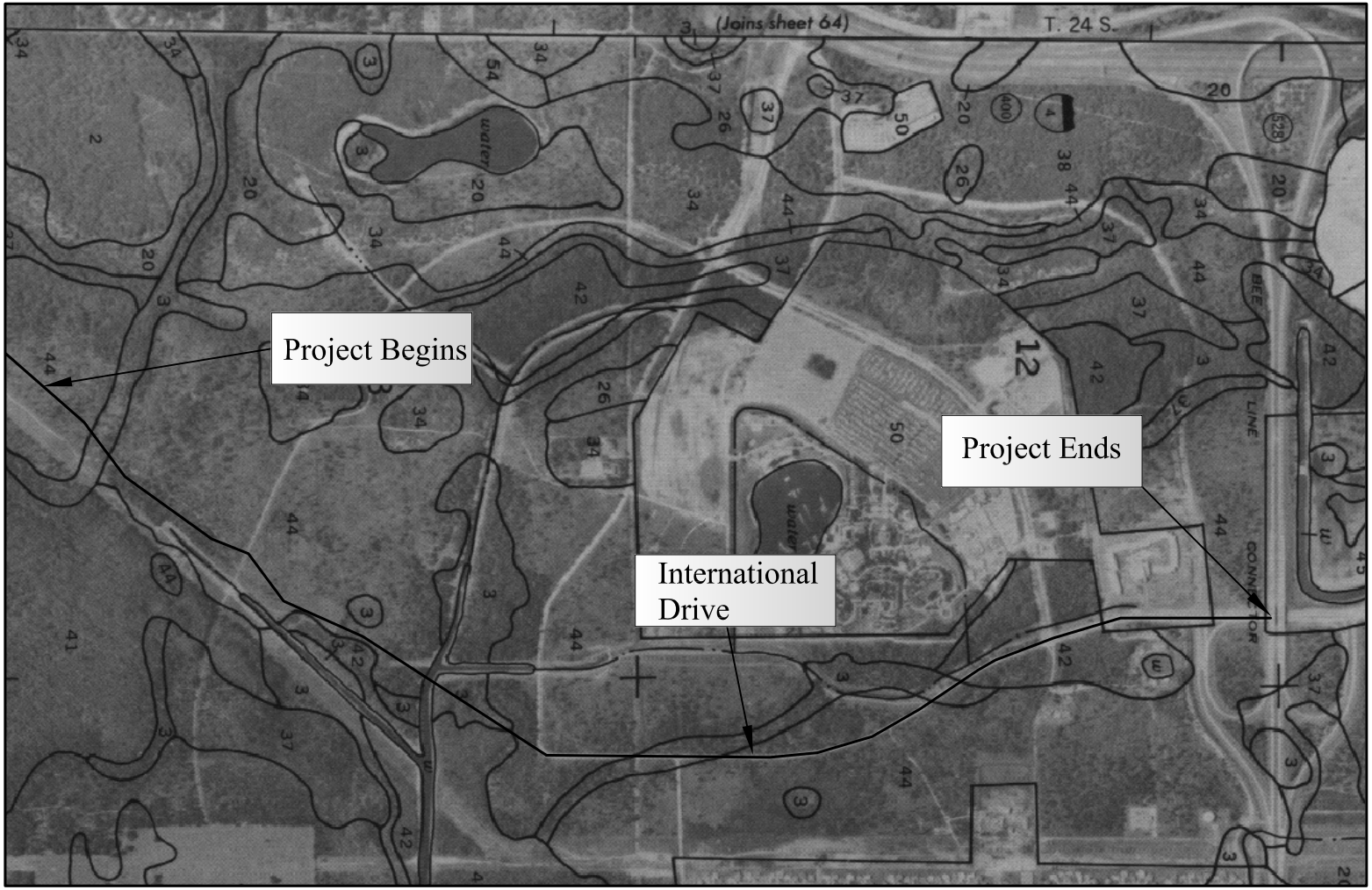
ORANGE COUNTY
PUBLIC WORKS
FLORIDA

PROJECT NAME:
TOPOGRAPHIC MAP
INTERNATIONAL DRIVE
(S. Westwood Blvd N. Westwood Blvd)

COUNTY	PROJECT NO.
ORANGE	–

NES PROJECT NO.
R10003

FIGURE 2



LEGEND

3 Basinger fine sand
42 Sanibel muck
44 Smyrna fine sand
50 Urban Land

PROJECT	BORING LOCATION	U.S.G.S QUADRANGLE MAP	ISSUED	PHOTOREVISED
BEGINS-ENDS	S7,12,13&18 T24S R28&29E	LAKE JESSAMINE	1953	1980

NES *Civil Geotechnical Environmental Consulting Engineering*

SCALE: NOT TO SCALE
DATE: 07-14-2010

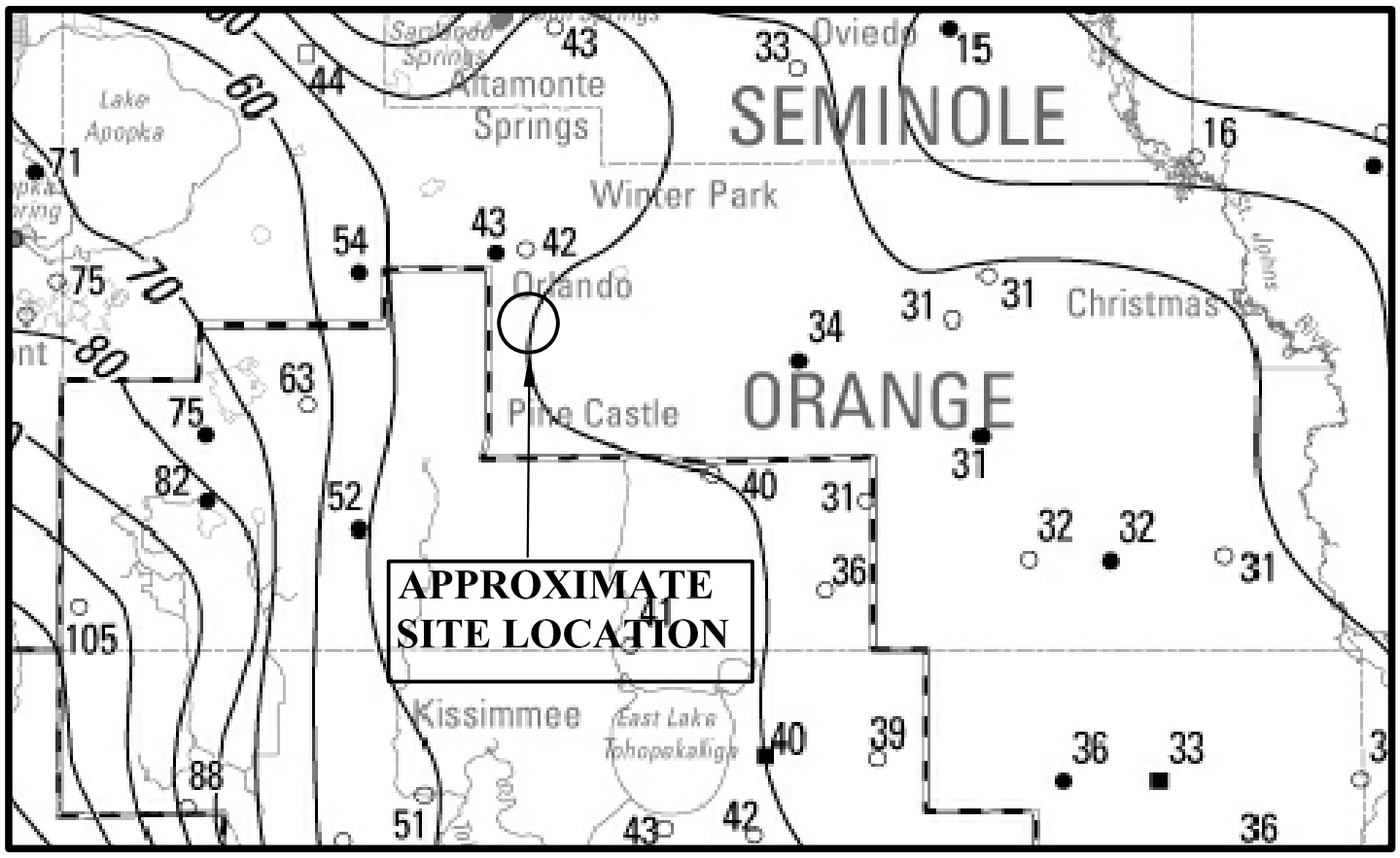
ORANGE COUNTY PUBLIC WORKS FLORIDA

PROJECT NAME:
SOILS MAP
INTERNATIONAL DRIVE
(S. Westwood Blvd N. Westwood Blvd)

COUNTY	PROJECT NO.
ORANGE	--

NES PROJECT NO.
R10003

FIGURE 3



REFERENCE: POTENTIOMETRIC SURFACE OF THE UPPER FLORIDAN AQUIFER IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT AND VICINITY, FLORIDA, MAY, 2009

QUAD: LAKE JESSAMINE

SECTION: 7, 12, 13, 18

TOWNSHIP: 24 SOUTH

RANGE: 28, 29 EAST

LEGEND

— 40 — POTENTIOMETRIC CONTOUR-- Shows altitude at which water level would have stood in tightly cased wells. Contour interval is 10 feet. Datum is sea level.

Note: Elevations Shown on Map are in feet, NGVD

POTENTIOMETRIC SURFACE MAP

INTERNATIONAL DRIVE
(S WESTWOOD BLVD TO
N WESTWOOD BLVD)
ORANGE COUNTY, FLORIDA

NES *Civil Geotechnical Environmental Consulting Engineering*

DRAWN:	SCALE:	PROJECT NO.:
MRK	NTS	R10003
CHKD:	DATE:	FIGURE 4
GNN	07-14-10	

APPENDIX B

Sheet 1	Roadway Soil Survey
Sheets 2 to 8	Roadway Auger Boring Profiles

VERIFICATION CHECKER — Green Check or Circle & Remark Incorrect — GNN — Date: 08/02/10
REMARKS INCORPORATION (Blue Highlighter) — IAU — Date: 08/02/10
CHECKED Corrected (Green) Change (Red) — GNN — Date: 08/02/10

CHECKED Corrected (Yellow) Change (Red) — GNN — Date: 08/02/10
CONCURRENCE, ORIGINATOR (Red Check) — IAU — Date: 08/02/10
CHANGE INCORPORATION (Blue Highlighter) — GNN — Date: 08/02/10

ORIGINATOR IAU Date: 08/02/10

QC/QA REVIEW

NES PROJECT No.: R10003
ROADWAY: INTERNATIONAL DRIVE
SUBMITTED BY: NES

NADIC ENGINEERING SERVICES, INC

ROADWAY CROSS SECTION OF SOIL SURVEY

REPORT OF TESTS

SECTION: 7, 12, 13, 18
TOWNSHIP: 24 SOUTH
RANGE: 28 & 29 EAST
SURVEYED BY: NES
SURVEY BEGINS: 9+00 International Drive
SURVEY ENDS: 132+00 International Drive
SURVEY BEGINS: 93+00 Central Florida Pkwy
SURVEY ENDS: 103+00 Central Florida Pkwy
DATE SURVEYED: JUNE to JULY, 2010
DATE REPORTED: SEPTEMBER, 2010

	ORGANIC CONTENT		MOISTURE CONTENT		SIEVE ANALYSIS RESULTS % PASS						ATTERBERG LIMITS (%)					CORROSION TEST RESULTS					SUBSTRUCTURE ENVIRONMENTAL CLASSIFICATION	
STRATUM NO.	No. OF TESTS	% ORGANIC	No. OF TESTS	% MOISTURE CONTENT	No. OF TESTS	% PASSING 10 MESH	% PASSING 40 MESH	% PASSING 60 MESH	% PASSING 100 MESH	PASSING 200 MESH	No. OF TESTS	LIQUID LIMIT	PLASTICITY INDEX	AASHTO GROUP	DESCRIPTION	No. OF TESTS	pH	RESISTIVITY OHM-CM	CHLORIDES PPM	SULFATE PPM	CONCRETE	STEEL
1	3	3-4	3	7-18	27	99-100	90-99	50-92	17-58	4-11	-	-	-	A-3	LIGHT GRAY TO DARK BROWN FINE SAND, OCCASIONAL SILT/CLAY AND ROOTS	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	2	27-29	10	A-2-4	GRAY TO BROWN SILTY SAND	-	-	-	-	-	-	-
3	-	-	-	-	7	100	94-100	83-93	43-57	5-18	1	32	11	A-2-6	GRAY TO BROWN CLAYEY SAND	-	-	-	-	-	-	-
4	5	5-8	5	5-76	-	-	-	-	-	-	-	-	-	A-8	DARK BROWN FINE SAND WITH ORGANICS	-	-	-	-	-	-	-
5	-	-	1	33	1	-	-	-	-	73	1	58	39	A-7	GRAY SANDY CLAY	-	-	-	-	-	-	-
6	-	-	-	-	3	16-74	13-54	9-38	4-20	2-11	-	-	-	A-1	DARK GRAY TO BROWN LIMEROCK WITH FINE SAND	-	-	-	-	-	-	-
7	-	-	-	-	3	75-95	61-83	45-61	20-28	7-8	-	-	-	A-3	GRAY FINE SAND WITH LIMEROCK FRAGMENTS	-	-	-	-	-	-	-

NOTES:

(1) STRATA BOUNDARIES ARE APPROXIMATE AND REPRESENT SOIL STRATA AT EACH TEST HOLE LOCATION ONLY. ANY STRATUM CONNECTING LINES SHOWN ARE FOR ESTIMATING EARTHWORK ONLY AND DO NOT INDICATE ACTUAL STRATUM LIMITS. SUBSURFACE VARIATIONS BETWEEN BORINGS SHOULD BE ANTICIPATED AS INDICATED IN FDOT SECTION 2-4. FOR FURTHER DETAILS SEE FDOT STANDARD SPECIFICATIONS SECTION 120-3.

(2) SOIL PARAMETER NOT TESTED DENOTED AS "-" ABOVE.

(3) ▼ INDICATES WATER TABLE WHERE ENCOUNTERED AT THE TIME OF SURVEY.
▽GNE INDICATES GROUNDWATER LEVEL NOT ENCOUNTERED AT THE TIME OF SURVEY.
INDICATES ESTIMATED SEASONAL HIGH WATER LEVEL.

(4) REMOVAL OF PLASTIC AND HIGH PLASTIC MATERIAL OCCURING WITHIN THE ROADWAY SHALL BE ACCOMPLISHED IN ACCORDANCE WITH INDEX No. 500 UNLESS OTHERWISE STATED IN THE PLANS. THE MATERIAL UTILIZED IN EMBANKMENT CONSTRUCTION SHALL BE IN ACCORDANCE WITH FDOT STANDARD INDEX No. 505.

(5) STRATA 1, 2, 6 AND 7 SHALL BE TREATED AS SELECT (S) MATERIALS PER FDOT INDEX No. 505.

(6) STRATUM 3 & 5 SHALL BE TREATED AS PLASTIC (P) MATERIALS, PER INDEX 500 & 505.

(7) STRATUM 4 SHALL BE TREATED AS MUCK (M) MATERIALS, PER INDEX 500 & 505.

(8) STRATUM 2 MAY RETAIN EXCESS MOISTURE AND MAY BE DIFFICULT TO DRY AND COMPACT.

ORANGE COUNTY

REVISIONS

DATE	BY	DESCRIPTION

NES — *Civil Geotechnical Environmental Consulting Engineering*

ENGINEER OF RECORD:
GODWIN N. NNADI, P.E. #50637
NES
601 N. Hart Boulevard
ORLANDO, FLORIDA 32818

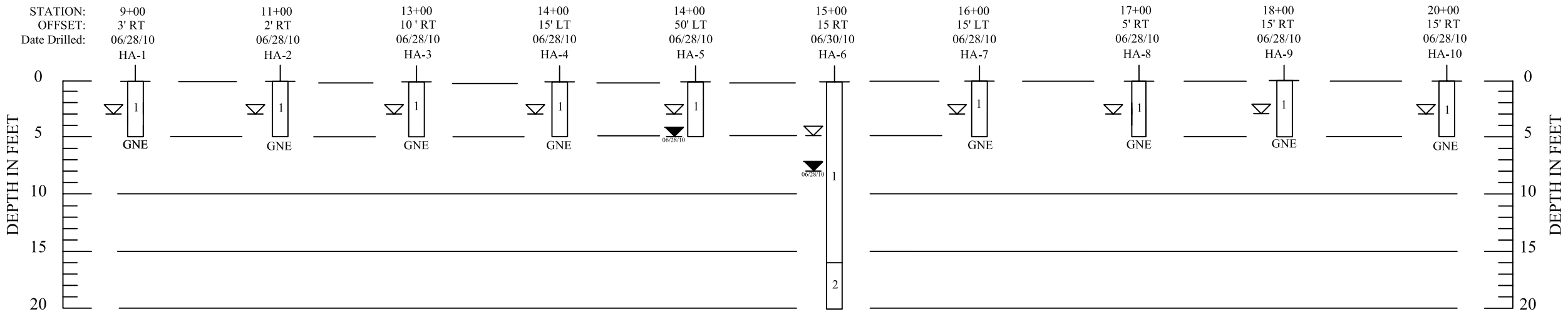
SEAL:

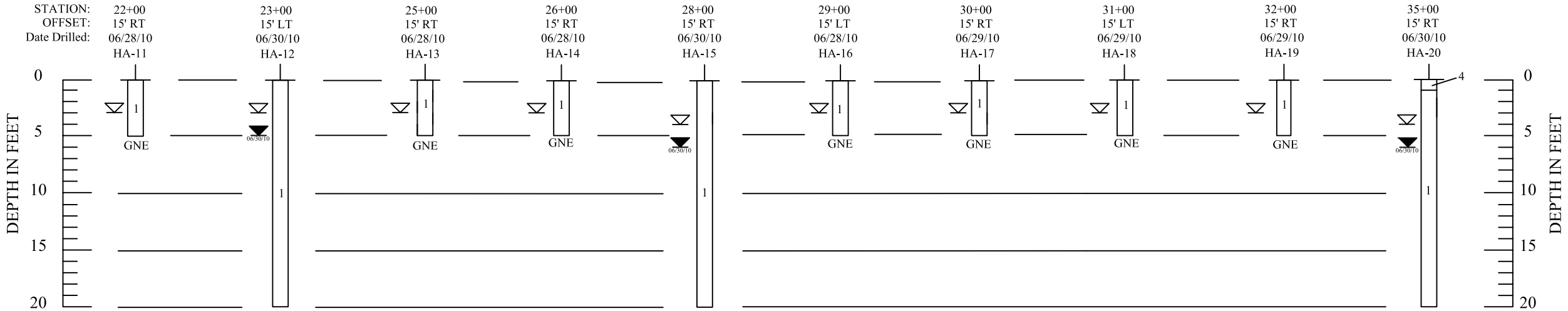
ORANGE COUNTY PUBLIC WORKS

ROAD NAME	COUNTY
INTERNATIONAL DRIVE	ORANGE

SHEET TITLE: ROADWAY SOIL SURVEY
PROJECT NAME: INTERNATIONAL DRIVE (From S.Westwood Blvd to N.Westwood Blvd)
Project No.
Sheet No.

NES Project No. R10003





LEGEND

1 Light gray to dark brown fine SAND occasional silt/clay and roots, (A-3)

2 Gray to brown silty SAND, (A-2-4)

3 Gray to brown clayey SAND, (A-2-6)

4 Dark brown fine SAND with organics, (A-8)

(A-3) A.A.S.H.T.O. soil classification group symbol

Estimated seasonal high groundwater level

06/28/10 Encountered groundwater level on date shown

GNE Groundwater not encountered in the top 5 feet

REVISIONS			REVISIONS		
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAMES	DATES
DRAWN BY:	IAU	07-13-10
CHECKED BY:	GNN	07-13-10
DESIGNED BY:	N/A	N/A
CHECKED BY:	N/A	N/A
APPROVED BY:	GNN	

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CERTIFICATE OF AUTHORIZATION NO. 8214
NES GEOTECHNICAL ENVIRONMENTAL CONSULTING ENGINEERING

ORANGE COUNTY FLORIDA

ORANGE COUNTY PUBLIC WORKS

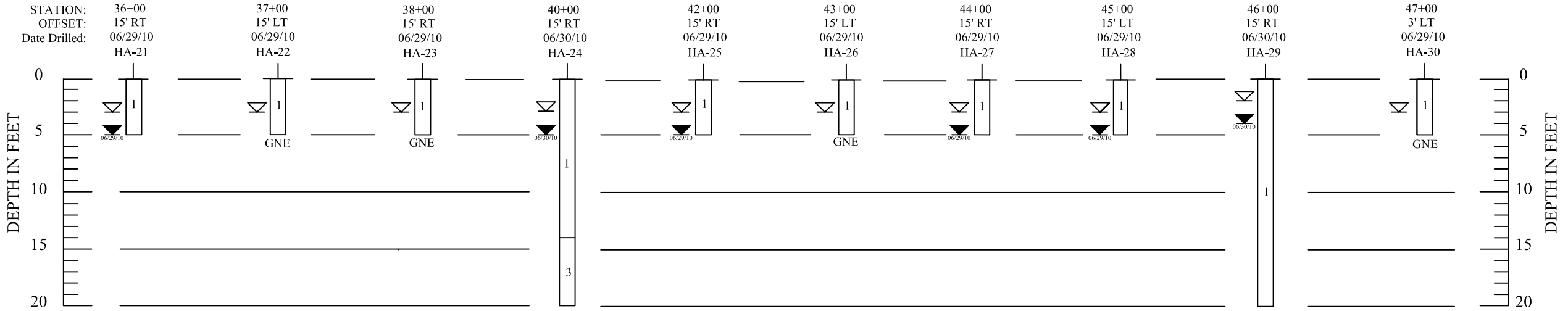
ROAD NAME	NES PROJECT NO.
INTERNATIONAL DRIVE	R10003

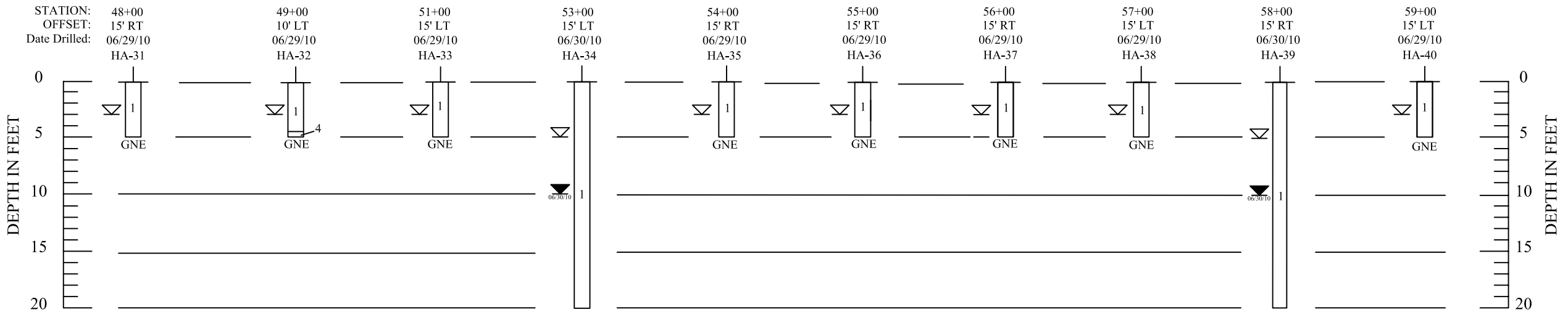
SHEET TITLE:
ROADWAY AUGER BORING PROFILES

PROJECT NAME:
INTERNATIONAL DRIVE
(From S. Westwood Blvd to N. Westwood Blvd)

SHEET NO.

Z:\Roadways\GNnadi\Orange County\International Drive\Acad





LEGEND

1 Light gray to dark brown fine SAND occasional silt/clay and roots, (A-3)

3 Gray to brown clayey SAND, (A-2-6)

4 Dark brown fine SAND with organics, (A-8)

(A-3) A.A.S.H.T.O. soil classification group symbol

Estimated seasonal high groundwater level

Encountered groundwater level on date shown

GNE Groundwater not encountered in the top 5 feet

Z:\Roadways\GNnadi\Orange County\International Drive\Acad

REVISIONS			REVISIONS		
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAMES	DATES
DRAWN BY:	IAU	07-13-10
CHECKED BY:	GNN	07-13-10
DESIGNED BY:	N/A	N/A
CHECKED BY:	N/A	N/A
APPROVED BY:	GNN	

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ORANGE COUNTY FLORIDA

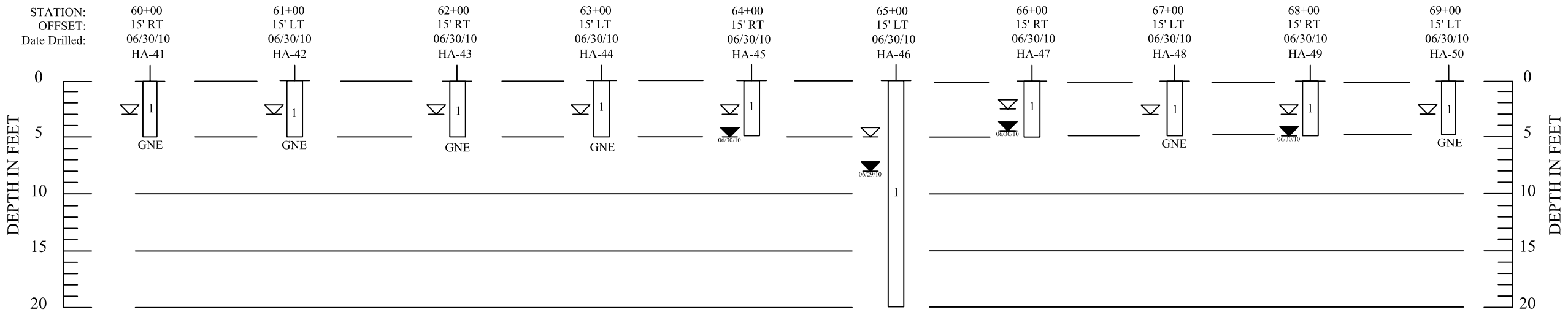
ORANGE COUNTY PUBLIC WORKS

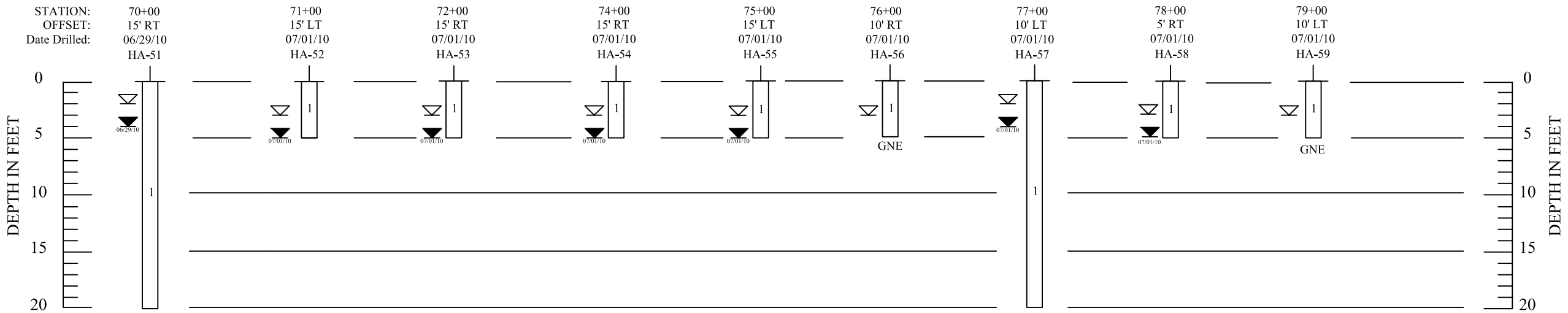
ROAD NAME	NES PROJECT NO.
INTERNATIONAL DRIVE	R10003

SHEET TITLE: ROADWAY AUGER BORING PROFILES

PROJECT NAME: INTERNATIONAL DRIVE (From S. Westwood Blvd to N. Westwood Blvd)

SHEET NO.





LEGEND

1 Light gray to dark brown fine SAND occasional trace silt/clay and roots, (A-3)

(A-3) A.A.S.H.T.O. soil classification group symbol

Estimated seasonal high groundwater level

06/30/10 Encountered groundwater level on date shown

GNE Groundwater not encountered in the top 5 feet

REVISIONS			REVISIONS		
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAMES	DATES
DRAWN BY:	IAU	07-13-10
CHECKED BY:	GNN	07-13-10
DESIGNED BY:	N/A	N/A
CHECKED BY:	N/A	N/A
APPROVED BY:	GNN	

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ORANGE COUNTY FLORIDA

ORANGE COUNTY PUBLIC WORKS

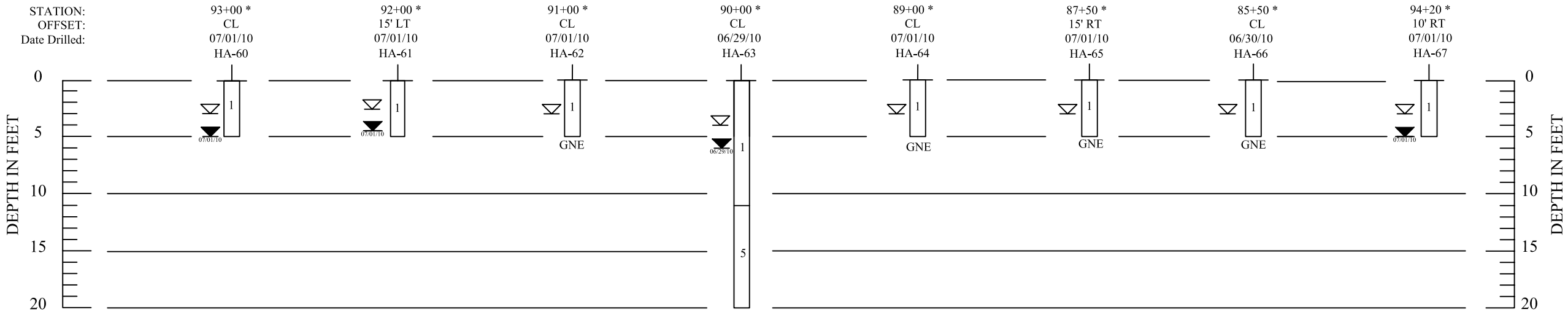
ROAD NAME	NES PROJECT NO.
INTERNATIONAL DRIVE	R10003

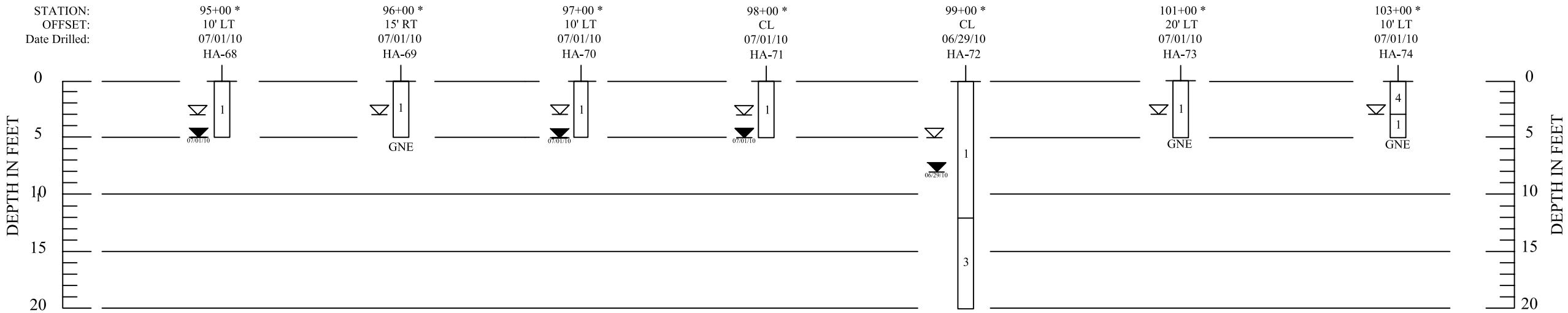
SHEET TITLE: ROADWAY AUGER BORING PROFILES

PROJECT NAME: INTERNATIONAL DRIVE (From S. Westwood Blvd to N. Westwood Blvd)

SHEET NO.

Z:\Roadways\GNnadi\Orange County\International Drive\Acad





* Central Florida Parkway Baseline

LEGEND

1 Light gray to dark brown fine SAND occasional trace silt/clay and roots, (A-3)

3 Gray to brown clayey SAND, (A-2-6)

4 Dark brown fine SAND with organics, (A-8)

5 Gray sandy CLAY, (A-7)

(A-3) A.A.S.H.T.O. soil classification group symbol

Estimated seasonal high groundwater level

06/29/10 Encountered groundwater level on date shown

GNE Groundwater not encountered in the top 5 feet

REVISIONS			REVISIONS		
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAMES	DATES
DRAWN BY:	IAU	07-16-10
CHECKED BY:	GNN	07-16-10
DESIGNED BY:	N/A	N/A
CHECKED BY:	N/A	N/A
APPROVED BY:	GNN	

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NES GEOTECHNICAL ENVIRONMENTAL CONSULTING ENGINEERING

ORANGE COUNTY PUBLIC WORKS

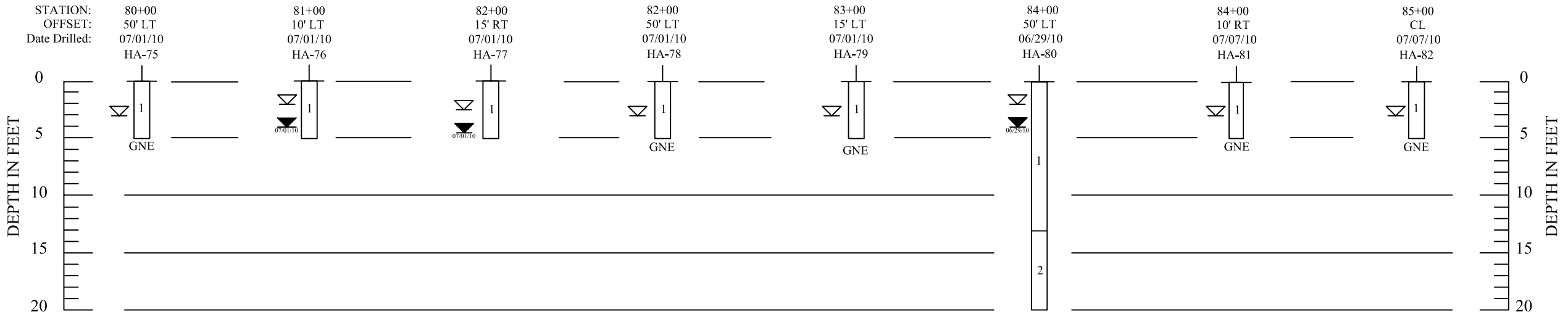
ROAD NAME	NES PROJECT NO.
CENTRAL FLORIDA PKWY	R10003

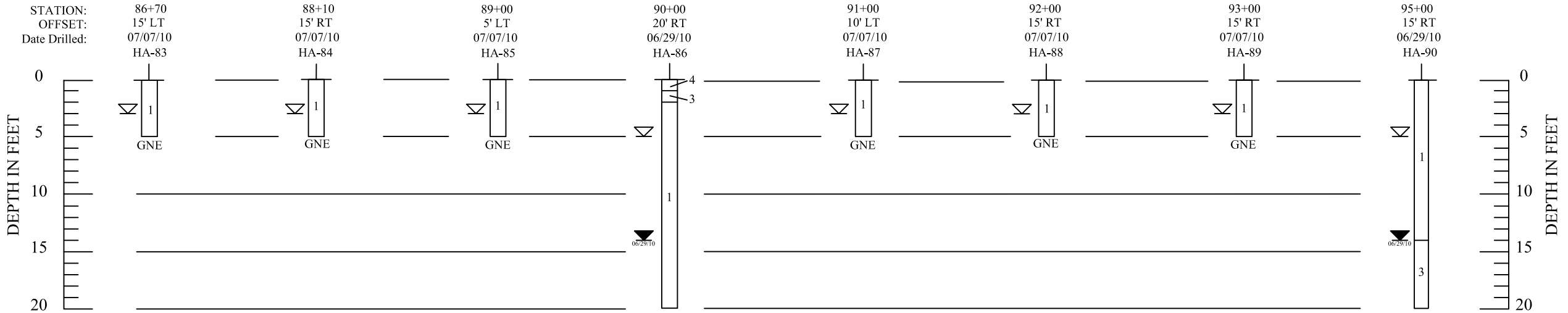
SHEET TITLE: ROADWAY AUGER BORING PROFILES

PROJECT NAME: INTERNATIONAL DRIVE (From S. Westwood Blvd to N. Westwood Blvd)

SHEET NO.

Z:\Roadways\GNnadi\Orange County\International Drive\Acad





LEGEND

1 Light gray to dark brown fine SAND occasional trace silt/clay and roots, (A-3)

2 Gray to brown silty SAND, (A-2-4)

3 Gray to brown clayey SAND, (A-2-6)

4 Dark brown fine SAND with organics, (A-8)

(A-3) A.A.S.H.T.O. soil classification group symbol

Estimated seasonal high groundwater level

06/29/10 Encountered groundwater level on date shown

GNE Groundwater not encountered in the top 5 feet

REVISIONS			REVISIONS		
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAMES	DATES
DRAWN BY:	IAU	07-13-10
CHECKED BY:	GNN	07-13-10
DESIGNED BY:	N/A	N/A
CHECKED BY:	N/A	N/A
APPROVED BY:	GNN	

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ORANGE COUNTY FLORIDA

ORANGE COUNTY PUBLIC WORKS

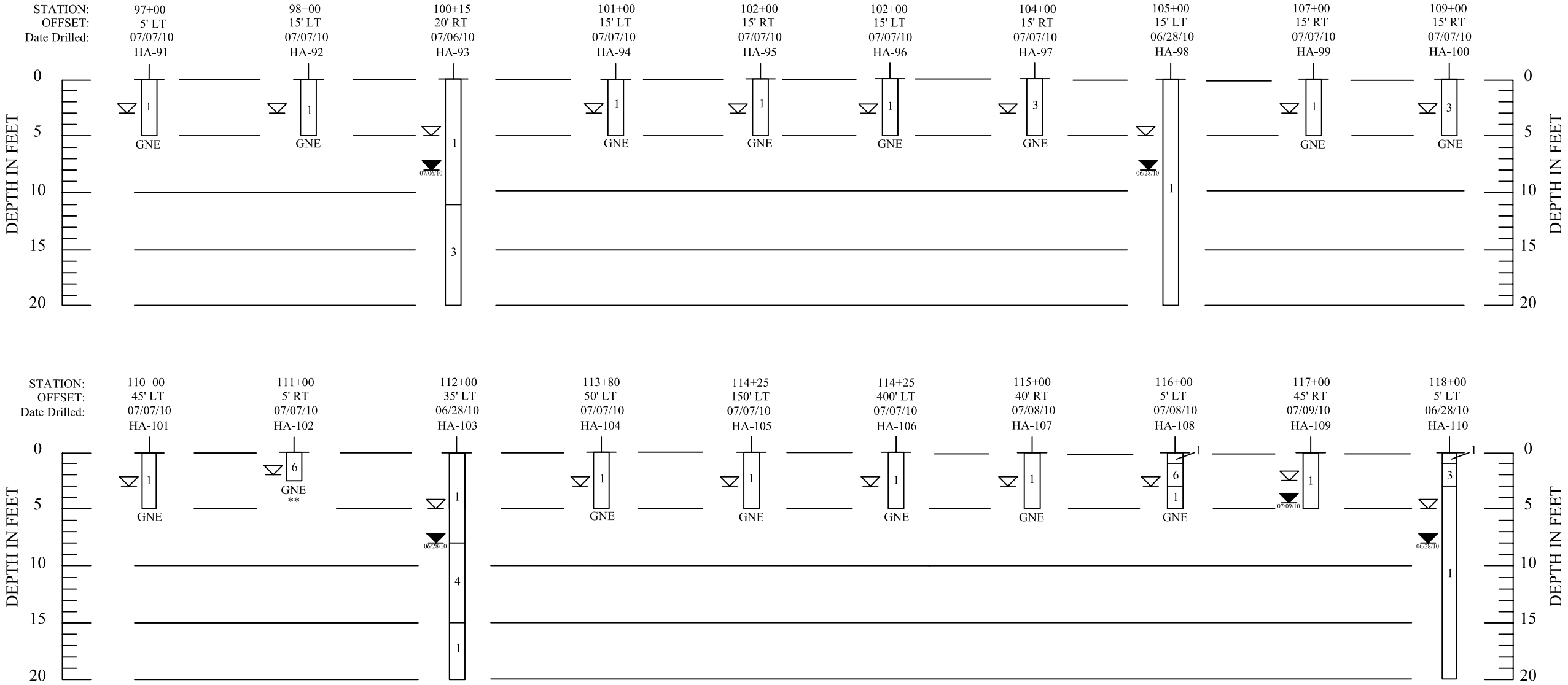
ROAD NAME	NES PROJECT NO.
INTERNATIONAL DRIVE	R10003

SHEET TITLE:
ROADWAY AUGER BORING PROFILES

PROJECT NAME:
INTERNATIONAL DRIVE
(From S. Westwood Blvd to N. Westwood Blvd)

SHEET NO.

Z:\Roadways\GNnadi\Orange County\International Drive\Acad



LEGEND

1 Light gray to dark brown fine SAND occasional trace silt/clay and roots, (A-3)

3 Gray to brown clayey SAND, (A-2-6)

4 Dark brown fine SAND with organics, (A-8)

6 Dark gray to brown limerock with fine sand, (A-1)

(A-3) A.A.S.H.T.O. soil classification group symbol

Estimated seasonal high groundwater level

08/07/09 Encountered groundwater level on date shown

GNE Groundwater not encountered in the top 5 feet

** Borehole terminated at a depth of 2.5 feet

Z:\Roadways\GNnadi\Orange County\International Drive\Acad

REVISIONS			REVISIONS		
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAMES	DATES
DRAWN BY:	IAU	07-28-10
CHECKED BY:	GNN	07-28-10
DESIGNED BY:	N/A	N/A
CHECKED BY:	N/A	N/A
APPROVED BY:	GNN	

GODWIN N. NNADI, Ph.D., P.E.
FL. REG. NO. 50637
NADIC ENGINEERING SERVICES, INC.
601 N. HART BOULEVARD
ORLAND, FL 32818
PH (407) 521-4771 FAX (407) 521-4772
CERTIFICATE OF AUTHORIZATION NO. 8214
NES GEOTECHNICAL ENVIRONMENTAL CONSULTING ENGINEERING

ORANGE COUNTY FLORIDA

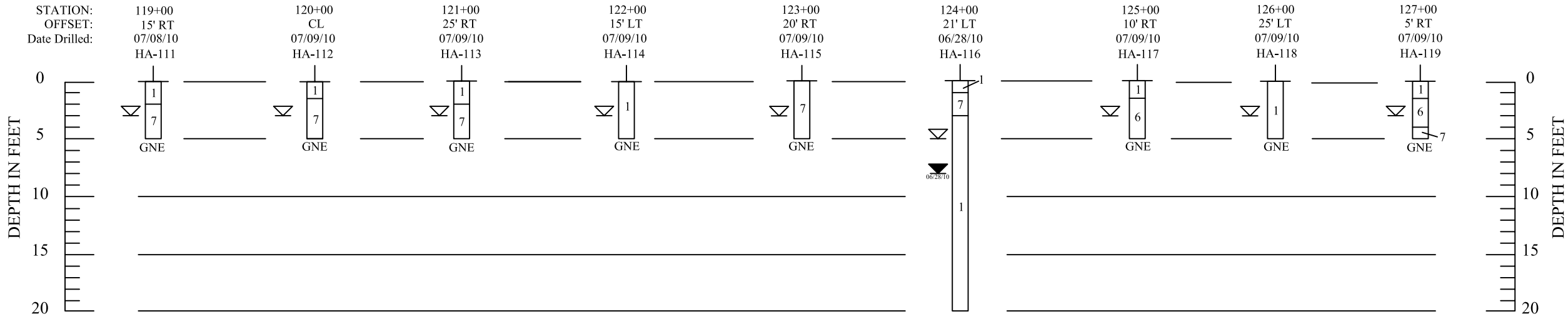
ORANGE COUNTY PUBLIC WORKS

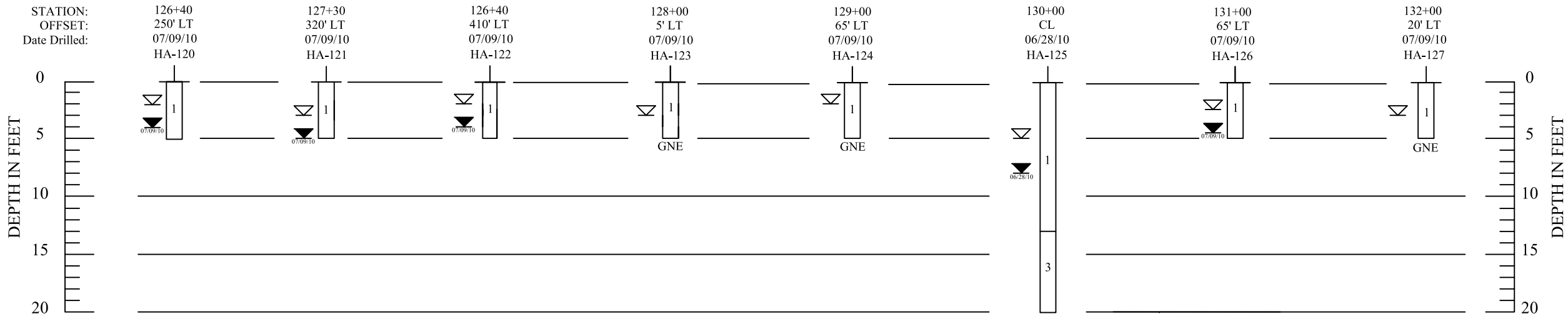
ROAD NAME	NES PROJECT NO.
INTERNATIONAL DRIVE	R10003

SHEET TITLE: ROADWAY AUGER BORING PROFILES

PROJECT NAME: INTERNATIONAL DRIVE (From S. Westwood Blvd to N. Westwood Blvd)

SHEET NO.





LEGEND

1 Light gray to dark brown fine SAND occasional trace silt/clay and roots, (A-3)

3 Gray to brown clayey SAND, (A-2-6)

6 Dark gray to brown limerock with fine sand, (A-1)

7 Gray fine SAND with limerock fragments, (A-3)

(A-3) A.A.S.H.T.O. soil classification group symbol

Estimated seasonal high groundwater level

(06/28/10) Encountered groundwater level on date shown

GNE Groundwater not encountered in the top 5 feet

REVISIONS			REVISIONS		
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

	NAMES	DATES
DRAWN BY:	IAU	07-28-10
CHECKED BY:	GNN	07-28-10
DESIGNED BY:	N/A	N/A
CHECKED BY:	N/A	N/A
APPROVED BY:	GNN	

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ORANGE COUNTY PUBLIC WORKS

ROAD NAME	NES PROJECT NO.
INTERNATIONAL DRIVE	R10003

SHEET TITLE: ROADWAY AUGER BORING PROFILES

PROJECT NAME: INTERNATIONAL DRIVE (From S. Westwood Blvd to N. Westwood Blvd)

SHEET NO.

Z:\Roadways\GNnadi\Orange County\International Drive\Acad

APPENDIX C

Table 1	Summary of Laboratory Test Results - Roadway
Table 2	FDOT Mean Method Design LBR Calculations
Table 3	FDOT 90 Percent Method Design LBR Calculations
Figure 5	FDOT 90 Percent Graph

LBR Calculation

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS – ROADWAY
INTERNATIONAL DRIVE
ORANGE COUNTY, FLORIDA
NES PROJECT NO. R10003

Location	Boring Number	Approx. Station No.	Offset (feet)	Sample Depth (feet)	Stratum No.	Moisture Content (%)	Organic Content (%)	Sieve Analysis (Percent Passing)					Atterberg Limits (%)		AASHTO Classif.
								#10	#40	#60	#100	#200	Liquid Limit	Plasticity Index	
International Drive	HA-1	9+00	3 RT	5	1	-	-	100	97	79	39	7	-	-	A-3
	HA-4	14+00	15 LT	1	1	-	-	99	90	70	31	6	-	-	A-3
	HA-8	17+00	5 RT	3	1	-	-	100	96	88	47	6	-	-	A-3
	HA-11	22+00	15 RT	5	1	-	-	100	94	66	30	6	-	-	A-3
	HA-12	23+00	15 LT	3	1	18	4	-	-	-	-	-	-	-	A-3
	HA-15	28+00	15 RT	7	1	-	-	100	99	89	47	9	-	-	A-3
	HA-18	31+00	15 LT	1	1	-	-	100	97	84	45	9	-	-	A-3
	HA-22	37+00	15 LT	4	1	-	-	100	99	87	44	5	-	-	A-3
	HA-29	46+00	15 RT	9	1	-	-	100	98	90	48	8	-	-	A-3
	HA-34	53+00	15 LT	4	1	-	-	100	99	86	42	4	-	-	A-3
	HA-38	57+00	15 LT	1	1	-	-	100	97	87	50	11	-	-	A-3
	HA-42	61+00	15 LT	5	1	-	-	100	99	91	52	6	-	-	A-3
	HA-46	65+00	15 LT	15	1	-	-	100	99	92	48	6	-	-	A-3
	HA-49	68+00	15 RT	3	1	-	-	100	90	58	17	8	-	-	A-3
	HA-53	72+00	15 RT	5	1	-	-	100	99	92	58	5	-	-	A-3
	HA-57	77+00	10 LT	8	1	-	-	100	99	91	52	10	-	-	A-3
	HA-77	82+00	15 RT	3	1	-	-	100	99	92	54	8	-	-	A-3
	HA-80	84+00	50 LT	8	1	7	3	-	-	-	-	-	-	-	A-3
	HA-81	84+00	10 RT	5	1	-	-	100	99	92	55	5	-	-	A-3
	HA-83	86+70	15 LT	1	1	-	-	100	98	89	51	9	-	-	A-3
	HA-88	92+00	15 RT	4	1	-	-	100	98	90	51	4	-	-	A-3
	HA-93	100+15	20 RT	9	1	-	-	100	99	90	49	11	-	-	A-3
	HA-95	102+00	15 RT	2	1	-	-	100	99	89	47	5	-	-	A-3
	HA-116	124+00	21 LT	5	1	16	4	-	-	-	-	-	-	-	A-3
	HA-127	132+00	20 LT	3	1	-	-	100	98	87	52	8	-	-	A-3
	HA-6	15+00	15 RT	17	2	-	-	-	-	-	-	-	29	10	A-2-4
	HA-80	84+00	50 LT	14	2	-	-	-	-	-	-	-	27	10	A-2-4

TABLE 1 (Cont)
SUMMARY OF LABORATORY TEST RESULTS – ROADWAY
INTERNATIONAL DRIVE
ORANGE COUNTY, FLORIDA
NES PROJECT NO. R10003

Location	Boring Number	Approx. Station No.	Offset (feet)	Sample Depth (feet)	Stratum No.	Moisture Content (%)	Organic Content (%)	Sieve Analysis (Percent Passing)					Atterberg Limits (%)		AASHTO Classif.
								#10	#40	#60	#100	#200	Liquid Limit	Plasticity Index	
International Drive	HA-24	40+00	15 RT	14	3	-	-	-	-	-	-	-	32	11	A-2-6
	HA-86	90+00	20 RT	2	3	-	-	100	98	89	50	18	-	-	A-2-6
	HA-90	95+00	15 RT	15	3	-	-	100	100	93	57	16	-	-	A-2-6
	HA-97	104+00	15 RT	5	3	-	-	100	98	88	56	15	-	-	A-2-6
	HA-100	109+00	15 RT	3	3	-	-	100	98	88	52	13	-	-	A-2-6
	HA-110	118+00	5 LT	2	3	-	-	100	94	85	52	15	-	-	A-2-6
	HA-125	130+00	CL	14	3	-	-	100	97	83	43	11	-	-	A-2-6
	HA-20	35+00	15 RT	1	4	21	6	-	-	-	-	-	-	-	A-8
	HA-32	49+00	10 LT	5	4	18	8	-	-	-	-	-	-	-	A-8
	HA-86	90+00	20 RT	11	4	76	6	-	-	-	-	-	-	-	A-8
	HA-103	112+00	35 LT	9	4	28	5	-	-	-	-	-	-	-	A-8
	HA-102	111+00	5 RT	1	6	-	-	16	13	9	4	2	-	-	A-1
	HA-108	116+00	5 LT	1	6	-	-	74	47	32	15	7	-	-	A-1
	HA-119	127+00	5 RT	1.5	6	-	-	73	54	38	20	11	-	-	A-1
	HA-112	120+00	CL	1.5	7	-	-	84	67	45	20	7	-	-	A-3
	HA-113	121+00	25 RT	2	7	-	-	95	83	61	28	8	-	-	A-3
	HA-116	124+00	21 LT	2	7	-	-	75	61	45	22	8	-	-	A-3
Central Florida Parkway	HA-61	92+00	15 LT	3	1	-	-	100	99	89	50	5	-	-	A-3
	HA-65	87+50	15 RT	4	1	-	-	100	97	91	55	8	-	-	A-3
	HA-68	95+00	10 LT	1	1	-	-	100	91	85	50	8	-	-	A-3
	HA-74	103+00	10 LT	1	4	5	6	-	-	-	-	-	-	-	A-8
	HA-72	99+00	CL	13	3	-	-	100	99	92	50	11	-	-	A-2-6
	HA-63	90+00	CL	13	5	-	-	-	-	-	-	73	58	39	A-7
Sea Harbor Dr	HA-105	114+25	150 LT	3	1	-	-	100	98	89	50	8	-	-	A-3
Westwood Blvd	HA-122	126+50	410 LT	4	1	-	-	100	99	88	54	6	-	-	A-3

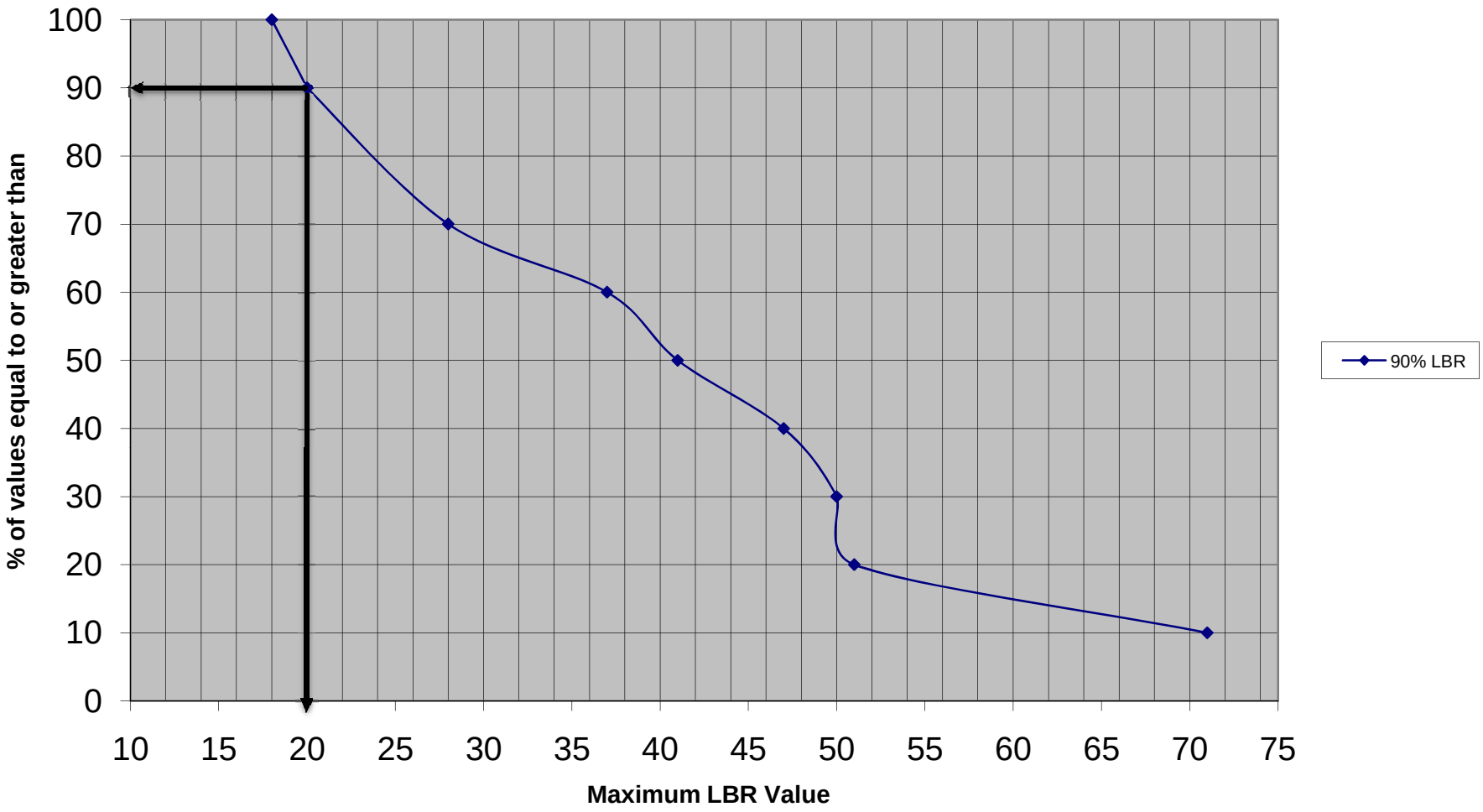
Table 2
FDOT Mean Method Design LBR Calculations
International Drive (From S. Westwood Blvd to N. Westwood Blvd)
NES Project No. R10003

Sample ID	Location	Stratum No.	Maximum LBR Value	LBR Value at -2% of Moisture at Maximum LBR	LBR Value at +2% of Moisture at Maximum LBR
HA-4	I-Drive	1	28	14	10
HA-25	I-Drive	1	37	32	31
HA-46	I-Drive	1	51	12	24
HA-63	Cent Fl Pkwy	1	20	15	16
HA-71	Cent Fl Pkwy	1	20	13	15
HA-86	I-Drive	3	41	34	26
HA-102	I-Drive	6	71	62	60
HA-106	I-Drive	1	47	33	46
HA-115	I-Drive	7	50	32	21
HA-122	I-Drive	1	18	16	12
			Mean Value	26	26
				± Value Average = 26.0	

Table 3
FDOT 90 Percent Method Design LBR Calculations
International Drive (From S. Westwood Blvd to N. Westwood Blvd)
NES Project No. R10003

Sample ID	Location	Stratum No.	Maximum LBR Value	No. values Equal or Greater Than	% of Values Equal to or Greater Than
HA-122	I-Drive	1	18	10	100
HA-63	Cent. Fl Pkwy	1	20	9	90
HA-71	Cent. Fl Pkwy	1	20	9	90
HA-4	I-Drive	1	28	7	70
HA-25	I-Drive	1	37	6	60
HA-86	I-Drive	3	41	5	50
HA-106	I-Drive	1	47	4	40
HA-115	I-Drive	7	50	3	30
HA-46	I-Drive	1	51	2	20
HA-102	I-Drive	6	71	1	10
90 Percent LBR Value = 20					

Figure 5
FDOT 90% Graph
International Drive (S. Westwood Blvd to N. Westwood Blvd)



Project Information

Project Name: I-Drive widening

NES Project No: R10003

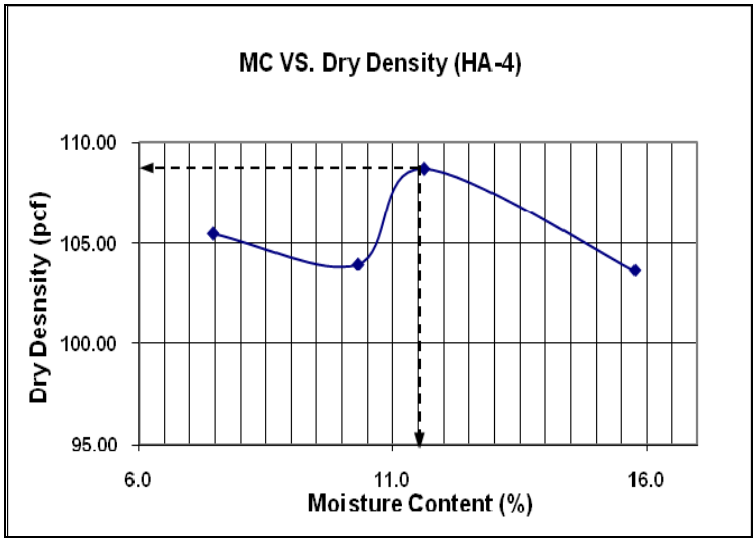
Sample Information

Sample No: HA-4

Location: 14+00@ 15 ft. LT, HA–4, Baseline: I-Drive

Date Tested: 8/11/10

Material Description:
Brown fine sand, (A-3)
Stratum 1



Modified Proctor Test Results (FM 5-521)

Optimum Moisture (%) = 11.5

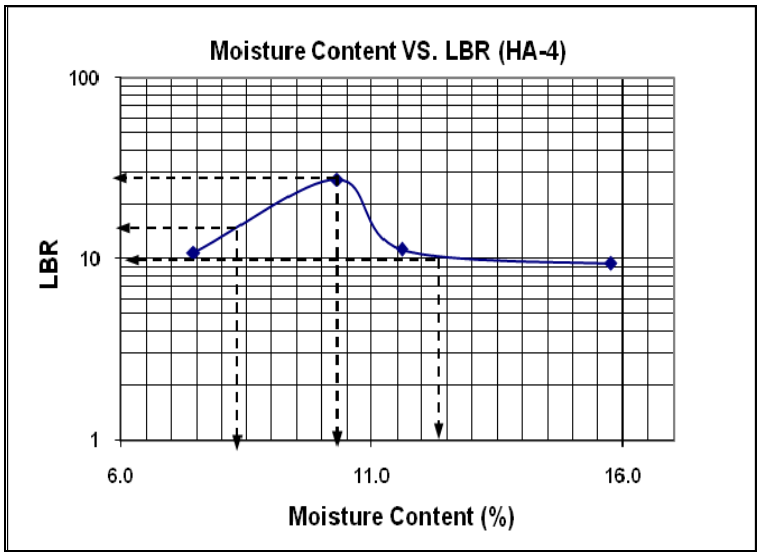
Max. Dry Density (pcf)= 108.7

LBR Test Results (FM 5-515)

Max. LBR at Optimum LBR Moisture= 28

LBR at -2% of Optimum LBR Moisture= 14

LBR at +2% of Optimum LBR Moisture= 10



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Orlando, FL 32818

Project Information

Project Name: I-Drive widening

NES Project No: R10003

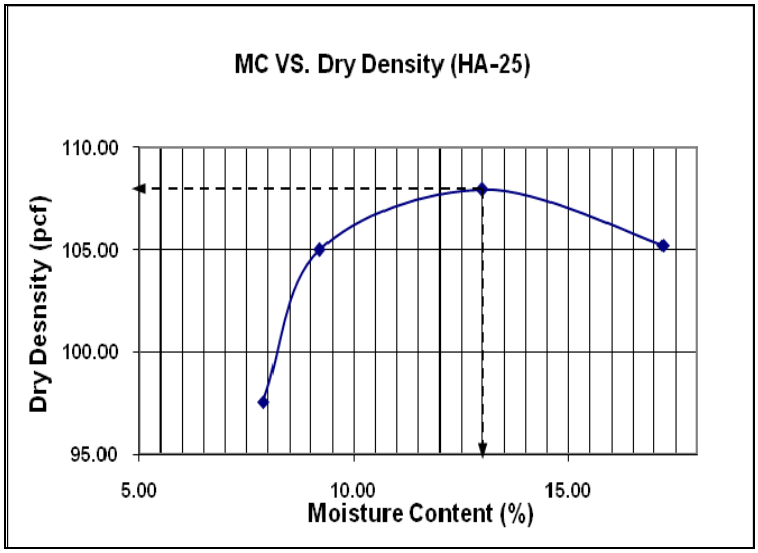
Sample Information

Sample No: HA-25

Location: 42+00@ 15 ft. RT, HA–25, Baseline: I-Drive

Date Tested: 08/11/10

Material Description:
Gray fine sand, (A-3)
Stratum 1



Modified Proctor Test Results (FM 5-521)

Optimum Moisture (%) = 13

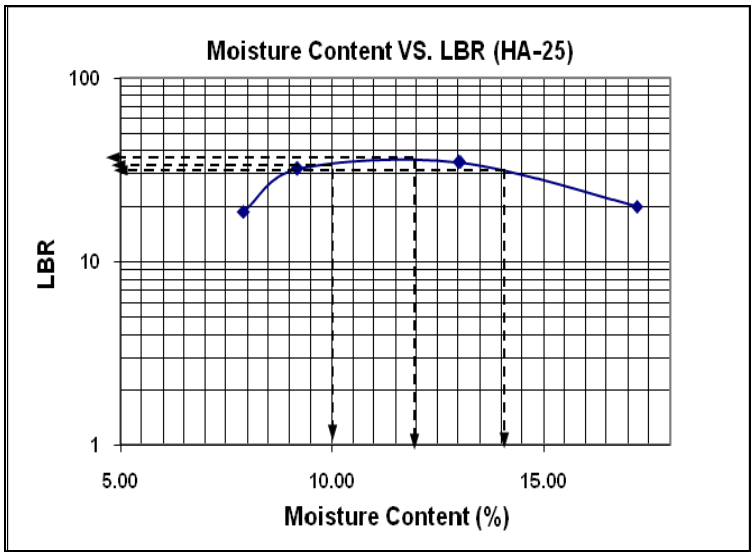
Max. Dry Density (pcf)= 108

LBR Test Results (FM 5-515)

Max. LBR at Optimum LBR Moisture= 37

LBR at -2% of Optimum LBR Moisture= 32

LBR at +2% of Optimum LBR Moisture= 31



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Orlando, FL 32818

Project Information

Project Name: I-Drive widening

NES Project No: R10003

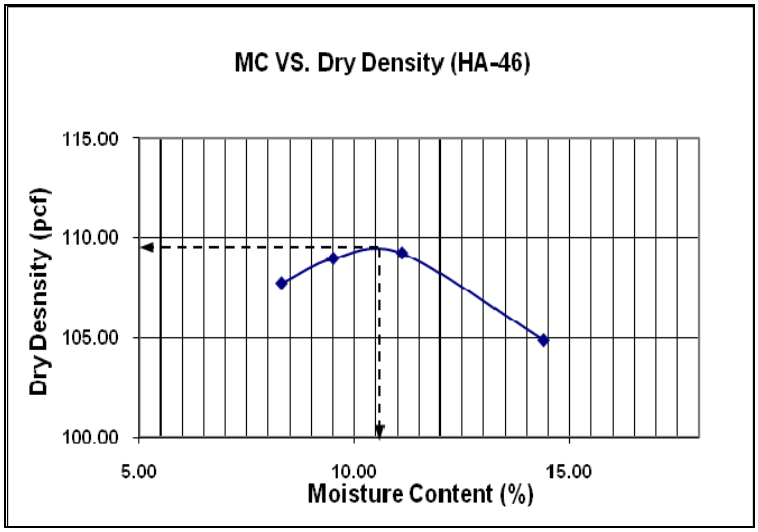
Sample Information

Sample No: HA-46

Location: 65+00@ 15 ft. LT, HA-46, Baseline: I-Drive

Date Tested: 08/13/10

Material Description:
Brown fine sand trace clay, (A-3)
Stratum 1



Modified Proctor Test Results (FM 5-521)

Optimum Moisture (%)= 10.6

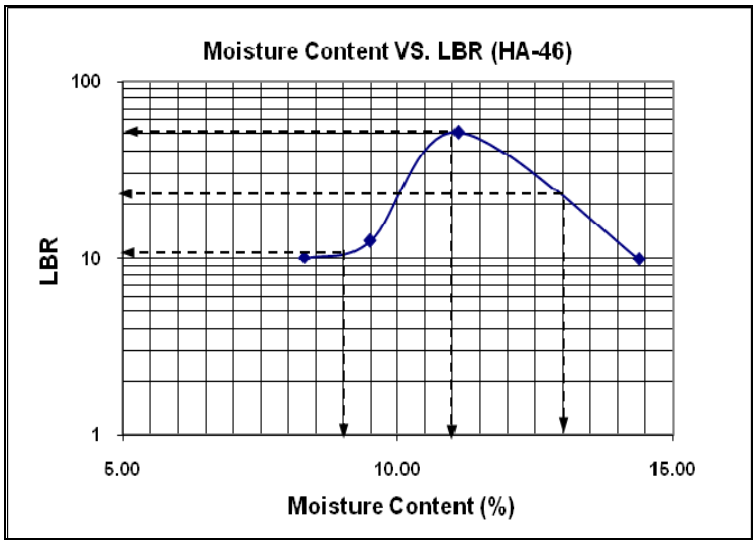
Max. Dry Density (pcf)= 109.5

LBR Test Results (FM 5-515)

Max. LBR at Optimum LBR Moisture= 51

LBR at -2% of Optimum LBR Moisture= 12

LBR at +2% of Optimum LBR Moisture= 24



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Orlando, FL 32818

Project Information

Project Name: I-Drive widening

NES Project No: R10003

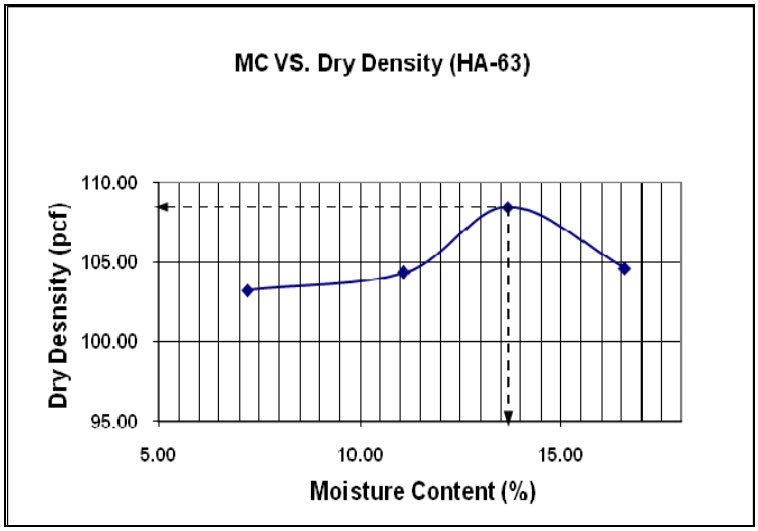
Sample Information

Sample No: HA-63

Location: 90+00@ CL, HA-63, Baseline: Central Fl Pkwy

Date Tested: 08/12/10

Material Description:
Brown fine sand, (A-3)
Stratum 1



Modified Proctor Test Results (FM 5-521)

Optimum Moisture (%)= 13.7

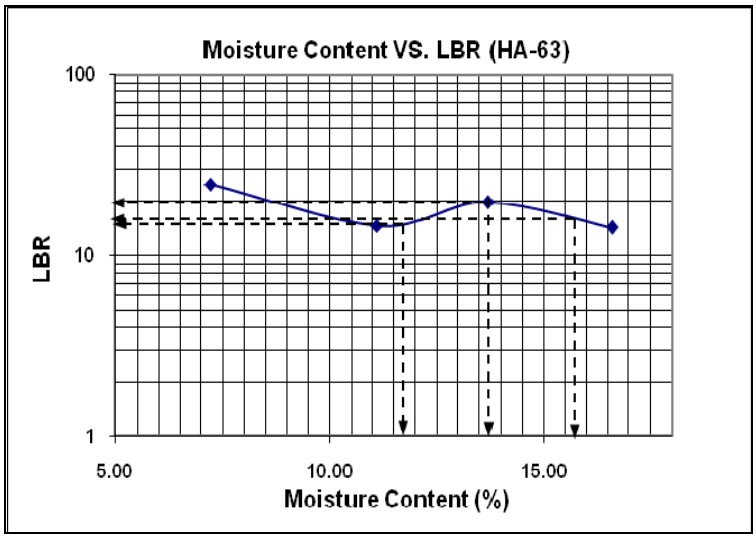
Max. Dry Density (pcf)= 108.5

LBR Test Results (FM 5-515)

Max. LBR at Optimum LBR Moisture= 20

LBR at -2% of Optimum LBR Moisture= 15

LBR at +2% of Optimum LBR Moisture= 16



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Project Information

Project Name: I-Drive widening

NES Project No: R10003

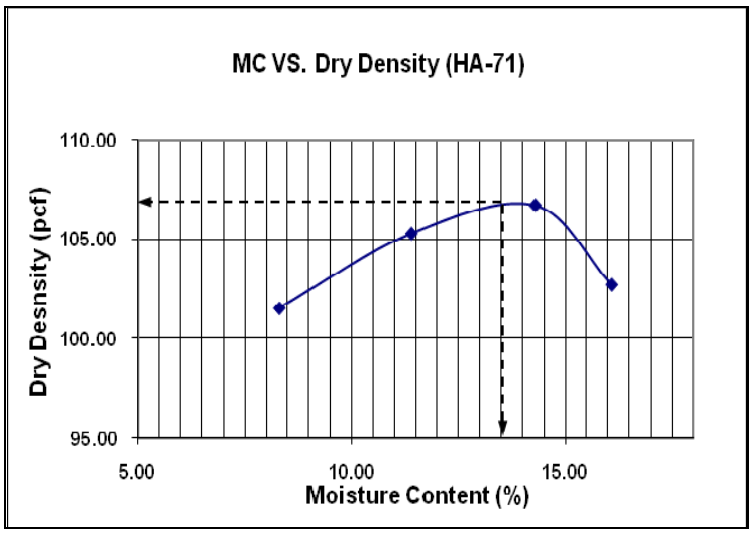
Sample Information

Sample No: HA-71

Location: 98+00@ CL, HA–71, Baseline: Central Fl Pkwy

Date Tested: 08/13/10

Material Description:
Brown fine sand, (A-3)
Stratum 1



Modified Proctor Test Results (FM 5-521)

Optimum Moisture (%) = 13.6

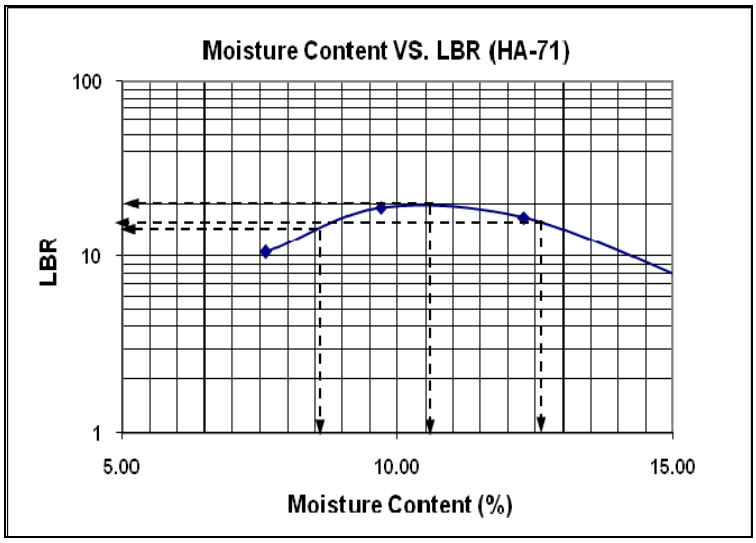
Max. Dry Density (pcf)= 106.5

LBR Test Results (FM 5-515)

Max. LBR at Optimum LBR Moisture= 20

LBR at -2% of Optimum LBR Moisture= 13

LBR at +2% of Optimum LBR Moisture= 15



601 N. Hart Blvd
Orlando, FL 32818

Project Information

Project Name: I-Driven widening

NES Project No: R10003

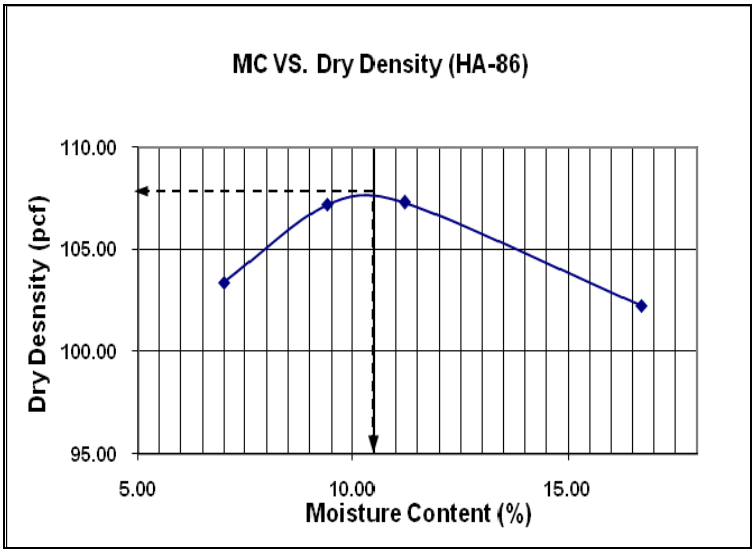
Sample Information

Sample No: HA-86

Location: 90+00@ 20 ft. RT, HA-86, Baseline: I-Drive

Date Tested: 08/11/10

Material Description:
Gray fine sand with clay, (A-2-6)
Stratum 3



Modified Proctor Test Results (FM 5-521)

Optimum Moisture (%) = 10.5

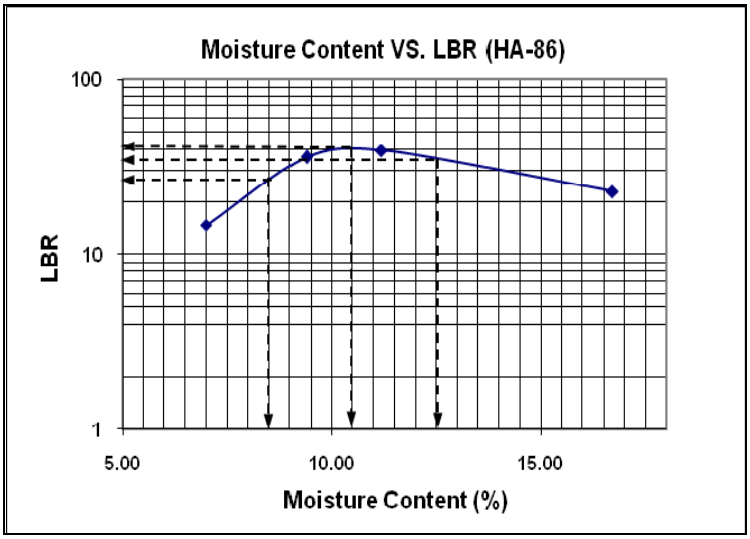
Max. Dry Density (pcf)= 107.8

LBR Test Results (FM 5-515)

Max. LBR at Optimum LBR Moisture= 41

LBR at -2% of Optimum LBR Moisture= 34

LBR at +2% of Optimum LBR Moisture= 26



601 N. Hart Blvd
Orlando, FL 32818

Project Information

Project Name: I-Drive widening

NES Project No: R10003

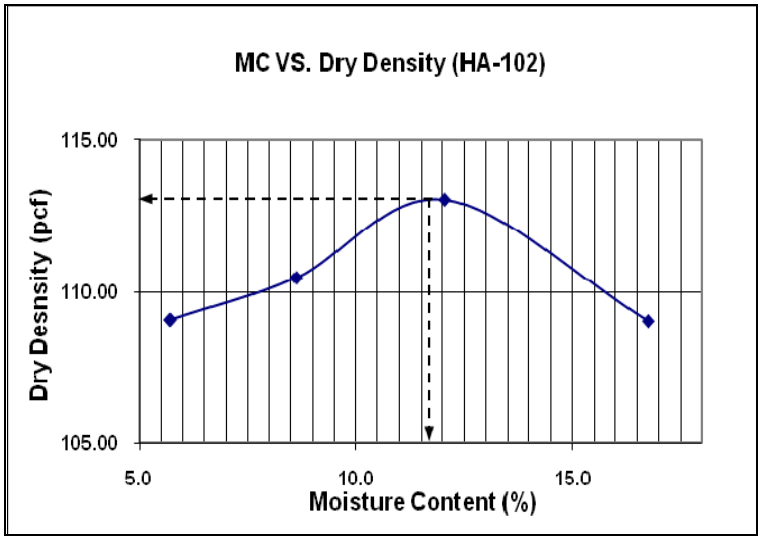
Sample Information

Sample No: HA-102

Location: 111+00@ 5 ft. RT, HA-102, Baseline: I-Drive

Date Tested: 08/13/10

Material Description:
Gray to Brown limerock with fine sand, (A-1)
Stratum 6



Modified Proctor Test Results (FM 5-521)

Optimum Moisture (%) = 11.7

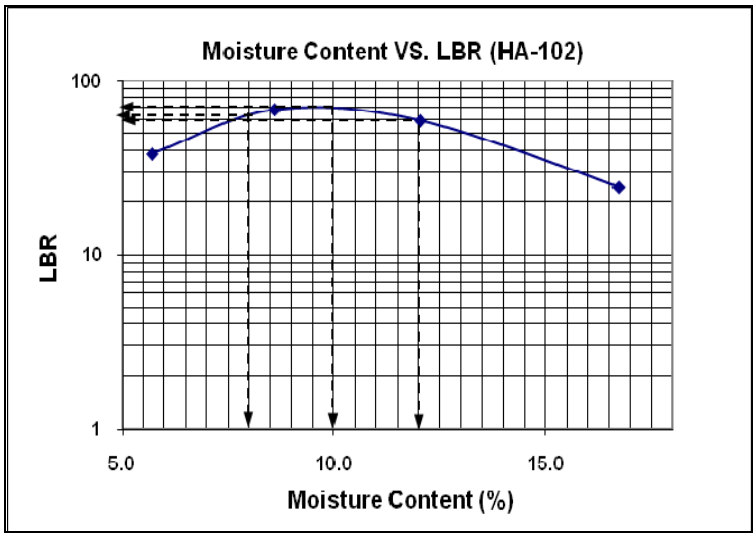
Max. Dry Density (pcf)= 113

LBR Test Results (FM 5-515)

Max. LBR at Optimum LBR Moisture= 71

LBR at -2% of Optimum LBR Moisture= 62

LBR at +2% of Optimum LBR Moisture= 60



601 N. Hart Blvd
Orlando, FL 32818

Project Information

Project Name: I-Drive widening

NES Project No: R10003

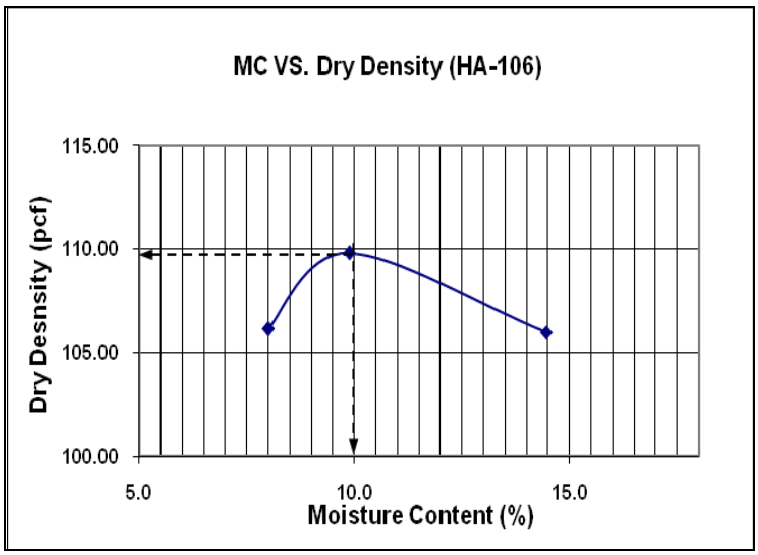
Sample Information

Sample No: HA-106

Location: 114+25@ 400 ft. LT, HA-106, Baseline: I-Drive

Date Tested: 08/13/10

Material Description:
Brown fine sand, (A-3)
Stratum 1



Modified Proctor Test Results (FM 5-521)

Optimum Moisture (%) = 10

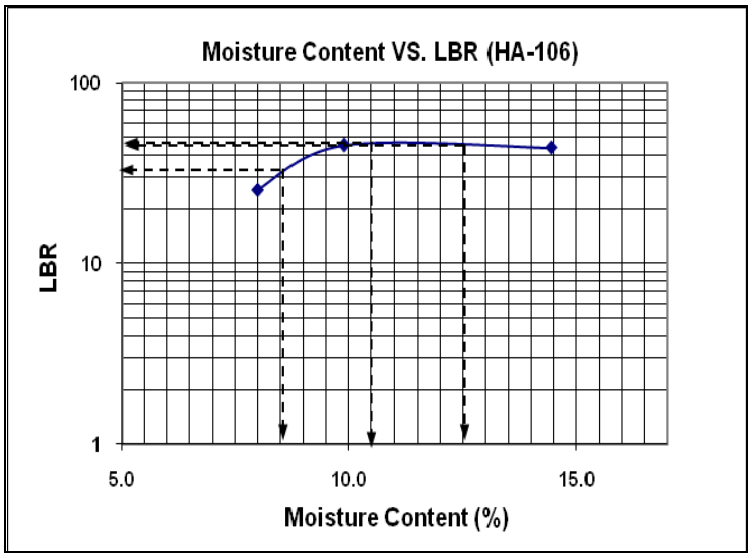
Max. Dry Density (pcf)= 109.6

LBR Test Results (FM 5-515)

Max. LBR at Optimum LBR Moisture= 47

LBR at -2% of Optimum LBR Moisture= 33

LBR at +2% of Optimum LBR Moisture= 46



601 N. Hart Blvd
Orlando, FL 32818

Project Information

Project Name: I-Drive widening

NES Project No: R10003

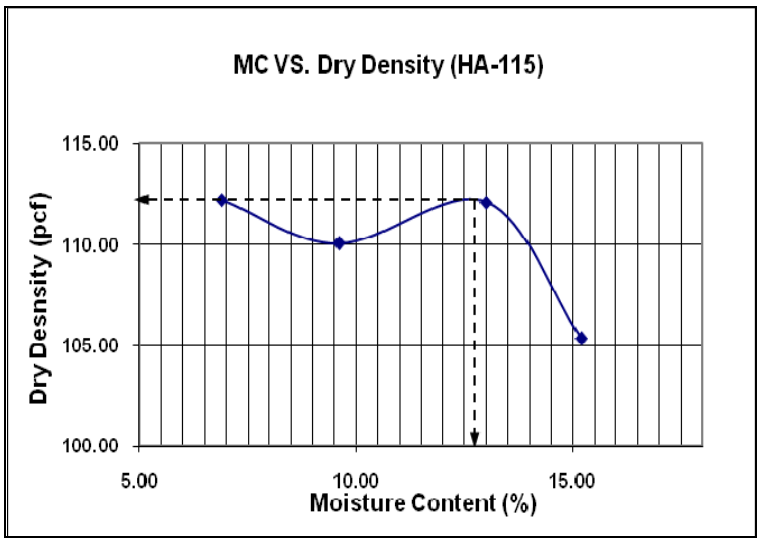
Sample Information

Sample No: HA-115

Location: 123+00@ 20 ft. RT, HA-115, Baseline: I-Drive

Date Tested: 08/11/10

Material Description:
Gray fine sand with limerock fragments, (A-3)
Stratum 7



Modified Proctor Test Results (FM 5-521)

Optimum Moisture (%) = 12.7

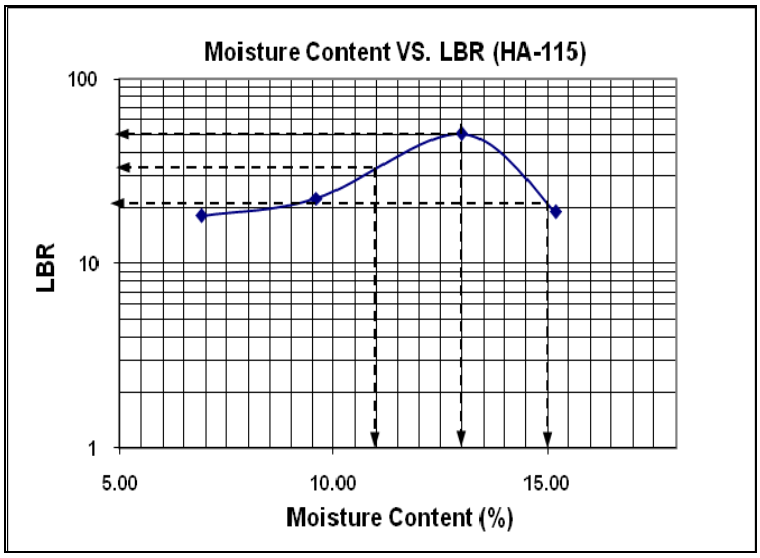
Max. Dry Density (pcf)= 112.2

LBR Test Results (FM 5-515)

Max. LBR at Optimum LBR Moisture= 50

LBR at -2% of Optimum LBR Moisture= 32

LBR at +2% of Optimum LBR Moisture= 21



601 N. Hart Blvd
Orlando, FL 32818

Project Information

Project Name: I-Drive widening

NES Project No: R10003

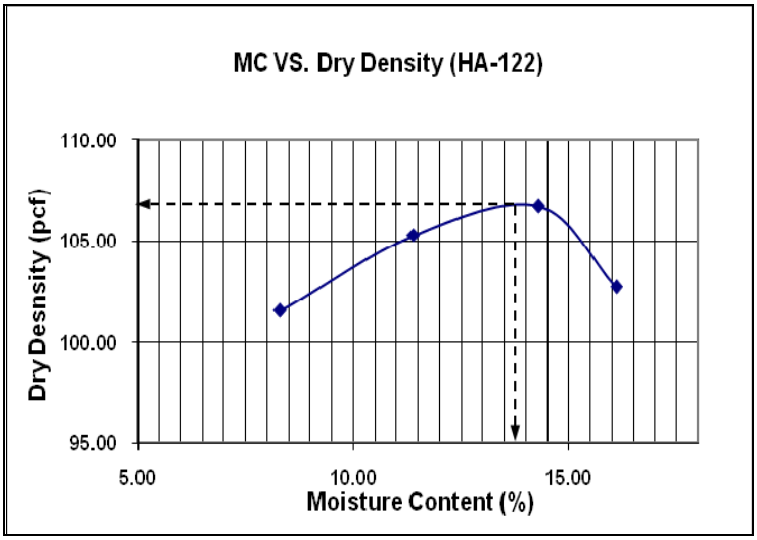
Sample Information

Sample No: HA-122

Location: 126+50@ 410 ft. LT, HA-122, Baseline: I-Drive

Date Tested: 08/12/10

Material Description:
Brown fine sand, (A-3)
Stratum 1



Modified Proctor Test Results (FM 5-521)

Optimum Moisture (%) = 13.6

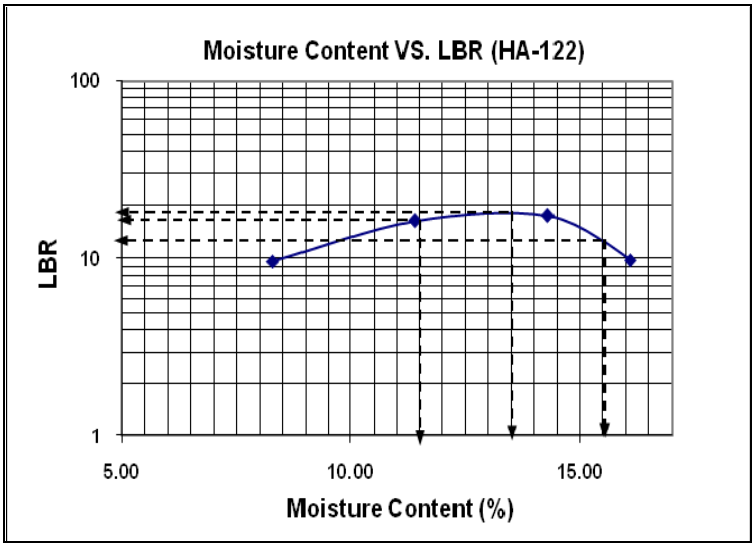
Max. Dry Density (pcf)= 106.9

LBR Test Results (FM 5-515)

Max. LBR at Optimum LBR Moisture= 18

LBR at -2% of Optimum LBR Moisture= 16

LBR at +2% of Optimum LBR Moisture= 12



601 N. Hart Blvd
Orlando, FL 32818

APPENDIX D

Check List

TABLE OF CONTENTS

"GEOTECHNICAL REPORT REVIEW CHECKLISTS"

The following checklists cover the major information and recommendations which should be addressed in project geotechnical reports.

Section A covers site investigation information which will be common to all geotechnical reports for any type of geotechnical feature.

Sections B through I cover the basic information and recommendations which should be presented in geotechnical reports for specific geotechnical features: centerline cuts and embankments, embankments over soft ground, landslides, retaining walls, structure foundations and material sites.

Subject Page

SECTION A, Site Investigation Information 1
SECTION B, Centerline Cuts and Embankments 3
SECTION C, Embankments Over Soft Ground 5
SECTION E, Retaining Walls 7
SECTION F, Structure Foundations - Spread Footings 8
SECTION G, Structure Foundations - Piles 9
SECTION H, Structure Foundations - Drilled Shafts 12

In most sections and subsections the user has been provided supplemental page references to the Soils and Foundations Workshop Manual. These page numbers appear in parentheses ( ) immediately adjacent to the section or subsection topic. Generalist engineers are particularly encouraged to read these references. Additional reference information on these topics is available in the Geotechnical Notebook, a copy of which is kept in all Division Offices by either the Bridge Engineer or the engineer with the soils responsibility.

Certain checklist items are of vital importance to have been included in the geotechnical report. These checklist items have been marked with an asterisk (*). A negative response to any of these asterisked items is cause to contact the geotechnical engineer for clarification of this omission.

"GTR REVIEW CHECKLIST" (SITE INVESTIGATION)

A. Site Investigation Information

Since the most important step in the geotechnical design process is the conduct of an adequate site investigation, presentation of the subsurface information in the geotechnical report and on the plans deserves careful attention.

		Yes	No	Unknown or N/A
Geotechnical Report Text (Introduction) (Pages 322-325)				
1.	Is the general location of the investigation described an/or a vicinity map included?	X		
2.	Is scope and purpose of the investigation summarized?	X		
3.	Is concise description given of geologic setting and topography of area?	X		
4.	Are the field explorations and laboratory tests on which the report is based listed?	X		
5.	Is general description of subsurface soil, rock, and groundwater conditions given?	X		
*6.	Is the following information included with the geotechnical report (typically included in report appendices):			
	a. Test hole logs? (Pages 25-33)	X		
	b. Field test data?	X		
	c. Laboratory test data? (Pages 74-75)	X		
	d. Photographs (if pertinent)?			X
Plan and Subsurface Profile (Pages 24, 47-49, 335)				
*7.	Is a plan and subsurface profile of the investigation site provided?	X		
8.	Are the field explorations located on the plan view?			X
*9.	Does the conducted site investigation meet minimum criteria outlined in Table 2?	X		
10.	Are the explorations plotted and correctly numbered on the profile at their true elevation and location?			X
11.	Does the subsurface profile contain a word description and/or graphic depiction of soil and rock types?	X		

A. Site Investigation Information (Cont.)

		Yes	No	Unknown or N/A
12.	Are groundwater levels and date measured shown on the subsurface profile?	X		
Subsurface Profile or Field Boring Log (Pages 16-17, 25-29)				
13.	Are sample types and depths noted?	X		
*14.	Are SPT blow counts, percent core recovery, and RQD values shown?			X
15.	If cone penetration tests were made, are plots of cone resistance and friction ratio shown with depth?			X
Laboratory Test Data (Pages 60, 74-75)				
*16.	Were lab soil classification tests such as natural moisture content, gradation, Atterberg limits, performed on selected representative samples to verify field visual soil identifications?	X		
17.	Are laboratory test results such as shear strength (Page 62), consolidation (Page 68), etc., included and/or summarized?			X

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

"GTR REVIEW CHECKLIST" (CENTERLINE CUTS AND EMBANKMENTS)

B. Centerline Cuts and Embankments (Pages 6-9)

In addition to the basic information listed in Section A, is the following information provided in the project geotechnical report?

Are station to station descriptions included for:	Yes	No	Unknown or N/A
1. Existing surface and subsurface drainage?			X
2. Evidence of springs and excessively wet areas?			X
3. Slides, slumps, and faults noted along the alignment?			X
Are station to station recommendations included for the following:			
General Soil Cut or Fill			
4. Specific surface/subsurface drainage recommendations.			X
5. Excavation limits of unsuitable materials?	X		
*6. Erosion protection measures for backslopes, side slopes, and ditches, including riprap recommendations or special slope treatments?			X
Soil Cuts (Pages 101-102)			
*7. Recommended cut slope design?			X
8. Are clay cut slopes designed for minimum F.S. = 1.50?			X
9. Special usage of excavated soils?			X
10. Estimated shrink-swell factors for excavated materials?			X
11. If answer to 3 is yes, are recommendations provided for design treatments?			X
Fills (Pages 77-79)			
12. Recommended fill slope design?			X
13. Will fill slope design provide minimum F.S. = 1.25?			X
Rock Slopes			
*14. Are recommended slope designs and blasting specifications provided?			X

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

B. Centerline Cuts and Embankments (Cont.)		Yes	No	Unknown or N/A
*15.	Is the need for special rock slope stabilization measures, e.g., rockfall catch ditch, wire mesh slope protection, shotcrete, rock bolts, addressed?			X
16.	Has the use of "template" designs been avoided (such as designing all rock slopes on ¼ to 1 rather than designing based on orientation of major rock jointing)?			X
*17.	Have effects of blast induced vibrations on adjacent structures been evaluated?			X

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

C. Embankments Over Soft Ground

Where embankments must be built over soft ground (such as soft clays, organic silts, or peat), stability and settlement of the fill should be carefully evaluated. In addition to the basic information listed in Section A, is the following information provided in the project geotechnical report?

	Embankment Stability (Pages 77-79, 95-97)	Yes	No	Unknown or N/A
*1.	Has the stability of the embankment been evaluated for minimum safety factors of 1.25 for side slope stability and 1.30 for end slope stability of bridge approach embankments?			X
*2.	Has the shear strength of the foundation soil been determined from lab testing and/or field vane shear or static cone penetrometer tests?			X
*3.	If the proposed embankment does not provide minimum factors or safety given above, are recommendations given for feasible treatment alternates which will increase factor of safety to minimum acceptable (such as change alignment, lower grade, use stabilizing counterberms, excavate and replace weak subsoil, fill stage construction, lightweight fill, geotextile fabric reinforcement, etc.)?			X
*4.	Are cost comparisons of treatment alternates given and a specific alternate recommended?			X
	Settlement of Subsoil (Pages 146-160)			
5.	Have consolidation properties of fine grained soils been determined from laboratory consolidation tests?			X
*6.	Have settlement amount and settlement time been estimated?			X
7.	For bridge approach embankments, are recommendations made to get the settlement out before the bridge abutment is constructed (waiting period, surcharge, or wick drains)?			X
8.	If geotechnical instrumentation is proposed to monitor fill stability and settlement, are detailed recommendations provided on the number, type, and specific locations of the proposed instruments?			X

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

C. Embankments Over Soft Ground (Cont.)	Yes	No	Unknown or N/A
9. Construction Considerations: (Pages 183, 331-334)			
a. If excavation and replacement of unsuitable shallow surface deposits (peat, muck, topsoil) is recommended - are vertical and lateral limits of recommended excavation provided?		X	
b. Where a surcharge treatment is recommended, are plan and cross-section of surcharge treatment provided in geotechnical report for benefit of the roadway designer?		X	
c. Are instructions or specifications provided concerning instrumentation, fill placement rates and estimated delay times for the contractor?		X	
d. Are recommendations provided for disposal of surcharge material after the settlement period is complete?		X	

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

"GTR REVIEW CHECKLIST" (RETAINING WALLS)

E. Retaining Walls (See Section 5 of "Geotechnical Engineering Notebook")

In addition to the basic information listed in Section A, is the following information provided in the project geotechnical report?

		Yes	No	Unknown or N/A
*1.	Does the geotechnical report include recommended soil strength parameters and groundwater elevation for use in computing wall design lateral earth pressures and factor of safety for overturning, sliding, and external slope stability?			X
2.	Is it proposed to bid alternate wall designs?			X
*3.	Are acceptable reasons given for the choice and/or exclusion of certain wall types (gravity, reinforced soil, tieback, cantilever, etc.)?			X
*4.	Is an analysis of the wall stability included with minimum acceptable factors of safety against overturning (F.S. = 2.0), sliding (F.S. = 1.5), and external slope stability (F.S. = 1.5)?			X
5.	If wall will be placed on compressible foundation soils, is estimated total settlement, differential settlement, and time rate of settlement given?			X
6.	Will wall types selected for compressible foundation soils allow differential movement without distress?			X
7.	Are wall drainage details including materials and compaction provided?			X
8.	Construction Considerations:			
	a. Are excavation requirements covered - safe slopes for open excavations, need for sheeting or shoring?			X
	b. Fluctuation of groundwater table?			X

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

"GTR REVIEW CHECKLIST" (SPREAD FOOTINGS)

F. Structure Foundations - Spread Footings (Pages 191-205)

In addition to the basic information listed in Section A, is the following information provided in the project foundation report?

		Yes	No	Unknown or N/A
*1.	Are spread footings recommended for foundations support? If not, are reasons for not using them discussed?			X
	If spread footing supports are recommended, are conclusions/recommendations given for the following:			
*2.	Is recommended bottom of footing elevation and reason for recommendation (e.g., based on frost depth, estimated scour depth, or depth to competent bearing material) given?			X
*3.	Is recommended allowable soil or rock bearing pressure given?			X
*4.	Is estimated footing settlement and time given?			X
*5.	Where spread footings are recommended to support abutments placed in the bridge end fills, are special gradation and compaction requirements provided for select end fill and backwall drainage material? (Pages 137-141)			X
6.	Construction Considerations:			
	a. Have the materials been adequately described on which the footing is to be placed so the project inspector can verify that material is as expected?			X
	b. Have excavation requirements been included for safe slopes in open excavations, need for sheeting or shoring, etc?			X
	c. Has fluctuation of the groundwater table been addressed?			X

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

"GTR REVIEW CHECKLIST" (PILE FOUNDATIONS)

G. Structure Foundations - Piles (Pages 224-311)

In addition to the basic information listed in Section A, if pile support is recommended or given as an alternate, conclusions/recommendations should be provided in the project geotechnical report for the following:

		Yes	No	Unknown or N/A
*1.	Is the recommended pile type given (displacement, nondisplacement, pipe pile, concrete pile, H-pile, etc.) with valid reasons given for choice and/or exclusion? (Pages 224-226)			X
2.	Do you consider the recommended pile type(s) to be the most suitable and economical?			X
*3.	Are estimated pile lengths and estimated tip elevations given for the recommended allowable pile design loads?			X
4.	Do you consider the recommended design loads to be reasonable?			X
5.	Has pile group settlement been estimated (only of practical significance for friction pile groups ending in cohesive soil)? (Pages 245-247)			X
6.	If a specified or minimum pile tip elevation is recommended, is a clear reason given for the required tip elevation, such as underlying soft layers, scour, downdrag, piles uneconomically long, etc.?			X
*7.	Has design analysis (wave equation analysis) verified that the recommended pile section can be driven to the estimated or specified tip elevation without damage (especially applicable where dense gravel-cobble-boulder layers or other obstructions have to be penetrated)?			X
8.	Where scour piles are required, have pile design and driving criteria been established based on mobilizing the full pile design capacity below the scour zone?			X

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

G. Structure Foundations - Piles (Cont.)	Yes	No	Unknown or N/A
9. Where lateral load capacity of large diameter piles is an important design consideration, are p-y curves (load vs. deflection) or soil parameters given in the geotechnical report to allow the structural engineer to evaluate lateral load capacity of all piles?			X
*10. For pile supported bridge abutments over soft ground:			
a. Has abutment pile downdrag load been estimated and solutions such as bitumen coating considered in design? Not generally required if surcharging of the fill is being performed. (Pages 248-251)			X
b. Is bridge approach slab recommended to moderate differential settlement between bridge ends and fill?			X
c. If the majority of subsoil settlement will not be removed prior to abutment construction (by surcharging), has estimate been made of the amount of abutment rotation that can occur due to lateral squeeze of soft subsoil? (Pages 114-115)			X
d. Does the geotechnical report specifically alert the structural designer to the estimated horizontal abutment movement?			X
11. If bridge project is large, has pile load test program been recommended? (Pages 299-302)			X
12. For a major structure in high seismic risk area, has assessment been made of liquefaction potential of foundation soil during design earthquake (note: only loose saturated sands and silts are "susceptible" to liquefaction)?			X
13. Construction Considerations: (Pages 279-311)			
Have the following important construction considerations been adequately addressed?			X

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

G. Structure Foundations - Piles - (Cont.)		Yes	No	Unknown or N/A
a.	Pile driving details such as: boulders or obstructions which may be encountered during driving - need for preaugering, jetting, spudding, need for pile tip reinforcement, driving shoes, etc.?			X
b.	Excavation requirements - safe slope for open excavations, need for sheeting or shoring? Fluctuation of groundwater table?			X
c.	Have effects of pile driving operation on adjacent structures been evaluated - such as protection against damage caused by footing excavations or pile driving vibrations?			X
d.	Is preconstruction condition survey to be made of adjacent structures to prevent unwarranted damage claims?			X
e.	On large pile driving projects have other methods of pile driving control been considered such as dynamic testing or wave equation analysis?			X

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

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Appendix B

Permits Obtained by Owner

- **Florida Department of Environmental Protection (FDEP)**

- Florida Department of Environmental Protection – Notification/Application for Constructing a Domestic Wastewater Collection/Transmission System

- Florida Department of Environmental Protection – Notice of Intent to Use the General Permit for Construction of Water Main Extensions for PWSs

Per Section 01001 – Article 1.05 (C), the Contractor shall strictly adhere to the specific requirements of the governmental unit(s) or agency(ies) having jurisdiction over the Work. Whenever there is a difference in the requirements of a jurisdictional body and these Specifications, the more stringent shall apply.

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FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
CENTRAL DISTRICT
3319 MAGUIRE BOULEVARD, SUITE 232
ORLANDO, FLORIDA 32803

RICK SCOTT
GOVERNOR

CARLOS LOPEZ-CANTERA
LT. GOVERNOR

HERSCHEL T. VINYARD JR.
SECRETARY

NOTICE OF PERMIT ISSUANCE

In the Matter of an
Application for Permit by:

ORANGE COUNTY UTILITIES DEPARTMENT
9150 CURRY FORD ROAD
ORLANDO FLORIDA 32825

ATTENTION JOSE HERNANDEZ P.E. (jose.hernandez2@ocfl.net)
CHIEF ENGINEER

Orange County - CS
International Drive Utility Relocation and Improvements
Connected to: OCUD South WRF (FLA107972)

Dear Mr. Hernandez:

Enclosed is Permit Number CS48-0133232-091 to construct a sewage collection/transmission system, issued pursuant to 403.087(1), Florida Statutes.

The Department's proposed agency action shall become final unless a timely petition for an administrative hearing is filed under Sections 120.569 and 120.57, Florida Statutes, within fourteen days of receipt of notice. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the Department's proposed permitting decision may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received by the clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000.

Petitions by the applicant or any of the persons listed below must be filed within fourteen days of receipt of this written notice. Petitions filed by any persons other than those entitled to written notice under Section 120.60(3), Florida Statutes, must be filed within fourteen days of publication of the notice or within fourteen days of receipt of the written notice, whichever occurs first. Under Section 120.60(3), Florida Statutes, however, any person who has asked the Department for notice of agency action may file a petition within fourteen days of receipt of such notice, regardless of the date of publication.

The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition within fourteen days of receipt of notice shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57, Florida Statutes. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

(a) The name, address, and telephone number of each petitioner; the name, address, and telephone number of the petitioner's representative, if any; the Department permit identification number and the county in which the subject matter or activity is located;

(b) A statement of how and when each petitioner received notice of the Department action;

(c) A statement of how each petitioner's substantial interests are affected by the Department action;

(d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;

(e) A statement of facts that the petitioner contends warrant reversal or modification of the Department action;

(f) A concise statement of the ultimate facts alleged, as well as the rules and statutes which entitle the petitioner to relief; and

(g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wants the Department to take.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under Section 120.573, Florida Statutes, is not available for this proceeding.

This permit action is final and effective on the date filed with the clerk of the Department unless a petition is filed in accordance with the above. Upon the timely filing of a petition this permit will not be effective until further order of the Department.

Any party to the permit has the right to seek judicial review of the permit action under Section 120.68, Florida Statutes, by the filing of a notice of appeal under Rules 9.110 and 9.190, Florida Rules of Appellate Procedure, with the clerk of the Department in the Office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida, 32399-3000; and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice of appeal must be filed within 30 days from the date when this permit action is filed with the clerk of the Department.

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
CENTRAL DISTRICT
3319 MAGUIRE BOULEVARD, SUITE 232
ORLANDO, FLORIDA 32803

RICK SCOTT
GOVERNOR

CARLOS LOPEZ-CANTERA
LT. GOVERNOR

HERSCHEL T. VINYARD JR.
SECRETARY

STATE OF FLORIDA
DOMESTIC WASTEWATER COLLECTION/TRANSMISSION INDIVIDUAL PERMIT

Permittee:
Orange County Utilities Department
9150 Curry Ford Road
Orlando Florida 32825

Attention: Jose Hernandez, P.E.
Chief Engineer

Permit Number: CS48-0133232-091
Date of Issue: February 12, 2014
Expiration Date: February 11, 2019
County: Orange
Project: International Drive Utility Relocation and Improvements
Connected to: OCUD South WRF (FLA107972)

This permit is issued under the provisions of Chapter 403, Florida Statutes (F.S.), and Chapters 62-4 and 62-604, Florida Administrative Code (F.A.C.).

The above named permittee is hereby authorized to construct the facilities shown on the application and other documents on file with the Department and made a part hereof and specifically described as follows:

DESCRIPTION OF PROJECT:

Construction of a sewage collection/transmission system for the International Drive Utility Relocation and Improvements project, serving International Drive Utility Improvements, generating no new flows.

The sewage collection/transmission system shall consist of: (A) 500 LF of 12 inch PVC force main, (B) 210 LF of 12 inch PVC gravity main, and (C) associated manhole, valves, and appurtenances .

LOCATION OF PROJECT: International Drive from Westwood Blvd South to Westwood Blvd North, Orlando, Orange County, Florida.

IN ACCORDANCE WITH: The limitations, requirements and other conditions set forth in pages 1 through 3 of this permit.

Permittee:
Orange County Utilities Department

Permit Number: CS48-0133232-091
Expiration Date: February 11, 2019

Attention: Jose Hernandez, P.E.
Chief Engineer

PERMIT CONDITIONS:

1. This permit is subject to the general conditions of Rule 62-4.160, F.A.C., as applicable. This rule is available at the Department's Internet site at: http://www.dep.state.fl.us/water/wastewater/rules.htm#domestic [62-4.160]

2. Upon completion of construction of the collection/transmission system project, and before placing the facilities into operation for any purpose other than testing for leaks or testing equipment operation, the permittee shall submit to the Department's Central District Office Form 62-604.300(8)(b), Request for Approval to Place a Domestic Wastewater Collection/Transmission System into Operation. This form is available at the Department's Internet site at: http://www.dep.state.fl.us/water/wastewater/forms.htm [62-604.700(2), 11-6-03]

3. The new or modified collection/transmission facilities shall not be placed into service until the Department clears the project for use. [62-604.700(3), 11-6-03]

4. Permit revisions shall only be made in accordance with Rule 62-4.050(4)(s), F.A.C. Request for revisions shall be made to the Department in writing and shall include the appropriate fee. Revisions not covered under Rule 62-4.050(4)(s), F.A.C., shall require a new permit. [62-604.600(8), 11-6-03]

5. Abnormal events shall be reported to the Department's Central District office in accordance with Rule 62-604.550, F.A.C. For unauthorized spills of wastewater in excess of 1000 gallons per incident, or where information indicates that public health or the environment may be endangered, oral reports shall be provided to the STATE WARNING POINT TOLL FREE NUMBER, (800) 320-0519, as soon as practical, but no later than 24 hours from the time the permittee or other designee becomes aware of the circumstances. Unauthorized releases or spills less than 1000 gallons per incident are to be reported orally to the Department's Central District office within 24 hours from the time the permittee, or other designee becomes aware of the circumstances. [62-604.550, 11-6-03]

Permittee:
Orange County Utilities Department

Permit Number: CS48-0133232-091
Expiration Date: February 11, 2019

Attention: Jose Hernandez, P.E.
Chief Engineer

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Dennise Judy
Manager
Wastewater Permitting

FILING AND ACKNOWLEDGEMENT

Filed, on this date, pursuant to Section 120.52, F.S., with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk — February 12, 2014
Date

DJ/wgb

Copies furnished to:
William R. Whidden, P.E. (bill.whidden@woolpert.com)

CERTIFICATE OF SERVICE

This is to certify that this NOTICE OF PERMIT ISSUANCE and all copies were mailed before the close of business on February 12, 2014 to the listed persons, by _____.

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FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
Central District
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Notification of Acceptance of Use of a General Permit

Permittee:
Jose Hernandez, P.E., Chief Engineer
Orange County Utilities Department
9150 Curry Ford Road
Orlando, FL 32825
jose.hernandez2@ocfl.net;

Permit Number: 0124922-565-DSGP
Issue date: March 3, 2014
Expiration Date: March 4, 2019
County: Orange
Project Name: International Dr. Utility Improvements
Water Supplier: Orange County Utilities Department
PWS ID: 3484119
PWS Type: Community

Dear Mr. Hernandez:

On February 7, 2014, the Florida Department of Environmental Protection received a "*Notice of Intent to Use the General Permit for Construction of Water Main Extensions for PWSs*" [DEP Form No. 62-555.900(7)], under the provisions of Rule 62-4.530 and Chapter 62-555, Florida Administrative Code (F.A.C.). The proposed project includes the relocation of existing potable water main to eliminate conflicts with the proposed roadway storm water piping and structures. Pipeline consists of replacement of an existing 12-inch water main with 24-inch water main. The project is located Along International Drive between Westwood Boulevard North and Westwood Boulevard South.

Based upon the submitted Notice and accompanying documentation, this correspondence is being sent to advise that the Department does not object to the use of such general permit at this time. Please be advised that the permittee is required to abide by Rule 62-555.405, F.A.C., all applicable rules in Chapters 62-4, 62-550, 62-555, F.A.C., and the General Conditions for All General Drinking Water Permits (found in 62-4.540, F.A.C.).

The permittee shall comply with all sampling requirements specific to this project. These requirements are attached for review and implementation.

Pursuant to Rule 62-555.345, F.A.C., the permittee shall submit a certification of construction completion [DEP Form No. 62-555.900(9)] to the Department and obtain approval, or clearance, from the Department before placing any water main extension constructed under this general permit into operation for any purpose other than disinfection or testing for leaks.

Within 30 days after the sale or legal transfer of ownership of the permitted project that has not been cleared for service in total by the Department, both the permittee and the proposed permittee shall sign and submit an application for transfer of the permit using Form 62-555.900(8), F.A.C., with the appropriate fee. The permitted construction is not authorized past the 30-day period unless the permit has been transferred.

This permit will expire five years from the date of issuance. If the project has been started and not completed by that time, a new permit must be obtained before the expiration date in order to continue work on the project, per Rule 62-4.030, F.A.C.

Sincerely,

Caroline Shine, Environmental Administrator
Drinking Water/UIC/Groundwater Permitting
FDEP Central District
(407) 897-2927

cc: William R. Whidden, P.E., Woolpert, Inc. [bill.whidden@woolpert.com]
Cary Padell, FDEP

CLEARANCE REQUIREMENTS

Requirements for clearance upon completion of projects are as follows:

1) **Clearance Form**
Submission of a fully completed Department of Environmental Protection (DEP) Form 62-555.900(9) *Certification of Construction Completion and Request for Clearance to Place Permitted PWS Components into Operation* and a copy of this general permit notification.

2) **Record Drawings, if deviations were made**
Submission of the portion of record drawings showing deviations from the DEP construction permit, including preliminary design report or drawings and specifications, if there are any deviations from said permit (Note that it is necessary to submit a copy of only the portion of record drawings showing deviations and not a complete set of record drawings.).

3) **Bacteriological Results**
Copies of satisfactory bacteriological analysis (a.k.a. Main Clearance), taken within sixty (60) days of completion of construction, from locations within the distribution system or water main extension to be cleared, in accordance with Rules 62-555.315(6), 62-555.340, and 62-555.330, F.A.C. and American Water Works Association (AWWA) Standard C 651-92, as follows:

- From a sampling plan to be provided by the Engineer including all points of connection of the proposed potable water mains to the existing mains.

Each location shall be sampled on two consecutive days, with sample points and chlorine residual readings clearly indicated on the report. A sketch or description of all bacteriological sampling locations must also be provided.

4) **Pressure Test Results**
Copy of satisfactory pressure test results demonstrating compliance with AWWA Standard requirements.

The entire clearance document package can be submitted in Portable Document Format (pdf) to DEP_CD@dep.state.fl.us, with a copy to Cary.Padell@dep.state.fl.us for faster processing. Any submitted drawings (**must be sized 11" x 17**") and the engineer of record's signed seal and dates on the required document must be legible for acceptance.

For further clarification contact:
Cary Padell
3319 Maguire Blvd, Suite 232
Orlando, Florida 32803-3767
(407) 897-4124

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Appendix C

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Appendix D

Orange County Utilities Department
APPENDIX D, LIST OF APPROVED PRODUCTS

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APPENDIX D **LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS** **FEBRUARY 11, 2011**

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Air Release	ARV Enclosure	**All ARV above ground enclosures shall be vented with tamper proof locking device**						
		Water Plus Polyethylene Enclosure	131632 H30-B	Blue 44" Tall	131632 H30-P	Pantone 44"	131632 H30-G	Green 44" Tall
			171730 H40-B	Blue 30" Tall	171730 H40-P	Pantone 30"	171730 H40-G	Green 30" Tall
		Hot Box Vent Guard Fiberglass Enclosure	AVG2036 Encl GP3232 Base	Blue 36" Tall	AVG2036 Encl GP3232 Base	Pantone 36" Tall	AVG2036 Encl GP3232 Base	Green 36" Tall
			AVG2041 Encl GP3232 Base	Blue 41" Tall	AVG2041 Encl GP3232 Base	Pantone 41" Tall	AVG2041 Encl GP3232 Base	Green 41" Tall
		Safety-Guard/Hydro Guard	15100 Encl	Blue 34" Tall	15100 Encl	Pantone 34" Tall	15100 Encl	Green 34" Tall
	Air Release Valves	**Air Release Valves shall be Combination Type, 316 SS**						
		ARI	D-040SS	Combination	D-040SS	Combination	D-020 (SS)	Combination
		H-TEC	NA	NA	NA	NA	986 (316SS)	Combination
		Vent-O-Mat	Series RBX DN50	2"	Series RBX DN50	2"	RGX series	
	ARV Vault	**Air Release Valve Frame and Cover**						
		US Foundry	NA	NA	NA	NA	USF 7665-HH-HJ	
Blow Off	Auto Blow Off	**Automatic Blow Off Valve**						
		Hydro Guard	HG-1 Standard Unit	Automatic	NA	NA	NA	NA
	Blow Off Valve	**Blow Off Valve - Fits standard 5-1/4 inch Valve Box**						
		Kupferle Foundry Co	Truflo Series TF #550		Truflo Series TF #550		NA	NA
		Water Plus Corp	The Hydrant Plus Series VB 2000B		The Hydrant Plus Series VB 2000B		NA	NA
Casing Seals / Spacers	Casing End Seals	**Casing End Seals. Annular space between pipe and steel casing shall be brick and mortar with end seals to secure ends.**						
		Advance Products	Model AC and AW		Model AC and AW		Model AC and AW	
		BWM Company	Model WR and PO		Model WR and PO		Model WR and PO	
		Cascade Water Works	Model CCES		Model CCES		Model CCES	
		CCI Pipeline	Model ESW and ESC		Model ESW and ESC		Model ESW and ESC	
		Pipeline Seal & Insulator, Inc (PSI)	Model C and W		Model C and W		Model C and W	
		Power Seal	Model 4810ES		Model 4810ES		Model 4810ES	

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Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Casing Seals / Spacers	Casing spacer	**Casing spacers shall be a min. 8-inches wide for pipe 12" Dia or less or min. 12-inches wide for pipe 16 or greater , shall have a minimum 14 gauge 304 stainless steel shell/band, minimum 10 gauge 304 reinforced risers; minimum thickness of 0.090 EPDM or PVC interior liners, glass reinforces polymer or ultra high molecular weight polyethylene and 304 stainless bolts, nuts and washers.**						
		Advance Products	SSI8 / SSI12		SSI8 / SSI12		SSI8 / SSI12	
		BWM Company	BWM-SS-8 / SS-12		BWM-SS-8 / SS-12		BWM-SS-8 / SS-12	
		Cascade Water Works	Series CCS 8" / 12"		Series CCS 8" / 12"		Series CCS 8" / 12"	
		CCI Pipeline	Model CCS8 / CSS12		Model CCS8 / CSS12		Model CCS8 / CSS12	
		Pipeline Seal & Insulator, Inc (PSI)	Series S8G-2 / S12G-2		Series S8G-2 / S12G-2		Series S8G-2 / S12G-2	
Coatings	Exterior Coatings for Exposed Metal Assets	**Coatings: Aerial pipe, hydrants, above ground piping, fittings, valves and Appurtenances - System 1 Zinc / Urethane / Fluoropolymer application and color code per Section 3119 Coatings & Linings. Coating shall not be in contact with Potable water unless NSF 61 approved.**						
		Carboline	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils
			Carbothane 133 HB	3.0 -5.0 mils	Carbothane 133 HB	3.0 -5.0 mils	Carbothane 133 HB	3.0 -5.0 mils
			Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils
		Tnemec	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils
			Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils
			EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils
			Hydroflon Series 700	2.0 - 3.0 mils	Hydroflon Series 700	2.0 - 3.0 mils	Hydroflon Series 700	2.0 - 3.0 mils
	Exterior Coatings for Exposed Metal Assets	**Coatings: Aerial pipe, hydrants, above ground piping, fittings, valves and Appurtenances - System 2 Zinc / Epoxy / Urethane application and color code per Section 3119 Coatings & Linings. Coating shall not be in contact with Potable water unless NSF 61 approved.**						
		Carboline	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils
			Carboguard 60	4.0 -6.0 mils	Carboguard 60	4.0 -6.0 mils	Carboguard 60	4.0 -6.0 mils
			Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils
		Tnemec	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils
			Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils
			Hi-Build Epoxoline II Series N69	4.0 - 10.0 mils	Hi-Build Epoxoline II Series N69	4.0 - 10.0 mils	Hi-Build Epoxoline II Series N69	4.0 - 10.0 mils
			EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils
		PPG / Ameron	Amercoat 68HS	Min 3.0 mils	Amercoat 68HS	Min 3.0 mils	Amercoat 68HS	Min 3.0 mils
			Amercoat 385	4.0 - 6.0 mils	Amercoat 385	4.0 - 6.0 mils	Amercoat 385	4.0 - 6.0 mils
			Amercoat 450H	2.0 - 3.0 mils	Amercoat 450H	2.0 - 3.0 mils	Amercoat 450H	2.0 - 3.0 mils

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Fittings	Fittings	**Ductile Iron Fittings C153 SSB / C110 FLG: (Water & Reclaimed Water fittings shall cement lined or holiday free fusion bonded epoxy lined) (Wastewater fittings interior shall be Protecto 401 and holiday free)**						
		American	30" & up	FBE / Cement	30" & up	FBE / Cement	30" & up	Protecto 401
		Sigma		FBE / Cement		FBE / Cement		Protecto 401
		Star		FBE / Cement		FBE / Cement		Protecto 401
		Tyler Union & Clow		FBE / Cement		FBE / Cement		Protecto 401
Flow	Flow Meter	**Flow Meters With Replaceable Sensors**						
		EMCO	NA	NA	NA	NA	Unimag 4411E	
Hydrants	Hydrants	**Hydrants Shall open left, 1-1/2 Pentagon operating nut, NST hose & pumper thread, rotate 360 degrees, closed drains, epoxy on shoe in & out and 304 SS nuts & bolts below ground.**						
		American Flow Control	B-84-B (6 inch)		NA	NA	NA	NA
		Clow	Medallion 2545		NA	NA	NA	NA
		Mueller	Super Centurion 250		NA	NA	NA	NA
Joint Restraints	Ductile iron pipe MJ Restraints	**Mechanical Joint Wedge-action Restraining Gland, Epoxy Coated Restrain ductile iron pipe to mechanical joint fittings, pipe and appurtenances.**						
		EBAA Iron Inc	Megalug Series 1100		Megalug Series 1100		Megalug Series 1100	
		Ford / Uni-Flange	UFR-1400		UFR-1400		UFR-1400	
		Sigma	OneLok Series SLD/SLDE		OneLok Series SLD/SLDE		OneLok Series SLD/SLDE	
		Smith Blair	Cam Lok Series 111		Cam Lok Series 111		Cam Lok Series 111	
		Star	Star Grip Series 3000		Star Grip Series 3000		Star Grip Series 3000	
		Tyler Union	TufGrip Series TLD		TufGrip Series TLD		TufGrip Series TLD	
	DIP Bell Joint Restraints (4"-12") (New & Existing)	**Bell Joint Restraints for Ductile Iron Pipe (4"-12") (New & Existing) - All restraints split serrated on bell and spigot ends. Pipe 16" and greater shall have restraint gaskets or locking bells. (Wastewater only for restraint of existing DIP FM)**						
		EBAA Iron Inc	Tru-Dual Series 1500TD		Tru-Dual Series 1500TD		Tru-Dual Series 1500TD	
		Ford / Uni-Flange	Uni-Flange Series 1390C		Uni-Flange Series 1390C		Uni-Flange Series 1390C	
		Sigma	PV-Lok Series PWP-C		PV-Lok Series PWP-C		PV-Lok Series PWP-C	
		Smith Blair	Bell-Lock Series 165		Bell-Lock Series 165		Bell-Lock Series 165	
		Star	StarGrip Series 3100S		StarGrip Series 3100S		StarGrip Series 3100S	
		Tyler Union	TufGrip-Series 300C		TufGrip-Series 300C		TufGrip-Series 300C	
	DIP Bell Joint Restraints (16" & Greater)	**Ductile Iron Pipe Bell Joint Restraints for Ductile Iron Pipe (16" & Greater) - All restraints shall have a split back-up ring for the bell and a serrated or wedge action gland for the spigot end. New installation for water & reclaimed water piping 16" and greater shall have restraint gaskets or locking bells.**						
		EBAA Iron Inc	Series 1100HD	Existing Only	Series 1100HD	Existing Only	Series 1100HD	Existing Only
		Sigma	Series SSLDH	Existing Only	Series SSLDH	Existing Only	Series SSLDH	Existing Only
		Star	Series 3100S	Existing Only	Series 3100S	Existing Only	Series 3100S	Existing Only

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Joint Restraints	Ductile iron pipe Bell Joint Restraint Gaskets and Locking Bell (4" & Above)	**Bell Joint Restraint Gaskets and Locking Bell (4" & Above) Stainless Steel locking wedges built into the gasket-rubber. ANSI/AWWA C111/A21.11 Standard for Rubber-Gasket Joints for Ductile Iron Pressure Pipe. Ductile Iron Bell Joint Restraint for Push-On Pipe- Locking bell joint system that prevents joint separation and allows for joint deflection. Bells shall be painted red to verify restrained gasket.**						
		American	Fast Grip Gasket	Gasket	Fast Grip Gasket	Gasket	NA	NA
			Flex-Ring Joint	Bell Lock	Flex-Ring Joint	Bell Lock	NA	NA
			Lok-Ring Joint	Bell Lock	Lok-Ring Joint	Bell Lock	NA	NA
		Griffin	Talon RJ Gasket	Gasket	Talon RJ Gasket	Gasket	NA	NA
			Snap-Lok	Bell Lock	Snap-Lok	Bell Lock	NA	NA
		McWane Inc. DI Pipe Group	Sure Stop 350 Gasket	Gasket	Sure Stop 350 Gasket	Gasket	NA	NA
			Thrust-Lock	Bell Lock	Thrust-Lock	Bell Lock	NA	NA
			TR-Flex	Bell Lock	TR-Flex	Bell Lock	NA	NA
			Super-Lock	Bell Lock	Super-Lock	Bell Lock	NA	NA
		US Pipe	Field Lok 350 Gasket	Gasket	Field Lok 350 Gasket	Gasket	NA	NA
			Field Lok Gasket	Gasket	Field Lok Gasket	Gasket	NA	NA
			TR-Flex	Bell Lock	TR-Flex	Bell Lock	NA	NA
			HP Lok Restraint Joint	Bell Lock	HP Lok Restraint Joint	Bell Lock	NA	NA
	SS to DIP Transition Restraint	**SS to DIP Transition Restraint -Flanged stainless steel pipe from Wetwell to Valve box restrained joint transition (epoxy coated, SS hardware) Flg x PE RJ.**						
		EBAA Iron Inc	NA	NA	NA	NA	Megaflange 2100	
		Sigma	NA	NA	NA	NA	SigmaFlange with One Lock SLDE	
		Smith Blair	NA	NA	NA	NA	911 Flange - Lock Restrained FCA	
	PVC Pipe MJ Restraints	**Mechanical Joint Wedge-action Restraining Gland, Epoxy Coated Restrain PVC pipe to mechanical joint fittings, and appurtenances.**						
		EBAA Iron Inc	Mega-lug Series 2000PV		Mega-lug Series 2000PV		Mega-lug Series 2000PV	
			NA	NA	NA	NA	Megalug Series 2200	(42"-48")
		Ford / Uni-Flange	UFR 1500 Series		UFR 1500 Series		UFR 1500 Series	
		Sigma	One Lok Series SLC/SLCE		One Lok Series SLC/SLCE		One Lok Series SLC/SLCE	
		Smith Blair	Cam Lok Series 120		Cam Lok Series 120		Cam Lok Series 120	
		Star	Star Grip Series 4000		Star Grip Series 4000		Star Grip Series 4000	
		Tyler Union	TufGrip Series TLP		TufGrip Series TLP		TufGrip Series TLP	
	PVC Bell Joint Restraints (4" - 12") (New & Existing)	**PVC Bell Joint Restraints: PVC pipe Split Serrated on Bell End and Spigot End. (4" - 12") (New & Existing)**						
		EBAA Iron Inc	Tru-Dual Series 1500TD		Tru-Dual Series 1500TD		Tru-Dual Series 1500TD	
		Ford / Uni-Flange	Uni-Flange Series 1390		Uni-Flange Series 1390		Uni-Flange Series 1390	
		Sigma	PV-Lok Series PWP		PV-Lok Series PWP		PV-Lok Series PWP	
		Smith Blair	Bell-Lock Series 165		Bell-Lock Series 165		Bell-Lock Series 165	
		Star	Series 1100C		Series 1100C		Series 1100C	
		Tyler Union	TufGrip 300C		TufGrip 300C		TufGrip 300C	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Joint Restraints	PVC Bell Joint Restraints (16" & Greater)	**PVC Bell Joint Restraints: (16" & Greater) PVC pipe Split Serrated on Bell End and Spigot End. Water & Reclaimed Water Existing pipe only. Wastewater shall be new and existing pipe.**						
		Ford / Uni-Flange	Series 1390	Existing Only	Series 1390	Existing Only	Series 1390	
		JCM	Sur-Grip Series 621	Existing Only	Sur-Grip Series 621	Existing Only	Sur-Grip Series 621	
		Sigma	PV-Lok PWP	Existing Only	PV-Lok PWP	Existing Only	PV-Lok PWP	
		Smith Blair	Bell-Lock Series 165	Existing Only	Bell-Lock Series 165	Existing Only	Bell-Lock Series 165	
		Star	Series 1100C	Existing Only	Series 1100C	Existing Only	Series 1100C	
Pipe	PVC C900 DR 18 Bell & Spigot (4" - 12")	**C900 Bell & Spigot PVC Pipe: 4 to 12-inch - AWWA C-900, Minimum DR18 for Water, Reclaimed and Wastewater. DR14 for Fire Lines. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.**						
		Certainteed 4" to 12"	Certa-Lok C900/RJ	Blue	Certa-Lok C900/RJ	Pantone Purple	Certa-Lok C900/RJ	Green
		Diamond Plastics Corp	C-900	Blue	C-900	Pantone Purple	Diamond C900	Green
		Ipex Inc	C-900 Blue Brute	Blue	C-900	Pantone Purple	C900 Blue Brute	Green
		JM Eagle	C-900	Blue	C-900	Pantone Purple	C-900	Green
		National Pipe & Plastics Inc	C-900 Dura- Blue	Blue	C-900	Pantone Purple	C-900 Pipe	Green
		North American Pipe Corp (NAPCO)	C-900	Blue	C-900	Pantone Purple	C-900	Green
		Sanderson Pipe Corp	C-900	Blue	C-900	Pantone Purple	C-900	Green
	PVC C905 DR 18 Bell & Spigot 16" and Larger	**C905 Bell & Spigot PVC Pipe 16" and Larger: AWWA C-905, Minimum DR18 for all Force Mains up to 24". Minimum DR21/DR25 for 30" and greater. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.**						
		Certainteed 16"	NA	NA	NA	NA	Certa-Lok C905/RJ	NA
		Diamond Plastics Corp	NA	NA	NA	NA	Trans-21 DR18	Green
		Ipex Inc	NA	NA	NA	NA	IPEX Centurion	Green
		JM Eagle	NA	NA	NA	NA	C905 Big Blue	Green
		National Pipe & Plastics Inc	NA	NA	NA	NA	C905	Green
		North American Pipe Corp (NAPCO)	NA	NA	NA	NA	C905 Big Blue	Green
	HDPE C906 DR11	**HDPE Pipe DR11 AWWA C906 shall be Ductile Iron Pipe Size, PE 3408/3608/4710 DIPS manufactured in accordance with ASTM F-714 and listed with NSF. Pipe shall be marked in accordance with either AWWA C901,AWWA C906. Compression type connections are not acceptable in new installations. Pipe joints shall be butt fusion or electro-fusion with flange or adapter. All HDPE shall be color coded to the Utility. Color identifications are in accordance with the APWA/ULCC Uniform Color Code. Manufacturers shall be members in good standing with PPI to maintain approval status.**						
		JM Eagle	HDPE	DR11 Blue	HDPE	DR11 Pantone	HDPE	DR11Green
		Performance Pipe(Chevron)	Driscoplex 4000	DR11 Blue	Driscoplex 4000	DR11 Pantone	Driscoplex 4300	DR11 Green
		PolyPipe, Inc.	EHMW Poly Pipe	DR11 Blue	EHMW	DR11 Pantone	EHMW	DR11Green

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pipe	Ductile Iron Pipe	**Ductile iron/Cast iron: (4" to 12" = Class 350, 16" to 24" - Class 250, 30" to 64" = Class 200). Water and Reclaimed water shall be cement lined. Wastewater Piping shall be Protecto 401 and Holiday Free. Exterior coatings as specified. Wastewater DIP piping shall be for pump station piping only. Manufacturers shall be members in good standing with DIPRA to maintain approval status.**						
		American	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		Griffin	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		McWane Inc. DI Pipe Group	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		US Pipe	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
Sample	Sample Station	**Sample Stations - Bacteriological Sample Station with built in flush system, all internal piping to be 2", brass and includes lockable green enclosures.**						
		Safety-Guard	SG-BSS-05 pedestal #77	green enclosure	NA	NA	NA	NA
		Water Plus Corp	Model 5000	green	NA	NA	NA	NA
Services	Brass Service Saddles	**Brass Service Saddles for 1" & 2" water & reclaimed water services on 4" through 12" Mains - Service saddles can be hinge or bolt controlled OD saddles to be used on C-900 and existing IPS OD PVC pipe.**						
		Ford	Series S-70, S-90	4"-12"	Series S-70, S-90	4"-12"	NA	NA
		AY McDonald	Model 3891 / 3895,3801 / 3805	4"-12"	Model 3891 / 3895,3801 / 3805	4"-12"	NA	NA
		Mueller	Series S-13000/H-13000	4"-12"	Series S-13000/H-13000	4"-12"	NA	NA
	Service Saddles	**Service Saddles for 1" (CC) & 2" (Iron pipe threads) Water & Reclaimed Water services on mains greater than 12". Service saddles for 2" taps (iron pipe threads) on 4" mains and greater for Waste Water. : Epoxy or nylon coated stainless steel 18-8-type 304 double straps, controlled O.D. saddles to be used on C-900 / C905 or DI for all 1-in and -2in taps on pipes over 12in.**						
		Ford	Series FC202	16" & greater	Series FC202	16" & greater	Series FC202	4" & greater
		JCM	Series 406	16" & greater	Series 406	16" & greater	Series 406	4" & greater
		Mueller	DR2S	16" & greater	DR2S	16" & greater	DR2S	4" & greater
		Romac	Series 202NS	16" & greater	Series 202NS	16" & greater	Series 202NS	4" & greater
		Smith Blair	Series 317	16" & greater	Series 317	16" & greater	Series 317	4" & greater
	Service Saddles for HDPE	**Service Saddles for 1" (CC) & 2" (Iron Pipe threads) Water and Reclaimed Water Services: Epoxy or nylon coated stainless steel 18-8-type 304 double straps, controlled O.D. saddles to be used on HDPE for all 1-in and -2in taps. Taps to HDPE pipe shall be approved on a case by case basis.**						
		Ford	Series FCP202		Series FCP202		Series FCP202	
		Romac	Series 202N-H		Series 202N-H		Series 202N-H	
		Smith Blair	Series 317-1 for HDPE		Series 317-1 for HDPE		Series 317-1 for HDPE	
	Corporation Stops Ball Type	**Corporation Stops Ball Type (1-inch with AWWA taper C threads only/pack joint outlet for CTS) 2" Corporation Stop Ball Type shall be 2" MIP X FIP threads.**						
		Ford	FB1000, FB1700-7		FB1000, FB1700-7		FB1700-7	2" ARV
		AY McDonald	4701B-22, 3149B2		4701B-22, 3149B2		3149B2	2" ARV
		Mueller	P25008, B-20046		P25008, B-20046		B-20046	2" ARV

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Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Services	Curb Stops	**Curb Stops - Straight Valves: Ball type compression 2" cts O.D. tubing by 2" FIP**						
		Ford	B41-777W		B41-777W		NA	NA
		AY McDonald	6102W-22		6102W-22		NA	NA
		Mueller	P25172		P25172		NA	NA
	Curb Stops	**Curb Stops - Straight Valves: ball type compression x compression**						
		Ford	B44-444W		B44-444W		NA	NA
		AY McDonald	6100W-22		6100W-22		NA	NA
		Mueller	P25146		P25146		NA	NA
	PE tubing	**Polyethylene tubing: AWWA C901. UV protection (SDR-9) 1-inch and 2-inch only. PE 3408 / PE 4710**						
		Charter Plastics	Blue Ice		Lav Ice		NA	NA
		Endot	Endopure Blue		Endocore Lavender		NA	NA
		JM Eagle	Pure-Core		NA	NA	NA	NA
Tapping Sleeves and Valves	Line Stops	**Line Stops**						
		JCM						
		Romac						
		Smith Blair						
	Tapping Sleeves	**Tapping Sleeves: (Mechanical joint for taps on cast iron, ductile iron, PVC & AC pipe, including size on size) with stainless steel nuts and bolts.**						
		American Flow Control	Series 2800		Series 2800		Series 2800	
			Series 1004		Series 1004		Series 1004	
		Clow	Series F-5205	DIP/PVC	Series F-5205	DIP/PVC	Series F-5205	DIP/PVC
			Series F-5207	A/C Pipe	Series F-5207	A/C Pipe	Series F-5207	A/C Pipe
		JCM	Series 414	FBE	Series 414	FBE	Series 414	FBE
		Mueller	Series H-615	DIP/PVC	Series H-615	DIP/PVC	Series H-615	DIP/PVC
			Series H-619	A/C Pipe	Series H-619	A/C Pipe	Series H-619	A/C Pipe
		Smith Blair	Style 623	FBE	Style 623	FBE	Style 623	FBE
	Tapping Valves: 12" and smaller	**Tapping Valves: 12" and smaller - Tapping Valves shall be furnished with an alignment lip and installed in the vertical position for Water and Reclaim Water. Wastewater shall be installed horizontally and abandoned in the open position. Tapping valves shall be resilient seated only and meet the requirements of AWWA C509 or C515**						
		American Flow Control	Series 2500	Alignment Lip	Series 2500	Alignment Lip	Series 2500	Alignment Lip
		Clow	Series F-6114	Alignment Lip	Series F-6114	Alignment Lip	Series F-6114	Alignment Lip
		Mueller	Series T2360 (4"-12")	Alignment Lip	Series T2360 (4"-12")	Alignment Lip	Series T2360 (4"-12")	Alignment Lip

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Tapping Sleeves and Valves	Tapping Valves: 16" and Larger	**Tapping Valves: 16" and Larger - Tapping valves shall be furnished with an alignment lip and be installed in the vertical position for Water and Reclaimed Water. No tapping valve shall be installed horizontally for Water and Reclaim Water unless approved by the engineer. Tapping Valves 16" and larger AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a spur gear actuator unless noted by the engineer. All tapping valves above 24" shall be furnished with NPT pipe plugs for flushing the tracks when valves are installed horizontally. Tapping valves for Wastewater shall be installed horizontally and abandoned in open position.**						
		American Flow Control	Series 2500	Alignment Lip & flushing port	Series 2500	Alignment Lip & flushing port	Series 2500	Alignment Lip & flushing port
		Clow	Series F-6114	Alignment Lip & flushing port	Series F-6114	Alignment Lip & flushing port	Series F-6114	Alignment Lip & flushing port
		Mueller	Series T2361 (14"&up)	Alignment Lip & flushing port	Series T2361 (14"&up)	Alignment Lip & flushing port	Series T2361 (14"&up)	Alignment Lip & flushing port
Valves	Butterfly Valve 42" and Above	**Butterfly Valves 42"and above. AWWA C504. Actuators input torques based on 150 psi valve pressure and 16 fps velocity with a maximum input of 80 ft-lb on 2" nuts and shall withstand 250 ft-lbs. Valve seats shall be leak-tight in both directions at 150 psi.**						
		Clow	Style #1450		Style #1450		NA	NA
		Dezurik	BAW		BAW		NA	NA
		Mueller / Pratt	LINSEAL III / Groundhog		LINSEAL III / Groundhog		NA	NA
	Check Valves	**Valves (Check) 4-inch and Larger (8 mil epoxy lined)**						
		American Flow Control	NA		NA		Series 600 or 50 line	
		Clow / M&H / Kennedy	NA		NA		106	
		Mueller	NA		NA		Series 2600	
	Gate Valves 4" - 12"	**Gate Valves 12" and smaller - resilient seated only AWWA C509 or C515. Valve seat shall be leak-tight in both directions at 150 psi.**						
		American Flow Control	Series 2500		Series 2500		NA	NA
		Clow	Series F-6100		Series F-6100		NA	NA
		Mueller	Series A-2360		Series A-2360		NA	NA
	Gate Valves (Vertical) 16" and Up	**Gate Valves 16" and larger (Vertical Installation) AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a gear actuator unless noted by the engineer. Valve seat shall be leak-tight in both directions at 150 psi.**						
		American Flow Control	Series 2500		Series 2500		NA	NA
		Clow	Series F-6100		Series F-6100			
		Mueller	Series A-2361		Series A-2361		NA	NA

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Valves	Plug Valves	**Plug Valves - Bi-directional, MJ & Flanged (min. 8mil fusion bonded epoxy with stainless steel bolts), gear operator to be sized for rated pressure of the valve. Valves 4"-20" shall be 80% Full Port and valves 24" and greater shall be minimum of 70% full port. Valve shall be factory tested to minimium 100 PSI in both directions.**						
		Clow	NA	NA	NA	NA	F-5412 FLG	4" & up
			NA	NA	NA	NA	F-5413 MJ	4" & up
		Dezurik	NA	NA	NA	NA	Series PEF or PEC	4"& up
		Millikan / Pratt	NA	NA	NA	NA	Eccentric / Ballcentric	4"& up
		Val-Matic	NA	NA	NA	NA	5600 or 5800 (FLG)	4" & up
			NA	NA	NA	NA	5700 or 5900 (MJ)	4" & up
Valve Boxes	Valve Boxes with Locking Lids (Cast Iron)	**Two piece standard screw type Heavy Duty Valve Boxes with Locking Lids (Cast Iron) and type of service cast in heavy duty traffic lid (H20 loading) ASTM A48**						
		Bingham/Taylor	Series 4905	Box	NA	NA	Series 4905	Box
			4905-X	Extension	NA	NA	4905-X	Extension
			4904-L	Blue Water Locking Lid	NA	NA	4904-L	Green Sewer locking Lid
		Sigma	Series VB 261X-267X	Box	VB-25031LK-VB-2612	Box	Series VB 261X-267X	Box
			VB 6302	Extension	VB-6302	Extension	VB 6302	Extension
			VB 4650W	Blue Water Locking Lid	VB2503LK	Purple Square Locking Lid	VB 4650S	Green Sewer locking Lid
		Star	Series VB-0002	Box	NA	NA	Series VB-0002	Box
			VBEX 12-24S	Extension	NA	NA	VBEX 12-24S	Extension
			VBLIDLOCK	Blue Water Locking Lid	NA	NA	VBLIDLOCK	Green Sewer locking Lid
		Tyler Union	Series 6850	Box	NA	NA	Series 6850	Box
			58, 59, 60	Extension	NA	NA	58, 59, 60	Extension
			Locking Lid	Blue Water Locking Lid	NA	NA	Locking Lid	Green Sewer locking Lid
	Valve Box	**For mains equal to, or greater than, 16" diameter or equal to greater than 6' feet deep**						
		American Flow Control	# 2A - 9A Retrofit Valve Box Insert	Fit inside std valve boxes	NA		2A - 9A Retrofit Valve Box Insert	Green Sewer locking Lid
		Mueller Company	MVB050C thru MVB130C with Extension Stem MVB875 Guide Plate	Blue Water Locking Lid	MVB050CR thru MVB130CR with Extension Stem MVB875 Guide Plate	Purple Square Locking Reclaim Lid	MVB050C thru MVB130C with Extension Stem MVB875 Guide Plate	Green Sewer locking Lid

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Coatings	Anti-Graffiti Paint	**Block Walls-Anti-Graffiti Paint per Section 3119 Coatings & Linings**						
		American Building Restoration Products	NA	NA	NA	NA	Polyshield Graffiti Preventer for Unpainted Masonry Type B	Super Bio Strip or Strip it all
		Tnemec / Chemprobe	NA	NA	NA	NA	626 DUR A PEL	680 Mark A Way
		Professional Products of Kansas, Inc	NA	NA	NA	NA	Professional Water Seal & Anti-Graffitiant (PWS-15 Super Strength)	Professional Phase II Cleaner
	Coatings for Existing Manholes	**Rehabilitation corrosion protection system per Section 3119 Coatings & Linings. Interior coating for force main connections to existing concrete manholes only. New precast structures and existing pump stations shall be lined.**						
		CCI Spectrum, Inc	NA	NA	NA	NA	Spectrashield	min of 500 mils
		Kerneos Aluminate Technologies	NA	NA	NA	NA	Sewpercoat	1" (1000mil)
		Raven Lining System	NA	NA	NA	NA	Raven 155 Primer Raven 405	min 8 mils min 125 mils
		Sauereisen	NA	NA	NA	NA	210 Series Topcoat Glaze 210G	min 125 mils min 20 mils
		Tnemec	NA	NA	NA	NA	Series 434 Topcoat Glaze 435	min 125 mils 15-20 mils
PVC Pipe and fittings	Pipe SDR 35 Gravity Mains	**PVC Pipe for Gravity SDR26/SDR 35 (Green in color) ASTM-D034. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.**						
		Certainteed	NA	NA	NA	NA	Gravity Sewer Pipe	
		Diamond Plastics Corp	NA	NA	NA	NA	Sani-21 SDR-35	
		JM Eagle	NA	NA	NA	NA	Gravity Sewer	
		National Pipe & Plastics, Inc.	NA	NA	NA	NA	Ever-Green Sewer Pipe	
		North American Pipe Corp (NAPCO)	NA	NA	NA	NA	Gravity Sewer	
		Sanderson Pipe Corp	NA	NA	NA	NA	Gravity Sewer	
	Locate Balls	**Locating Marker Systems - Wastewater Locator balls placed at all sanitary sewer cleanouts**						
		3M	NA	NA	NA	NA	3M™ EMS 4" Extended Range 5' Ball Marker 1404-XR	
	Fittings SDR 35	**Fittings, Adapters and Plugs - Gravity PVC ASTM-D3034, Min SDR26/ SDR 35**						
		GPK Products, Inc.	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Harrington Corporation (HARCO)	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Multi Fittings Corp.	NA	NA	NA	NA	SDR26/SDR 35 Trench Tough Sewer Fittings	
		JM Eagle	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Plastic Trends Inc	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		TIGRE USA, Inc.	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
PVC Pipe a	Flexible Pipe Connectors	**Flexible Pipe Connectors and Transitions**						
		Fernco	NA	NA	NA	NA	1002, 1051, 1056 Series	
		Indiana Seal	NA	NA	NA	NA	102, 151, 156 Series	
		Mission Rubber	NA	NA	NA	NA	MR02, MR51, MR 56 Series	
Precast Concrete Structures	MH Lids	**Frame and Cover**						
		USF Fabrication Inc.	NA	NA	NA	NA	USF 225-AS	
	Adj Ring	**Top Adjusting Rings - HDPE with heavy duty loading (H-20)**						
		Ladtech, Inc	NA	NA	NA	NA	24R, 24S with Rope Sealant CS2455	
	Hatches	**Wet Well and Valve Vault Access Frames and Covers (Include the term "Confined Space" etched or cast into the cover with recessed lock & hasp. Frames and covers per manufacturers specifications.**						
		Halliday Products	NA	NA	NA	NA	S1R or S2R Series	
		USF Fabrication Inc.	NA	NA	NA	NA	APS or APD Series	
	Precast Concrete Structures	**Precast Manhole and Wetwell Structures ASTM C478. Precast concrete shall be batched with concrete dyed crystalline waterproofing admixture with corrosion protection. Concrete without admixture or without color tint /tracer shall be rejected.**						
		Allied Precast	NA	NA	NA	NA	Dyed Admix	
		Atlantic Concrete Products, Inc.	NA	NA	NA	NA	Dyed Admix	
		Delzotto Products, Inc.	NA	NA	NA	NA	Dyed Admix	
		Dura Stress Underground Inc.	NA	NA	NA	NA	Dyed Admix	
		Hanson Pipe & Product	NA	NA	NA	NA	Dyed Admix	
		Mack Concrete	NA	NA	NA	NA	Dyed Admix	
		Oldcastle Precast	NA	NA	NA	NA	Dyed Admix	
		Standard Precast Inc.	NA	NA	NA	NA	Dyed Admix	
	Concrete Admix	**Crystalline Waterproofing Concrete Admix with color dye shall be added to all concrete structures (precast and cast-in-place) to provide waterproofing and corrosion resistance. Concrete without admixture or without color tint / tracer shall be rejected. % concentration of admix with colored dye added to the mix shall be based on weight of cement.**						
		Kryton International	NA	NA	NA	NA	KIM K-301R (with red dye)	2%
		Xypex Chemical Corp	NA	NA	NA	NA	Xypex Admix C-1000Red (with red dye)	3.0 - 3.5%
	Liners	**Interior Liner for New or existing Precast Manhole and Precast Wetwell Structures per Section 3119 Coatings & Linings**						
		AFE	NA	NA	NA	NA	Fiberglass Liner	
		AGRU Liner	NA	NA	NA	NA	HDPE Liner (Min 2 mm for Manhole / Min 5 mm for Pump Station)	
		Containment Solutions Inc. (Flowtite)	NA	NA	NA	NA	Fiberglass Liner	
		GSE Studliner	NA	NA	NA	NA	HDPE Liner (Min 2 mm for Manhole / Min 5 mm for Pump Station)	
		GU Liner	NA	NA	NA	NA	Reinforced Plastic Liner	
		L & F Manufacturing	NA	NA	NA	NA	Fiberglass Liner	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Precast Concrete Structures	Heat Shrink Seal	**Heat Shrink Seal - Precast structures shall be primed with manufacturer approved primer prior to application of heat shrunk encapsulation.**						
		Canusa-CPS	NA	NA	NA	NA	Wrapid Seal with WrapidSeal Primer (Canusa G Primer)	
		Pipeline Seal & Insulator, Inc (PSI)	NA	NA	NA	NA	Riser Wrap with Polyken 1027 or 1039 primer	
	Jointing Material	**Jointing Material Min. 2" width for all products to ensure squeeze out with manufacturer approved primer.**						
		Henry Company	NA	NA	NA	NA	Ram-Nek	with Primer
		Martin Asphalt Company	NA	NA	NA	NA	Evergrip 990	with Primer
		Trelleborg Pipe Seals	NA	NA	NA	NA	NPC – Bidco C-56	with Primer
	Pipe Seals Gravity	**Resilient Connector Pipe Seals, Manhole - Gravity less than 12-inch and less than 15-ft deep**						
		Atlantic Concrete	NA	NA	NA	NA	A-Lok (cast-in-place)	
		Hail Mary Rubber	NA	NA	NA	NA	Star Seal (cast-in-place)	
		IPS	NA	NA	NA	NA	Wedge Style	
		NPC	NA	NA	NA	NA	Kor-N-Seal Model WS	
		Press seal gasket	NA	NA	NA	NA	PSX Direct Drive	
	Pipe Seals Gravity	**Cast in Place Pipe Seals, Manhole - Gravity Greater Than or Equal to 12-inch and all pipe sizes greater than 15-ft deep**						
		Atlantic Concrete	NA	NA	NA	NA	A-Lok	cast in place
		Hail Mary Rubber	NA	NA	NA	NA	Star Seal	cast in place
	FM Pipe Seals	**Modular Pipe Seals for Wet Well and Valve Box penetrations and all forcemain connections to existing and new precast concrete structures. EPDM Rubber with 316 SS Hardware**						
		CCI Pipeline Systems	NA	NA	NA	NA	Wrap-It Link WL-SS Series	
		Pipeline Seal & Insulator, Inc / Link Seal	NA	NA	NA	NA	Link-Seal S-316 Modular Seal	
		Proco Products, Inc	NA	NA	NA	NA	PenSeal ES-PS Series	

APPENDIX D **LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS** **FEBRUARY 11, 2011**

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Generator	Gen	**Generator Systems, Fixed Shall be UL 2200 Certified.**						
		Caterpillar	NA	NA	NA	NA	CAT Diesel Generator Set	
		Cummins Power Generation	NA	NA	NA	NA	Diesel Generator Set	
	Fuel Tanks	**Generator Fuel Tanks. Shall be UL2085 certified.**						
		Convault	NA	NA	NA	NA	CVT-3SF or CVT-3FF	
		Phoenix	NA	NA	NA	NA	Envirovault	
	GR	**Generator Receptacle (GR)**						
		Cooper Crouse-Hinds	NA	NA	NA	NA	AR2042 (230V, 200A, 3P, 4W)	With AJA1 Angle Adaptor
		Cooper Crouse-Hinds	NA	NA	NA	NA	AR2042-S22 (460V, 200A, 3P, 4W)	With AJA1 Angle Adaptor
		Pyle National	NA	NA	NA	NA	JRE-4100 (230V, 100A, 3P, 4W)	
	ATS	**Generator Transfer Switch**						
		Russelectric	NA	NA	NA	NA	RMTD Series with model 2000 controller	NEMA 12/3R 316SS Enclosure
Odor Control Units	Biotrickling Filters	**Biotrickling filters**						
		BioAir	NA	NA	NA	NA		
		Biorem	NA	NA	NA	NA	Biosorbens BTF	
		Envirogen	NA	NA	NA	NA	BTF	
		Siemens	NA	NA	NA	NA	Zabocs BTF	
	Carbon Adsorption Units	**Carbon Adsorption Units**						
		Calgon	NA	NA	NA	NA		
		Pure Air Filtration	NA	NA	NA	NA		
		Siemens	NA	NA	NA	NA		
Pressure Gauges	Pressure Gauges	**Pressure Gauges shall have Diaphragm Seals. Oil filled.**						
		Ashcroft	NA	NA	NA	NA	10 1008SL 02L 60# 25 200SS 02T XYTSE	Gauge Diaphragm Seal
		Trerice	NA	NA	NA	NA	D83LFSS4002LA100 - Gauge M51001SSSS - Diaphragm Seal D99100 Fill and Mount Charge	
		Winter Gauges	NA	NA	NA	NA	PFQ770 0-60 PSI D70950 top D70954 Bottom	
Pumps	Pumps	**Submersible Pumps**						
		ABS	NA	NA	NA	NA		
		Flygt	NA	NA	NA	NA		

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pumps	Floats	**Float Regulator (FR) - Duplex and Triplex Pump Stations**						
		Atlantic Scientific	NA	NA	NA	NA		Roto-Float
	Radar	**Radar - Pulse Burst Radar Transmitter. Input 24 VDC and Output 4-20 mA**						
		Magnetrol	NA	NA	NA	NA		R82-520A-011
Pump Station Main Ser	Main Srvc Disconne	**Main Service Disconnect Breaker**						
		Square D	NA	NA	NA	NA		H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)
	Surge Protector Device	**Surge Protector - UL 1449, 3rd Edition listed and labeled, minimum 10 year warranty, NEMA LS-1 and IEEEC62, 41/45 tested with NEMA 4X enclosure, internal fusing, voltage and phase to match service. Rated 80,000 amps per mode for Duplex & Triplex stations and 150,000 Amperes per mode for Master Stations. All devices shall be provided with a NEMA 4X Plastic enclosure which is approved in lieu of stainless steel.**						
		Current Technology (Power & Systems	NA	NA	NA	NA		XN-80, TG-150 or CurrentGuard 150 Plus Series
		Josyln AKA (Total Protection Solutions)	NA	NA	NA	NA		TSS-ST 160 Series, ST 300 Series or JSP-300 Series
		Surge Suppressors, Inc	NA	NA	NA	NA		LSE Series or SHL Series
Sub Panel	Sub Panel	**Sub-Panel Enclosure - NEMA 12/3R Enclosure 316SS, white polyester Powder coated-finish inside and out, With 3 Point Pad lockable Handle, and Door Stop**						
		Hoffman	NA	NA	NA	NA		
		Schaefer	NA	NA	NA	NA		
		Universal enclosure systems	NA	NA	NA	NA		
Pump Station Control Panel	Control Panel	**Control Panel Supplier**						
		ECS	NA	NA	NA	NA		
		Sta-Con Inc	NA	NA	NA	NA		
	Enclosure	**Enclosure - NEMA 12/3R Enclosure 316SS, white polyester Powder coated finish inside and out, With 3 Point Pad lockable Handle, and Door Stop**						
		Hoffman	NA	NA	NA	NA		
		Schaefer	NA	NA	NA	NA		
		Universal enclosure systems	NA	NA	NA	NA		
	Mnts	**Mounting Channel for Enclosures**						
		Unistrut Stainless Steel	NA	NA	NA	NA		1" 5/8 x 1" 5/8 316 SS
	Seal-off	**Explosion-Proof Sealoff**						
		Cooper Crouse-Hinds	NA	NA	NA	NA		EYSR - 2 Inch Min.
	FL	**Flasher (FL)**						
		MPE	NA	NA	NA	NA		025-120-105
		SSAC	NA	NA	NA	NA		FS-126

APPENDIX D **LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS** **FEBRUARY 11, 2011**

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pump Station Control Panel	AL	**Alarm Light / With Base and Globe (AL)**						
		American Electric	NA	NA	NA	NA	F32552	
		Red Dot Globe	NA	NA	NA	NA	VGLR-01	
		Red Dot Base					VA-01	
	AH	**Alarm Horn (AH)**						
		Wheelock	NA	NA	NA	NA	3IT-115-R	
	Fuse	**Fuses (F)**						
		Bussmann	NA	NA	NA	NA	FNQ-R or KTK-R	
	HOA	**Hand-Auto-Off Selector (HOA)**						
		Square D	NA	NA	NA	NA	9001-SKS43B	
	HSS	**Horn Silence Button (HSS)**						
		Square D	NA	NA	NA	NA	9001-SKR1RH5	
	Inter-lock	**Mechanical Interlock**						
		Square D	NA	NA	NA	NA	S29354	
	Breakers	**Control Panel Main Circuit Breaker (MCB) With S29450 Circuit Breaker Auxiliary Switch**						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Emergency Circuit Breaker (ECB) With S29450 Circuit Breaker Auxiliary Switch						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Motor Circuit Breaker (MB)						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
		Control Circuit Breaker/ GFCI Receptacle Breaker/ SCADA Breaker						
		Square D	NA	NA	NA	NA	QOU120	
	MS	**Motor Starter (MS)**						
		Square D	NA	NA	NA	NA	Type S Class 8536	
	OL	**Overload Heater(OL)**						
		Square D	NA	NA	NA	NA	Part number will vary with size needed	
	OR	**Overload Reset**						
		Square D	NA	NA	NA	NA	9066-RA1	
	Transformer	**Control Circuit Transformer (XMFR)**						
		Square D	NA	NA	NA	NA	9070TF75D23	120/24 Volt .075 KVA
		Main Circuit Transformer (MCT)						
		Square D	NA	NA	NA	NA	9070T2000D1	480/120 2KVA
	SPB	**Supplemental Protector Breaker - 3 pole, 1-amp for Phase Monitor**						
		Square D	NA	NA	NA	NA	MG24532	

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pump Station Control Panel	PM	**Phase Monitor (PM)**						
		MPE 240 V.	NA	NA	NA	NA	001-230-118-OVG5	
		MPE 480 V.	NA	NA	NA	NA	002-480-123-OVG5	
	Pump Alternator	**Pump Automatic Alternator (PAA)**						
		Diversified Duplex	NA	NA	NA	NA	ARA-120-ACA	
		Diversified Triplex	NA	NA	NA	NA	ARA-120-AME	
		MPE Duplex	NA	NA	NA	NA	008-120-13SP	
		MPE Triplex	NA	NA	NA	NA	009-120-23P	
		MPE Triplex Socket	NA	NA	NA	NA	SD-12-PC	
	Alt. Test Switch	**Alt. Test Switch**						
		Carling Technologies	NA	NA	NA	NA	6GG5E-78	
		Honeywell	NA	NA	NA	NA	2TL1-50	
	Relay	**Relay**						
		Potter Brumfield 24 Volt	NA	NA	NA	NA	KRPA-11AN-24	
		Potter Brumfield 120 Volt	NA	NA	NA	NA	KRPA-11AN-120	
		Square D 24 Volt	NA	NA	NA	NA	8501KP12P14V14	
		Square D 120Volt	NA	NA	NA	NA	8501KP12P14V20	
	Relay Base	**Relay Base**						
		IEDC 8 Pin Relay Base 600 Volt	NA	NA	NA	NA	SR2P-06	
	Duplex Receptacle / GFCI	**Duplex Receptacle/GFCI (DR) Upgraded to 20 Amp**						
		Hubbell	NA	NA	NA	NA	GFTR20BK	
		Pass & Seymour	NA	NA	NA	NA	2095TRBK	
	ETM	**Elapse Time Meter (ETM)**						
		Reddington	NA	NA	NA	NA	711-0160	
	Grounding	**Grounding System**						
		Marathon	NA	NA	NA	NA	Neutral Isolation Block 1421570	
		Panduit	NA	NA	NA	NA	Ground Lug LAM2A 1/0 - 014 -6Y	
		Square D	NA	NA	NA	NA	Ground Buss PK7GTA	
	TS	**Terminal Strip (TS)**						
		Marathon	NA	NA	NA	NA	Series 200	
		Square D	NA	NA	NA	NA	9080GR6	
	TS	**Terminal Strip End Blocks and End Clamps**						
		Square D	NA	NA	NA	NA	9080GM6B & 9080GH10	

APPENDIX D **LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS** **FEBRUARY 11, 2011**

Cat.	Desc	Manufacturer	Water Model #	Water Comments	Reclaimed Water Model #	Reclaimed Water Comments	Wastewater Model #	Wastewater Comments
Pump Station Control Panel	PL	**Pilot Light (PL) 24 Volt with 1819 Bulb**						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelight 930507X	
	RL	**Run Indicator Light (RL) 120 Volt**						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelites 930507X With 120MB Bulb	
	MT	**Moisture and Temperature Failure Light (MT) 120 Volt with 120MB Bulb**						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelites 930507X	
Sluice	Sluice Gate	**Sluice Gate for Wet Well with Motorized Operator**						
		BNW	NA	NA	NA	NA	Model 77 - 316 SS	
		Fontaine	NA	NA	NA	NA	Model 20 - 316 SS	
VFD	VFD	**Variable Frequency Drives**						
		Square D	NA	NA	NA	NA		