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SECTION 09960
HIGH PERFORMANCE FERROUS METAL COATINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The scope of services includes surface preparation, coating systems and methods of application. All work shall be done in strict accordance with this specification, the Contract Documents, and the manufacturer's printed instructions.
- B. The Contractor shall provide all supervision, labor, tools, materials, equipment, maintenance of traffic, containment systems, scaffolding, other structures and incidentals required for mobilization, transportation, unloading, storage, surface preparation, protection of the public and environment, application of products, and cleanup necessary to complete this Contract in its entirety.
- C. The Contractor shall paint all exposed miscellaneous metal, pipe, fittings, valves, hangers, straps, support, hardware, equipment, appurtenances, and all other work required to be painted unless otherwise specified. The Contractor shall paint all surfaces he affects or damages during his performance of the Work, which may be exposed to view in the finished work including, but not limited to, metals, pipe, fittings, valves, equipment and all other existing items similar to proposed items specified for painting. Miscellaneous metal items to be painted shall be included in the Work of this Section where they come within the general intent of the Specifications or as stated herein.
- D. In general the following surfaces shall be painted:
 - 1. Pipe, fittings, flanges, appurtenances and other metal surfaces to 1-ft below grade. Pipe 1-ft below grade and within 6-inches above grade shall be considered immersion surface and shall be coated with the immersion surface high performance coating system.
 - 2. Metal or Galvanized materials including, but not limited to: pipe straps, hangers, pipe support floor stands, bypass piping, nuts, bolts, hardware and tapping saddles. Pipe straps shall be removed and coated on both sides.
 - 3. Pipe Surfaces under pipe straps. Pipe straps shall be removed and pipe coated underneath pipe straps regardless if pipe straps are to be coated. No more than two-thirds of the total number of pipe straps shall be removed at any given time unless the pipe is supported in a cradle.
 - 4. Incidentals within the limits of the project including but not limited to bollards, adjacent walkways, walls or supports containing graffiti.
 - 5. Contractor shall provide new ½-inch neoprene that shall be placed at contact interfaces between materials including, but not limited to, pipe support floor stands, pipe straps, and access barriers. The Contractor shall remove and replace existing neoprene where exposed with new material. In situations where ½-inch neoprene is not sized properly for existing conditions, the County, on a case by case basis may require a different thickness.

- E. The following surfaces or items are not generally required to be painted, unless noted otherwise. The Contractor shall properly protect these materials from surface preparation, coating application, or damage.
 - 1. Polished chrome, aluminum, nickel, stainless steel, brass, or bronze materials.
 - 2. Stainless steel hardware.
 - 3. Flexible couplings.
 - 4. Labels, signs or nameplates including but not limited to: UL, FM, equipment identification, performance rating, name and nomenclature plates shall not be coated.
 - 5. Aluminum handrails, walkways, window, louvers, and grating unless otherwise specified herein.

1.02 REFERENCES

- A. **SSPC** – Society for Protective Coatings
- B. **ASTM** – American Society of Testing Materials
- C. **NACE** – National Association of Corrosion Engineers
- D. **NSF** – National Sanitation Foundation (Standard 61)
- E. **AWWA** – American Water Works Association

1.03 DEFINITIONS

- A. Field Coating is the coating of new or rebuilt items at the job site. Field coating shall be the responsibility of the Contractor.
- B. Shop Coating is the coating of new or rebuilt items in the shop prior to delivery to the jobsite.
- C. Exterior – Outside, exposed to weather
- D. Interior – Inside, not subject to immersion service
- E. Immersion service – Material submerged or subject to splash or spray
- F. WFT – Wet Film Thickness
- G. DFT – Dry Film Thickness
- H. MDFT – average minimum dry film thickness
- I. **SCARIFY** – Roughen the entire existing coating surface by use of brush off blasting, hand tools, sanding, etc to provide an anchor profile for adhesion by new coating systems. Scarified surface shall be approved by the Coatings manufacturer and County prior to over-coating. Existing rust spots, weld slag, sharp edges, defects etc shall be removed by SSPC-SP11 Power tool cleaning to bare metal.

- J. General: The following referenced surface preparation specifications of the Joint Surface Preparation Standards from NACE International (NACE) and The Society for Protective Coatings (SSPC) shall form a part of this Specification:
1. SSPC-SP1 Solvent Cleaning. Remove all grease, oil, salt, acid, alkali, dirt, dust, wax, fat, foreign matter, and contaminants, etc. by one of the following methods: steam cleaning, alkaline cleaning, or volatile solvent cleaning. Rags and solvents must be replenished frequently to avoid spreading the contaminant rather than removing it. Low-pressure (1500-4000 psi) high volume (3-5 gal/min) water washing with appropriate cleaning chemicals is a recognized "solvent cleaning" method. All surfaces shall be cleaned per this Specification prior to using hand tools or blast equipment and between each coating application.
 2. SSPC-SP5 White Metal Blasting (NACE-1). Complete removal of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter, leaving the surface a uniform gray-white color.
 3. SSPC-SP6 Commercial Blast (NACE-3). Complete removal of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter, leaving only light shadows or discolorations from stains of rust, mill scale, or previous coating on 33% of the unit surface area. At least 66% of each unit surface area shall be free of all visible discoloration or staining.
 4. SSPC-SP 7 Brush-Off Blast (NACE 4). Complete removal of oil, grease, dust, dirt, loose rust, loose mill scale, and loose coatings, leaving tightly adherent mill scale, rust and previous coating. Tightly adherent rust, mill scale or paint may remain providing that it cannot be removed by lifting with a dull putty knife.
 5. SSPC-SP10 Near White Blast (NACE 2). Complete removal of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter, leaving only light shadows or discolorations from stains of rust, mill scale, or previous coating on 5% of the unit surface area. At least 95% of each unit surface area shall be free of all visible discoloration or staining.
 6. SSPC-SP 11 Power Tool Cleaning to Bare Metal. Complete removal of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide, corrosion products, and other foreign matter and retain or produce a minimum 1.0 mil surface profile. Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted.
 7. SSPC-SP 12 Waterjetting (NACE-5). Surfaces preparation by ultra-high pressure water jetting discharged from a nozzle at pressures of 70 MPa (10,000 psig) or greater to prepare a surface for coating or inspection. The difference in degrees of surface cleanliness is defined by the amount of pressure as follows:
 - a. Low Pressure Water Cleaning (LP WC) Less than 34 MPa (5,000 psi)
 - b. High Pressure Water Cleaning (HP WC) 34 to 70 MPa (5,000-10,000 psi)
 - c. High Pressure Water Jetting (HP WJ) 70 to 210 MPa (10,000-30,000 psi)
 - d. Ultra-High Pressure Water Jetting (UHP WJ) Above 210 MPa (30,000 psi)
 - e. WJ-1 Clean to Bare Substrate: Complete removal of all visible rust, dirt, previous coatings, mill scale, and foreign matter. Discoloration of the surface may be present.
 - f. WJ-2 Very Thorough or Substantial Cleaning: Complete removal of all visible oil, grease, dirt, and rust except for randomly dispersed stains of rust, tightly adherent thin coatings, and other tightly adherent foreign matter limited to a maximum of 5% of the surface.

- g. WJ-3 Thorough Cleaning: A WJ-3 surface shall be cleaned to a matte (dull, mottled) finish is free of all visible oil, grease, dirt, and rust except for randomly dispersed stains of rust, tightly adherent thin coatings, and other tightly adherent foreign matter limited to a maximum of 33% of the surface.
- h. WJ-4 Light Cleaning: A WJ-4 surface shall be cleaned to a finish which is free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose coating. Any residual material shall be tightly adherent.
- 8. SSPC-SP13 Surface Preparation of Concrete (NACE-6). Complete removal of contaminants, laitance, form oils, dust, dirt, loosely adhering concrete, and previous coating. Blasting, High-pressure water cleaning or waterjetting methods should be performed sufficiently close to the surface so as to open up surface voids, bug holes, air pockets, and other subsurface irregularities, but so as not to expose underlying aggregate.
- 9. SSPC-SP 14 Industrial Blast Cleaning (NACE-8). Complete removal of oil, grease, dust, dirt, loose rust, loose mill scale, and loose coatings, leaving tightly adherent mill scale, rust and previous coating evenly distributed on 10% of the unit surface area. Stains and discolorations may be present on 90% of the unit area. Tightly adherent rust, mill scale or paint cannot be removed by lifting with a dull putty knife.
- 10. SSPC-SP 15 Commercial Grade Power Tool Cleaning. Complete removal of all visible oil, grease, dirt, rust, coating, oxides, mill scale, corrosion products, and other foreign matter, except random staining shall be limited to no more than 33% of each unit area of surface. Staining may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating. Slight residues of rust and paint may also be left in the bottoms of pits if the original surface is pitted. (Equivalent standard as SSPC-SP6 Commercial Grade Blast Cleaning NACE-3).

1.04 SUBMITTALS

- A. Submit to the Engineer as provided in the General Conditions and Division 1, shop drawings, manufacturer's specifications and data on the proposed paint systems and detailed surface preparation, application procedures and dry film thickness.
- B. Contractor / Applicator Qualifications as listed below shall be submitted prior to the WORK.
 - 1. The Contractor's Project Superintendent / Project Manager shall be at minimum certified NACE Level 1 and be in good standing with NACE International prior to the WORK. The Contractor shall have a Competent Person onsite as defined by OSHA. Certification credentials shall be provided to the County and verifiable through the NACE.org certification search website.
 - 2. The Contractor must show proof that all employees associated with this project shall have been employed by the Contractor for a period not less than six (6) months.
 - 3. Coating shall be performed by experienced painters in accordance with the recommendations of the coating manufacturer and the Contract Documents. All paint shall be uniformly applied without sags, runs, spots, or other blemishes. Work that shows carelessness, lack of skill, or is defective in the opinion of the County, shall be corrected at the expense of the Contractor.

4. The applicator shall have practical experience and successful history in the application of the specified products to surfaces of water supply and wastewater collection and treatment facilities. A written list of references shall be provided to show experience and costs with high performance coatings on pipelines and aerial crossings as well with all other aspects with the defined Scope of Work.
 5. The Contractor shall provide a list of equipment owned and maintained by the Contractor that shall be utilized on the project.
 6. The Contractor shall provide their written QA / QC program.
 7. Contractors shall submit their protection and containment plan to prevent blasting debris, paint chips, paint overspray from entering water bodies, common areas or leaving the immediate work zone.
- C. Schedule of Painting Operations: The Contractor shall submit for approval a complete Schedule of Painting Operations within 30 days after the Notice to Proceed. The Contractor shall properly notify and coordinate with the County for schedule updates and site activities. This Schedule shall include for each surface to be painted, the brand name, the volume of solids, the coverage and the number of coats the Contractor proposes to use in order to achieve the specified dry film thickness. When the schedule has been approved, the Contractor shall apply all material in strict accordance with the approved Schedule and the manufacturer's instructions. Wet and dry paint film gauges shall be utilized by the County to verify the proper application while Work is in progress.
- D. Protection and Containment Plan: The Contractor shall submit for approval the process, equipment, design, materials, requirements, disposal and methods to provide for protection of the environment, collection of abrasive blasting material, collection of existing coatings, protection of the public and protection for public access.
- E. Maintenance of Traffic Plan (MOT): The Contractor shall prepare and submit a Traffic Control Plan to the Owner, and Orange County Public Works Department or Florida Department of Transportation for review and acceptance prior to commencing any Work on the site. The Traffic Control Plan shall detail procedures and protective measures proposed by the Contractor to provide protection and control of traffic affected by the Work consistent with the following applicable standards:
1. Standard Specifications for Road and Bridge Construction, Latest Edition including all subsequent supplements issued by the Florida Department of Transportation (FDOT Spec.).
 2. Manual of Traffic Control and Safe Practices for Street and Highway construction, Maintenance and Utility Operations, FDOT.
 3. Right-of-Way Utilization Regulations, Orange County, Florida, latest edition.
- F. Test panels/samples: At the request of the County, samples of the finished work prepared in strict accordance with these Specifications shall be furnished, and all painting shall be equal in quality to the approved samples. Finished areas shall be adequate for the purpose of determining the quality of workmanship. Experimentation with color tints shall be furnished to the satisfaction of the County where standard chart colors are not satisfactory.

- G. Equivalent materials of other manufacturers may be substituted on approval of the Engineer. Substitutions that decrease the film thickness, the number of coats applied, change the generic type of coating, or fail to meet the performance criteria of the specified materials will not be approved. Prime and finish coats of all surfaces shall be furnished by the same manufacturer. Requests for substitution shall include Manufacturer's literature for each product giving the name, generic type, descriptive information, evidence of satisfactory past performance, and an independent laboratory certification that their product meets the performance criteria of the specified materials including but not limited to the following:
1. Abrasion – Fed. Test Method Std. No. 141, Method 6192, CS-17 Wheel, 1,000 grams load
 2. Adhesion – Elcometer Adhesion Tester
 3. Exterior Exposure – Exposed at 45 degrees facing the ocean (South Florida Marine Exposure)
 4. Hardness – ASTM D3363-74
 5. Humidity – ASTM D2247-68
 6. Salt Spray (Fog) – ASTM B117-73

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. All paints and/or coatings applied in the performance of the Work shall be supplied by one paint supplier and be the product of one manufacturer; unless the County specifies or accepts a specialty paint not available from that manufacturer.
2. The paint manufacturer shall have supplied paint for water and wastewater facilities for a minimum of ten (10) years, and products supplied shall be contained within the manufacturer's standard water and wastewater brochure.
3. When the manufacturer's minimum recommendations exceed the specified requirements, Contractor shall comply with the manufacturer's minimum recommendations.

B. Safety and Health Requirements.

1. In accordance with the requirements of the OSHA Regulations for Construction, the Contractor shall provide and require the use of personal protective and lifesaving equipment for all persons working in or about the Project including, but not limited to, head and face protection, fall protection, safety harnesses and respiratory devices. Applicable health and safety precautions required by appropriate regulatory agencies such as OSHA, ANSI, etc., shall be followed.
2. Ventilation: Ventilation shall be adequate to reduce the concentration of air contaminants to the degree that a hazard to workers does not exist.
3. Sound Levels: Whenever the occupational noise exposure exceeds the maximum allowable sound levels, the Contractor shall provide and require the use of approved ear protective devices.
4. Illumination: Adequate illumination shall be provided while work is in progress. Whenever required by the County, the Contractor shall provide additional illumination and necessary support sufficient to cover all areas to be checked. The level of illumination required for observation purposes shall be determined by the County.

5. Temporary Ladders and Scaffolding: All temporary ladders and scaffolding shall conform to the applicable requirements of the OSHA Regulations for Construction. The Contractor shall provide access to the County for all areas of work during each phase of construction.
6. Safety of Public. Provide scaffolding, signage, temporary pedestrian access and barricades as required to protect the public from the work area. Areas to be closed off shall require public notice.

C. Pre-Job Meeting

1. A pre-job meeting shall be held prior to the commencement of the Work, prior to significant phases or per specific site location if the Work is not contiguous. Attendance shall include the County, Engineer, Contractor, and Painters Site Supervisor. The meeting will address site specific issues including but not limited to: schedule, access to the site, safety requirements, surface preparation, application, coating systems, inspection, quality control, MOT, protection of the public and protection of the environment as covered in the specifications.
2. Copies of all manufacturer's instructions and recommendations shall be furnished to the County and Engineer by the Contractor prior to the meeting.
3. It shall be the responsibility of the Coating Manufacturer to have their factory representative meet in person with the Contractor and Engineer a minimum of three times during the job as a consultant on surface preparation, mil thickness of coating and proper application of coating unless meeting is determined to be unnecessary by the Engineer.

D. Surface Preparation

1. Visual Standard SSPC-VIS-1 (Swedish SIS OS 5900), "Pictorial Surface Preparation Standards for Painting Steel Surfaces" and The National Association of Corrosion Engineers, "Blasting Cleaning Visual Standards" (TM-01-70 and TM-01-75) shall be the standards used to evaluate proper surface preparation.
2. To facilitate inspection, the Contractor shall on the first day of blasting operations, blast metal panels (12" x 12" x 1/4") to the degree called for in the Specifications and as noted above. Once a sample panel has been approved, it shall establish the quality of all subsequent Work by reference. The sample shall then be stored in a dry, sealed plastic container on the job site. Sample panels shall be prepared and approved for each type of sandblasting specified and shall be maintained and utilized by the County throughout the duration of sandblasting operations as reference standards of quality. Coatings shall be applied only at temperatures and conditions recommended by the paint manufacturer.

E. Inspection Devices:

1. The Contractor shall utilize, until final acceptance of the Work, inspection devices in good working condition for the detection of holidays, environmental conditions, and measurements of wet and dry-film thicknesses of protective coatings. Inspection devices shall be operated in strict accordance with the manufacturer's printed instructions and applicable SSPC and NACE standards and guidelines.

2. Thickness and Holiday Checking: Thickness of coatings shall be checked with a nondestructive, magnetic type thickness gauge. Coating integrity of coated surfaces shall be tested with an approved holiday detection unit per the paint manufacturer's recommendation. All pinholes shall be marked, repaired in accordance with the paint manufacturer's printed recommendations and re-tested. No pinholes or other irregularities will be permitted in the final coating. In cases of dispute concerning film thickness or holidays, the Contractor shall abide by the County's determination unless independent tests are performed by a certified lab at the Contractor's expense. Field measurements of film thickness shall not exceed the requirements of SSPC-PA 2 Measurement of Dry Coating Thickness with Magnetic Gages. Discrepancies shall be measured and verified with a micrometer or Tooke gauge if no other option is available.

1.06 PRODUCT DELIVERY STORAGE AND HANDLING

- A. Delivery: All materials shall be delivered to the job in undamaged, original packages with seals unbroken and in legible, labeled containers. Packages shall not be opened until the County inspects them and they are required for use. Labels shall show name of manufacturer, type of coating, formulation, date, color and manufacturers' recommendations and instructions for use.
- B. Storage: All painting materials shall be stored in a clean, dry, well-ventilated place, protected from sparks, flame, and direct rays of the sun or from excessive heat. Paint susceptible to damage from low temperatures shall be kept in a heated storage space when necessary. The Contractor shall be solely responsible for the protection of the materials he stores at the job site. Empty coating cans shall be neatly stacked in areas the Owner designates, and shall be removed from the job site on a schedule the Owner determines.
- C. Mixing: Mechanical mixers, capable of thoroughly mixing the pigment and vehicle together, shall mix the paint prior to use where required by manufacturer's instructions, however, thorough hand mixing will be allowed for small amounts up to one gallon. Pressure pots shall be equipped with mechanical mixers to keep the pigment in suspension, when required by manufacturer's instructions. Otherwise, intermittent hand mixing shall be done to assure that no separation occurs. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations.
- D. Thinning: Catalysts or thinners shall only be utilized as recommended by the manufacturer, and added or discarded strictly in accordance with the manufacturer's instruction. Unless the manufacturer specifically requires thinning for brush or roller application, no thinning shall be permitted.

1.07 PROJECT SITE CONDITIONS

- A. Application: Paint shall be applied only on thoroughly dry surfaces and during periods of favorable weather, unless specifically allowed by the paint manufacturer. Except as provided below, painting shall not be permitted when the atmospheric temperature is below 50° F, or when freshly painted surfaces may be damaged by rain, fog, dust, or condensation, and/or when it can be anticipated that these conditions will prevail during the drying period.
- B. No coatings shall be applied unless the relative humidity is below 85% unless recommended by the manufacturer.
- C. No coatings shall be applied unless surface temperature is a minimum of 5°F above dew point and temperature shall be maintained during curing.

1.08 WARRANTY

- A. Warranty Inspection: Warranty inspection shall be conducted during the eleventh month of the one (1) year warranty period following completion of all painting Work. All defective Work shall be repaired in strict accordance with this Specification, and to the satisfaction of the paint manufacturer and the County.
- B. Fluoropolymer / Fluorourethane. The Contractor shall warrant through the Manufacturer that the coating system shall not: check, crack, blister or delaminate from the substrate; change color more than 12 MacAdam units as determined in accordance with ASTM D2244; exhibit loss of gloss in excess of 24 units as measured by a gloss meter in accordance with ASTM D523-8; or chalk in excess of a rating of 8 as measured in accordance with ASTM D4214, Method A. Warranty coverage shall be effective for a period of 15 years from Final Completion depending on color. The Contractor shall notify the Manufacturer prior to ordering materials and begin the warranty process prior to starting the Work. The warranty information shall be provided to the County prior to ordering materials. Sample panels shall be obtained from the Manufacturer, and at least 2 sample panels shall be provided to the County in addition to the Manufacturers minimum requirements regarding the warranty process. The Contractor shall not be permitted to install the coating system until the Manufacturer has provided assurance that the color, substrate, surface preparation or existing conditions are in conformance with the Manufacturer's requirements for warranty.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The painting schedule has been prepared on the basis of Tnemec and Carboline products, and their recommendations for application.
- B. No paint containing lead shall be allowed.

2.02 COATING SYSTEMS

- A. The following summarizes the painting systems for various types of applications.
- B. The Contractor shall have the coating color matched or tinted by the coating supplier to exactly match Tnemec Color Codes as shown below. Manufacturers other than Tnemec shall submit a color matched swatch to the County for approval prior to ordering materials.

Generic Name	Application	Tnemec Color Codes
Safety Blue	Water Master Meters / Assemblies	True Blue / Safety 11SF
Safety Green	Wastewater Master Meters	Hunter Green 08SF
Safety Green	Pump Station Piping	Hunter Green 08SF
Safety Red	Fire Backflow Assemblies	Candy Apple Red / Safety 06SF
Pantone Purple 522C	Reclaimed Master Meters / Assemblies	Rec Water Purple 16SF
Safety Green	Hydrant Bonnet & Caps	Hunter Green 08SF
Safety Orange	Hydrant Bonnet & Caps	Tangerine Orange / Safety 04 SF
Safety Red	Hydrant Bonnet & Caps	Candy Apple Red / Safety 06SF
Aluminum	Hydrant Barrel	Aluminum 57GR

- C. Minimum film thickness shall be per manufacturer's recommendations unless a greater thickness is specified. The Contractor shall measure minimum film thickness in the field by utilizing a wet film gauge, which the County shall verify. Regardless of anchor profile, the Contractor shall utilize a wet film gauge to verify that the County-specified average minimum dry film thickness (MDFT) is being applied. The calculated value for wet film thickness (WFT) shall be derived from County's average MDFT unless the manufacturer's minimum range is greater. Following the manufacturer's recommended drying time, the Contractor shall measure and provide results to the County verifying that the average minimum dry film thickness meets the MDFT for each coat and final system, utilizing a dry film gauge. The County may conduct side-by-side verification.
- D. Coating systems shall incorporate the paints specified below, applied at the average dry film thickness (DFT) in mils per coat noted, and have the specified minimum average dry film thickness (MDFT) for each individual coat and total system.

HP – High Performance Coatings of FERROUS METALS

System HP-1 EXTERIOR EXPOSURE, UV EXPOSURE (NON-IMMERSION)

Complete removal of existing coating system

Coat	Tnemec	Carboline
Prime	Zinc Series 90-97 2.5 to 3.5 DFT Avg 3.0 MDFT	Carbozinc 621 3.0 to 8.0 DFT Avg 3.5 MDFT
Intermediate	Endura-Shield Series 73 2.0 to 3.0 DFT Avg 2.5 MDFT	Carbothane 133 HB 3.0 to 5.0 DFT Avg 3.5 MDFT
Finish	Hydroflon Series 700 2.0 to 3.0 DFT Avg 2.5 MDFT	Carboxane 950 2.0 to 3.0 DFT Avg 2.5 MDFT
Total	8 MDFT	9.5 MDFT

**System HP-2 EXTERIOR EXPOSURE, UV EXPOSURE (NON-IMMERSION)
Over-coating of localized inaccessible existing coatings and galvanized metal**

Coat	Tnemec	Carboline
Prime	Chembuild 135 4.0 to 9.0 DFT Avg 5.0 MDFT	Carboguard 553 3.0 to 4.0 DFT Avg 3.5 MDFT
Intermediate	Endura-Shield Series 73 2.0 to 3.0 DFT Avg 2.5 MDFT	Carbothane 133 HB 3.0 to 5.0 DFT Avg 3.5 MDFT
Finish	Hydroflon Series 700 2.0 to 3.0 DFT Avg 2.5 MDFT	Carboxane 950 2.0 to 3.0 DFT Avg 2.5 MDFT
Total	10.0 MDFT	9.5 MDFT

**System HP-5 EXTERIOR EXPOSURE, (IMMERSION)
Complete removal of existing coating system for immersion surfaces**

Coat	Tnemec	Carboline
Prime	Zinc Series 90-97 2.5 to 3.5 DFT Avg 3.0 MDFT	Carbozinc 621 3.0 to 8.0 DFT Avg 3.5 MDFT
Intermediate	Hi-Build Epoxoline II Series N69 4.0 to 8.0 DFT Avg 4.5 MDFT	Carboguard 60 4.0 to 6.0 DFT Avg 4.5 MDFT
Finish	Hi-Build Epoxoline II Series N69 4.0 to 8.0 DFT Avg 4.5 MDFT	Carboguard 60 4.0 to 6.0 DFT Avg 4.5 MDFT
Total	12.0 MDFT	12.5 MDFT

System HP-6 EXTERIOR EXPOSURE, UV EXPOSURE (NONIMMERSION)Over-coating of existing water based or unknown coating surface exposed to UV

Coat	Tnemec	Carboline
Existing	Existing coating system	Existing coating system
Spot Prime	Typoxy Series 27WB 4.0 to 14.0 DFT Avg 4.5 MDFT	NA
Prime	Typoxy Series 27WB 4.0 to 14.0 DFT Avg 4.5 MDFT	NA
Intermediate	Endura-Shield Series 73 2.0 to 3.0 DFT Avg 2.5 MDFT	NA
Finish	Hydroflon Series 700 2.0 to 3.0 DFT Avg 2.5 MDFT	NA
Total	9.5 MDFT	NA

DFT = Dry Film Thickness
MDFT = Minimum Dry Film Thickness

2.03 EQUIPMENT

- A. The Contractor's surface preparation, coating and painting equipment shall be designed and suitable for the application of the specific materials herein specified. The Contractor's equipment shall be subject to the approval of the County based on the manufacturer's data.
- B. Effective oil and water separators shall be used in all compressed air lines serving spray painting and sandblasting operations to remove oil or moisture from the air before it is used. Separators shall be placed as far as practical from the compressor.
- C. The Contractor shall furnish all equipment for application of the paint and the completion of the Work in first-class condition and shall comply with recommendations of the paint manufacturer.

PART 3 - EXECUTION

3.01 GENERAL

- A. All coating and painting shall conform to the applicable requirements of the Society for Protective Coatings (SSPC) Manual (most recent edition). Any material applied upon improperly prepared surfaces shall be removed and redone to the satisfaction of the Owner at the sole expense of the Contractor.
- B. All Work shall be performed by skilled craftsmen who are qualified to perform the required work and shall be done in a manner comparable to the best standards of practice found in that trade.
- C. The Contractor shall provide a supervisor to be at the work site during surface preparation, cleaning and coating operations. The supervisor shall have the authority to coordinate the work and make other decisions pertaining to the fulfillment of their contract.
- D. Prior to assembly, all surfaces that will be made inaccessible after assembly, shall be prepared as specified herein, and shall receive the paint or coating system as specified herein.
- E. Coating shall not be applied to wet or damp surfaces and shall not be applied in inclement weather. Do not apply when the surface temperature is less than 5° F above the dew point, or if relative humidity is greater than 85%. Dew or moisture condensation should be anticipated and if such conditions are prevalent, coating should be delayed until the surfaces are dry. Further, the day's coating should be completed well in advance of when condensation will occur, in order to permit the film a sufficient drying time prior to the formation of moisture.
- F. Any surfaces not specifically named in the Scope of Work, and not specifically exempted, shall be prepared, primed and painted in the manner and with materials consistent with these Specifications. The Owner shall select which of the manufacturer's products, whether the type is indicated herein or not, shall be used for such unnamed surfaces. No extra payment shall be made for this painting.

- G. Contractor shall inspect each pipe joint, pipe strap, personal barriers and appurtenances after providing access to the location but prior to commencing surface preparation activities. The Contractor shall immediately report leaks, damage, stripped bolts or nuts to the County.

3.02 SURFACE PREPARATION

- A. Solvent Cleaning: All dust, dirt, oil, or any contaminants that would affect the adhesion or durability of the finish coating shall be removed before hand tool cleaning, abrasive blasting and prior to each coating layer application by cleaning per SSPC-SP1 "Solvent Cleaning."
- B. Defects: All ferrous metal surfaces shall be free of all defects. The Contractor shall remove by chipping or grinding all sharp edges; other defects shall be ground smooth in accordance with NACE Standard RPO178, Appendix C. Weld flux, weld spatter, slag and excessive rust scale shall be removed by SSPC-SP 11 Power Tool Cleaning to Bare Metal. All weld seams, sharp protrusions, and edges shall be ground smooth prior to surface preparation or application of any coatings.
- C. Gaskets: Existing gaskets in between flanged joints shall be cut or ground flush with the existing flanged joint prior to surface preparation or field blasting operations. The Contractor shall not field blast into bell and spigot joints or under tapping saddles. Contractor shall blast perpendicular to the pipe surface. SSPC-SP3 Power Tool Cleaning shall be used inside bells and against tapping saddles to avoid damage to gaskets and locking mechanisms.
- D. Field blasting cleaning for all surfaces shall be accomplished by dry sandblasting method unless otherwise directed, or the County provides written approval
 1. The abrasive used in blast cleaning shall produce an anchor profile in accordance with the recommendations of the manufacturer of the protective coating, which is to be applied to the surface being cleaned.
 2. At all times during the blast cleaning operations, adequate means shall be employed to absolutely insure that existing protective coatings shall not be exposed to abrasion from blast cleaning operations.
 3. All blast cleaned surfaces shall be carefully dried and cleaned prior to application of specified coatings. No coatings or paint shall be applied over damp or moist surfaces.
 4. Field blasting and priming shall be completed on any particular area during the same workday, and the application of the primer shall follow immediately after surface preparation and cleaning prior to formation of any form of corrosion. If the surface is not primed within 8 hours, complete surface preparation shall be repeated.
 5. The Contractor shall at all times keep the work area in reasonably clean condition and shall not permit blasting materials to accumulate in an uncontrolled manner such as to constitute a nuisance or hazard to the satisfactory prosecution of the Work, operation of the existing facilities, public safety, environmental nuisances or public access.
 6. Touch-up systems shall be same as original specification except that approved manufacturer's organic zinc-rich shall be used in lieu of inorganic zinc where this system was originally used. Strict adherence to manufacturer's complete touch-up recommendations shall be followed. Any questions relative to compatibility of products shall be brought to the attention of the COUNTY and Coating Manufacturer; otherwise, Contractor assumes full responsibility.

7. Areas that are inaccessible to abrasive blasting, including adjacent to concrete pedestals, tapping saddles, pressure gauges or other appurtenances shall be cleaned in accordance with SSPC-SP 11 “Power Tool Cleaning to Bare Metal” immediately adjacent to the area as approved by the County.

E. Specified Surface Preparation: All surfaces shall be cleaned per SSPC-SP1 “Solvent Cleaning”. In addition to the surface preparation for the specific Service Condition, surface preparation shall be as follows:

Substrate	Condition	Surface Preparation
All Surfaces	All – Prior to Surface Preparation	SSPC-SP1 Solvent Cleaning
Steel	Exterior / Non-Immersion	SSPC-SP10 Near White Blast (NACE 2)
Steel	Exterior / Immersion	SSPC-SP5 White Metal Blasting (NACE-1)
Ductile Iron Pipe	Exterior / Non-Immersion	SSPC-SP6 Commercial Blast (NACE-3)
Ductile Iron Pipe	Exterior / Immersion	SSPC-SP10 Near White Blast (NACE 2)
Ferrous Metal	Exterior / Non-Immersion / Inaccessible to abrasive blasting	SSPC-SP 11 Power Tool Cleaning to Bare Metal
Galvanized Metals	Exterior / Non-Immersion	SSPC-SP 7 Brush-Off Blast (NACE 4)
PVC	Exterior / Non-Immersion	SSPC-SP1 Solvent Cleaning & Scarify by brush blast, power tools or hand sanding
Existing Coating System to be Over-Coated	Exterior / Non-Immersion	Scarify by brush blast or power tools

1. Exposed Pipe: Bituminous coated pipe shall not be used in above ground or exposed locations and shall be factory epoxy primed for all new pipe installations. After installation all exterior, exposed flanged joints shall have the gap between adjoining flanges sealed with a flexible caulking shall meet ASTM C-920 and shall be Sika Flex 1A or equal to prevent rust stains.
2. The Contractor shall 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.
3. Contractor shall coordinate with the County prior to surface preparation. County approval shall be required prior to application of the prime coat.

3.03 APPLICATION EQUIPMENT

A. Brush and / or Rollers

1. Top quality, properly styled brushes and rollers shall be used. Rollers with a baked phenolic resin core shall be utilized.
2. The brushing or rolling shall be done so that a smooth coat, as nearly uniform in thickness as possible, is obtained. Brush or roller strokes shall be made to smooth the film without leaving deep or detrimental marks.
3. Surfaces not accessible to brushes or rollers may be painted by spray, by dauber or sheepskins, and paint mitt.

4. It may require 2 coats to achieve the specified dry film thickness if application is by brush and roller.

B. Air, Airless or Hot Spray

1. The equipment used shall be suitable for the intended purpose, capable of properly atomizing the paint to be applied, and equipped with suitable pressure regulators and gauges.
2. Paint shall be applied in a uniform layer, with a 50% overlap pattern. All runs and sags should be brushed out immediately or the paint shall be removed and the surface resprayed.
3. High build coatings should be applied by a crosshatch method of spray application to ensure proper film thickness of the coating.
4. Areas inaccessible to spray shall be brushed; if also inaccessible to brush, daubs or sheepskins shall be used, as the manufacturer authorizes.
5. Special care shall be taken with thinners and paint temperatures so that paint of the correct formula reaches the receiving surface.
6. Nozzles, tips, etc., shall be of sizes and designs as recommended by the manufacturer of the paint being sprayed.
7. Edges, corners, crevices, welds, and bolts shall be given a brush coat (stripe coat) of each coating. The stripe coat shall be applied by a brush and worked in both directions prior to spray application. Special attention shall be given to filling all crevices with coating.

3.04 WORKMANSHIP

A. General

1. Under no circumstances shall Asphaltic seal coats and mastics be overcoated.
2. Paints shall be mixed in proper containers of adequate capacity. All paints shall be thoroughly stirred before use and kept stirred while using. No unauthorized thinners or other materials shall be added to any paint.
3. Only skilled painters shall be used, and specialists shall be employed where required.
4. Extreme care shall be exercised in the painting of all operable equipment, such as valves, electric motors, etc., so that the proper functioning of the equipment will not be affected.
5. The Contractor's scaffolding shall be erected, maintained, and dismantled without damage to structures, machinery, equipment or pipe. Drop cloths shall be used where required to protect the environment, the public, buildings, equipment, and areas surrounding the Work. All surfaces required to be clear for visual observations shall be cleaned immediately after paint application.
6. The prime coat shall be applied immediately following surface preparation within 8 hours of the same working day. All paint shall be applied by brushing, paint mitt and roller, conventional spraying, or airless spraying, using equipment approved by the paint manufacturer.
7. Each coat of paint shall be recoated as per manufacturer's instructions. Paint shall be considered re-coatable when an additional coat can be applied without any detrimental film irregularities such as lifting or loss of adhesion.
8. Surfaces that will be inaccessible after assembly shall receive either the full specified paint system or three shop coats of the specified primer before assembly.

9. Finish colors shall be as specified per the color table in section 2.02 of this specification, and shall be factory mixed (i.e., the Contractor shall not tint the paint, unless the COUNTY and the Coating Manufacturer so authorizes.)
 10. All shop-coated surfaces shall be protected from damage and corrosion before and after installation by treating damaged area immediately upon detection. Abraded or corroded spots on shop-coated surfaces shall be cleaned per SSPC-SP1 Solvent Cleaning” and then touched up with the same materials as the shop coat in accordance with the manufacturers instruction. At the discretion of the Owner, all shop coated surfaces that are faded, discolored, or that require more than minor touch up shall be field blast cleaned and repainted.
- B. Field Coating: All painting at the site shall be designated “Field Coating”.
1. All paint shall be at ambient temperature before applying, and no painting shall be done when the temperature is below 50° F, in dust-laden air, when rain is falling, mist is present, when relative humidity exceeds manufacturer’s recommendation when temperature is less than 5° F above the dew point, or until all traces of moisture have completely disappeared from the surface to be painted.
 2. Protective coverings or drop cloths shall be used to protect existing appurtenances, concrete walkways, concrete structures, existing surfaces, the public, the environment and equipment. Care shall be exercised to prevent paint or coating overspray and spatter onto surfaces that are not to be painted. Surfaces from which such materials cannot be removed satisfactorily shall be painted or repainted, as required to produce, a finish satisfactory to the County.
 3. All edges, corners, crevices, welds, hardware and irregular surfaces shall receive a brush coat (stripe coat) of the specified product for each coat prior to application of each complete coat.
 4. Coating shall be applied in a neat manner that will produce an even film of uniform and proper thickness, with finished surfaces free from brush marks or other irregularities. Each coat shall be carefully examined and faulty material, poor workmanship, holidays, damaged areas and other imperfections shall be touched up prior to applying succeeding coats. Each coat shall be thoroughly dry and hard before the next coat is applied in accordance with the coating manufacturer's recommendations for drying time between coats. Coating shall be cleaned in accordance with SSPC-SP1 prior to the application of next coating. In no case shall coating be applied at a rate of coverage greater than the maximum rate recommended by the coating manufacturer.
 5. Coating failures shall not be accepted and shall be entirely removed down to the substrate and the surface recoated. Failures include, but are not limited to, holidays, sags, checking, cracking, teardrops, fat edges, fisheyes, or delamination. Any repairs made on surfaces shall be repaired in accordance with the coating manufacturer's instructions.
 6. Each coat shall be uniform in coverage and color. Successive coats of paint shall be tinted so as to make each coat easily distinguishable from each other with the final undercoat tinted to the approximate shade of the finished coat.
 7. Painting shall be continuous and accomplished in an orderly manner so as to facilitate inspection. Surfaces of exposed members that will be inaccessible after erection shall be cleaned and painted before erection.

8. All materials shall be applied in accordance with the manufacturer's instructions. If spray painting is required, Contractor shall accept all responsibility for any damage caused by overspray and/or drifting paint mist.
9. Caulking: The Contractor shall caulk all voids or interfaces including but not limited to: flanges, threads, nuts, saddles, gaps, voids or spaces between appurtenances and pipe to be coated immediately after the prime coat to prevent rust formation where ferrous metal is not accessible to surface preparation or blasting. Flexible caulking shall meet or exceed ASTM C-920 and shall be Sika Flex 1A or equal.

3.05 FIELD QUALITY CONTROL

At a minimum, the Contractor shall provide field quality control and verification of the coating film thickness utilizing the below methods.

- A. Wet Film Gauge. Both the Contractor and the County shall use a wet film gauge to verify the applied coating desired wet film thickness (WFT) to produce the required minimum DFT.

$$\text{Target WFT} = \text{County specified average MDFT} / \text{Volume Solids} \times 100\%$$

If thinner is applied per the manufacturer's recommendations, the volume of solids shall be reduced accordingly. Regardless of anchor profile, surface pattern or base metal calculation of the substrate, the gauge reported WFT shall meet the target WFT value for the substrate or previously coated surface to ensure the required average MDFT will be achieved.

- B. DFT Magnetic Gauge. Dry Film Magnetic Pull-Off Gauge (Type I) shall be utilized to determine DFT in accordance with SSPC-PA 2 "Measurement of Dry Coating Thickness with Magnetic Gages." The average of the readings shall meet the County-specified MDFT for each coating application. Electromagnetic Gauge (Type II) shall not be considered acceptable for use on ductile iron pipe.
- C. Holiday Testing: Each coating layer shall be holiday tested at the recommended 100-125 volts DC per mil in accordance with the latest edition of the following standards: NACE SP0188-2006, NACE Standard RP0490, ASTM G62 and per the manufacturers recommendations. All low voltage holiday testing shall be performed using a Tinker & Razor Model M-1 Holiday Detector, or equal. Areas found to have holidays shall be marked and repaired in accordance with the paint manufacturer's instructions.
- D. Destructive Testing: Destructive testing using a Tooke gauge shall only be utilized in cases of dispute regarding DFT. The County shall be permitted up to three (3) cuts per disputed area using the Tooke Gauge and the Contractor shall be responsible for repairing the areas examined at no additional cost.
- E. Environmental Testing: humidity, dew point and temperature shall be constantly measured and logged. Any electronic gauges shall be first calibrated against a sling psychrometer each day.

3.06 INSPECTION OF SURFACES

- A. Before application of the prime coat and each succeeding coat, all surfaces to be coated shall be subject to inspection and approval by the County. The Contractor shall correct any defects or deficiencies before application of any subsequent coating. Coatings applied without County approval shall be removed and reapplied at no cost to the County.
- B. The Contractor shall provide the County access to all areas of the Work. All scaffolding or lifts shall be in compliance with OSHA requirements.
- C. The Contractor shall furnish samples of surface preparation and of painting systems to be used as a standard throughout the job, unless omitted by the County.
- D. When any appreciable time has elapsed or has exceeded the manufactures recommendations between coatings, the County shall carefully inspect previously coated areas and surfaces that are damaged or contaminated, in the opinion of the County shall be cleaned and recoated at the Contractor's expense. Re-coating times of manufacturer's printed instructions shall be adhered to.
- E. Coating thickness shall be determined by the use of a properly calibrated "DeFelsko Positest FM" Type 1 Coating Thickness Gauge (or equal) for ferrous metal or a "Tooke" Paint Inspection gauge (or equal) for non-ferrous and cementitious surfaces. Please note that use of the "Tooke" gauge is classified as a destructive test.

3.07 PROTECTION, CONTAINMENT AND CLEAN-UP

- A. The premises shall at all times be kept free from accumulation of waste material and rubbish caused by employees or work. At the completion of the painting remove all tools, scaffolding, surplus materials, and all rubbish from and about the site and leave the area "broom clean" unless more exactly specified.
- B. The Contractor shall protect at all times, in areas where painting is being done, floors, sidewalks, walls, bridges, environment, public property, equipment, vehicles, appurtenances, and finished surfaces adjacent to paint work. Cover all electric plates, surface hardware, nameplates, gauge glasses, etc., before start of painting work.
- C. The Contractor shall contain all spent abrasives, old paint chips, paint overspray and debris by means suitable to the County, including but not limited to, full shrouding of the area. The Contractor shall provide a complete design and plan of the intended shroud or cover. Care must be taken not to modify or damage the structure during the use of the shroud. If damage should occur, the Contractor is held responsible for all repairs. The Contractor's containment shall be adequate enough to stop blasting residue from being released into the environment. There should be no visible emissions of particulate matter or visible deposits on the ground outside the containment area. Water jetting or wet abrasive blast cleaning for the purpose of removing paint and surface debris shall be conducted within a containment designed, installed, and maintained in order to capture paint chips and debris. Collection of the water is not required. Mesh containment materials that capture paint chips and debris while allowing the water to pass through

shall have openings a maximum of 25 mils (625 microns) in greatest dimension. Low Pressure Water Cleaning for the purpose of removing chalk, dirt, grease, oil and other surface debris can be performed without additional containment provided paint chips are removed and collected prior to Low Pressure Water Cleaning (LP WC).

- D. At completion of the work, remove all paint where spilled, splashed, splattered, sprayed or smeared on all surfaces, hardware, equipment, painted, and unpainted surfaces.
- E. After completion of all painting, the Contractor shall remove from job site all painting equipment, surplus materials, and debris resulting from this work.
- F. The Contractor shall remove and properly dispose of all hazardous materials from the jobsite in accordance with Local, State, and Federal requirements as outlined by the Environmental Protection Agency.

3.08 SCHEDULE OF WORK

Asset	Location	Description	Surface Prep	Coating System No.
All	All systems and sites shall receive Solvent Cleaning prior to surface prep & Coating.	All	SSPC-SP1	-----
See Section 01010 For Surface Preparation and Coating System per Site Attach schedule of work to be painted				

END OF SECTION

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SECTION 11305
SUBMERSIBLE PUMPS AND APPURTENANCES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This Section specifies the furnishing, installation, and testing of submersible pumps and associated equipment for the duplex pump station(s), complete, tested and ready for operation. The pumps and associated equipment covered under this Section include the following requirements:
1. Two submersible pumps and motors for each duplex pump station or three submersible pumps and motors for each triplex pump station.
 2. The following accessories and associated equipment are to be provided by the pump supplier for each duplex/triplex pump station:
 - a. pump control panel
 - b. lifting cables and hooks
 - c. hatches and frames
 - d. electrical cables and cable hangers
 - e. level indicators/floats
 - f. mounting elbows, adapters and anchor bolts
 - g. seamless guide/slide rails with Type 316 stainless steel upper guide rail brackets
 - h. pump base plates
- B. Operating Requirements: Pumping equipment provided under this Section shall conform to Table 11305-A "Submersible Pumps Schedule."

1.02 QUALITY ASSURANCE

- A. Unit Responsibility: All equipment including but not limited to the pumps, motors, control panel and level sensors, access hatch frames and covers (for wetwell and valve box), pump mounting elbows, guide rails, pump base plates, pump lifting cable, cable holder, and startup service shall be supplied by the pump supplier to insure unit responsibility.
- B. Factory Tests: The pump manufacturer shall perform the following tests on each pump before shipment from the factory:
1. Megger the pump for insulation breaks or moisture.
 2. Prior to submergence, the pump shall be operated dry and be checked for correct rotation.
 3. Pump shall be operated for 30-minutes in a submerged condition.
 4. Pump shall be removed from test tank, meggered immediately for moisture, oil plugs removed for checking lower seal, inspection plug removed for checking of upper seal and possible water intrusion of stator housing.

5. A written certified test report giving the above information shall be supplied with each pump at the time of shipment.
6. All ends of pump cables shall be fitted with a rubber shrink fit boot to protect cable prior to electrical installation.

C. The Contractor shall furnish and install equipment from a single manufacturer.

1.03 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."

B. Certified pump test performance for:

1. Flow, gpm
2. Total Dynamic Head (TDH), feet
3. NPSHr, feet
4. Input Power and Shaft Power, horsepower
5. Overall Efficiency and Pump Efficiency, %

C. Layout drawings showing installation details with dimensions specific for this application.

D. Shop Drawings for all associated equipment and accessories specified under this Section in accordance with Division 1 in sufficient detail to enable the County to determine compliance with all stated specification requirements.

E. Operating Instructions: Operating and maintenance data shall be furnished to the County as provided in the General Conditions and Division 1. The instructions shall be prepared specifically for this installation and shall include all required cut sheets and operating and maintenance instructions for personnel unfamiliar with such equipment.

F. Manufacturer's Certification

1. After acceptance of pump Shop Drawings, factory performance test data will be submitted for approval on each pumping unit.
2. Tests shall be in accordance with the standards of the Hydraulic Institute including head, capacity, brake horsepower and pump efficiency.
3. A written certified test report shall be supplied with each pump at the time of shipment.

1.04 PRODUCT DELIVERY STORAGE AND HANDLING

A. All equipment shall be delivered in suitable packages, cases or crates, and stored or placed as directed by the manufacturer. Each package shall have an identifying mark and a complete list showing contents. Equipment shall not be stored directly upon the ground.

- B. All equipment shall be lifted and handled in a manner so as not to damage or deform the equipment in any way and in any special way as instructed by the manufacturer.
- C. All parts and equipment shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation. Finished surfaces of all exposed pump openings shall be protected by securely bolted wood planks. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion during periods of storage and installation and shall be satisfactory to the County up to the time of the final acceptance test.

1.05 WARRANTY

- A. Warranty: The pump manufacturer shall warrant the pumps being supplied to the County against defects in workmanship and materials for a period of 5-years or 10,000-hours under normal use, operation and service. The warranty shall apply to 100% parts and labor for the time specified and shall not be prorated.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 MANUFACTURERS

- A. The Contractor shall furnish and install motor driven totally submersible sewage pumps and associated equipment as provided by those submersible sewage pump manufacturers listed in Appendix D "List of Approved Products" to meet the requirements set forth in Table 11305-A.

2.03 MATERIALS

- A. All hardware and accessories in the wetwell shall be Type 316 stainless steel.

2.04 PUMPS AND ACCESSORIES

- A. General
 1. Brass or stainless steel nameplates identifying the name of the manufacturer, voltage, phase, rated horsepower, speed and any other pertinent data shall be attached to each pump.
 2. Anchors and Fasteners: All necessary foundation bolts, plates, nuts, and washers shall be furnished by the equipment manufacturer and shall be Type 316 stainless steel.

- B. Pump Design: The pumps shall be capable of handling raw unscreened domestic wastewater and passing a minimum 3-inch diameter solid sphere.
- C. Casing: The stator casing and oil casing shall be of gray cast iron construction, with all parts coming into contact with sewage protected by a corrosion resistant paint proven to withstand an environment of raw wastewater.
- D. Impeller: The impeller shall be constructed of gray cast iron, ASTM A-48, class 30 – 40. All external bolts and nuts shall be Type 316 stainless steel. Each pump shall be provided with a replaceable metallic wear ring system to maintain pump efficiency. Impellers can be of the closed or open type. The closed type can utilize a single or double vane. The open type shall be single or double vane with a self-cleaning, adjustable cast iron wear plate. All impellers shall be dynamically balanced and of non-clog design capable of passing solids, fibrous material, and heavy sludge and constructed with long throughways with no acute turns.
- E. Mechanical Seals: Each pump shall be provided with a tandem double mechanical seal running in an oil or air reservoir, composed of two separate lapped face seals, each consisting of one stationary and one rotating tungsten carbide or silicone ring with each pair held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening. The compression spring shall be protected against exposure to the pumped liquid. Silicone carbide may be used in place of tungsten carbide for the upper and lower seal. The pumped liquid shall be sealed from the oil or air reservoir by one face seal and the oil reservoir from the air filled motor chamber by the other. The seals shall require neither maintenance nor adjustment and shall be easily replaced. Seal shall be held in place by locking ring. Conventional double mechanical seals are not acceptable. Cartridge seals are acceptable.
- F. Guide Rails, Lifting Cable, and Discharge Elbow
 - 1. The design shall be such that pumping units will be automatically connected to the discharge piping when lowered into place on the discharge connection. Pump removal for service or inspection will be by quick disconnect and hoist retrieve. Removal shall not require personnel to enter the wetwell nor shall nuts, bolts or fasteners require removal. Each pump shall be fitted with 6-feet of Type 316 stainless steel, minimum Grade 50, 3/4-inch chain attached to the lifting mechanism and air craft rated 1/4-inch stainless steel cable provided between the cable holder and the chain ("Grip-eye System", or acceptable equal), to permit raising the pump for inspection and removal using a closed chain hook and electric hoist. The lifting bail shall be constructed of Type 316 stainless steel for each pump.
 - 2. A sliding guide bracket shall be an integral part of the pumping unit and the pump casing shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the wetwell with stainless steel anchor bolts and so designed as to receive the pump discharge flange without the need of any bolts or nuts.

3. Sealing of the pumping unit to the discharge connection shall be accomplished by a simple downward motion with the entire weight of the pumping unit guided by two Schedule 40 welded seamless Type 316 stainless steel guide bars which will press it tightly against the discharge connection. All Type 316 seamless tubular stainless steel guides shall be 2-inch diameter for use with pumps up to 25-horsepower. Pumps greater than 25-horsepower shall use 3-inch diameter Type 316 seamless tubular stainless steel guides. No portion of the pump shall bear directly on the floor of the wetwell and no rotary motion of the pump shall be required for sealing. Sealing at the discharge connection shall be metal-to-metal contact of the pump discharge and mating discharge connection.
 4. The pump base elbow design shall be interchangeable such that it will provide a watertight connection for any of the specified or otherwise accepted pumps without requiring any special tools, gaskets or adapters. Assembly shall be capable of receiving a standard Flygt pump without special modification to either the pump or existing base elbow.
 5. Approved pump manufacturers, if necessary to meet the above specification, shall provide a sliding guide bracket adapter.
 6. Pump base elbow shall be bolted to a 1-inch-thick steel pump base plate which is anchored to the wetwell floor at six locations with 6-inch epoxy anchors. Pump base plate shall extend 6-inches beyond the pump volute and base elbow and trimmed to fit as necessary.
- G. Pump Motor: All motors shall be built in accordance with the latest NEMA, IEEE, ANSI and AFBMA Standards where applicable. The pump motor shall be housed in an air filled watertight casing and shall have Class H insulated windings which shall be moisture resistant. The motors shall be NEMA Design B rated 155°C maximum. Pump motors shall have cooling characteristics suitable to permit continuous operation in a totally, partially or non-submerged condition. The pump shall be capable of running continuously in a totally dry non-submerged condition under full load without damage for extended periods. Before final acceptance a field running test demonstrating this ability, with 24-hours of continuous operation under the above conditions, shall be performed for all pumps being supplied as required by the County. The motor shall be capable of a minimum of 10 starts per hour. Motors 25-horsepower and below shall be rated 230/460-volt, 3-phase and speed shall be nominal 1,750 RPM or less. Motors greater than 25-horsepower shall be 460 volt, 3-phase and speed shall be nominal 1,750 RPM or less. Pump motors shall be non-overloading over the entire published performance curve.
- H. Heat and Moisture Sensors: Each motor shall incorporate a minimum of one ambient temperature compensated overheat sensing device. This protective device shall be wired into the pump controls in such a way that if excessive temperature is detected the pump will shut down. This device shall be self-resetting.

- I. Cables: Cables shall be designed specifically for submersible pump applications and shall be properly sealed. A type CGB watertight connector with a neoprene gland shall be furnished with each pump to seal the cable entry at the control panel. The pump cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the entry body containing a strain relief function, separate from the function of sealing the cable. The assembly shall bear against a shoulder in the pump top. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access through the pump top. Secondary sealing systems utilizing epoxy potting compounds may be used. The manufacturers shall supply a cable cap as part of the spare parts for each pump when this type of sealing system is used. All cables shall be continuous, without splices from the motor to the control panel, unless otherwise approved by the County. The junction chamber containing the terminal board shall be perfectly leak proof.
- J. Special Tools and Spare Parts
 1. Special Tools: Provide special tools for normal operation and maintenance in accordance with the Appendix B "Pump Station Start-Up Report" form.
 2. Spare Parts: The pump supplier will include at least one set of spare parts with a toolbox as detailed in accordance with Appendix B "Pump Station Start-Up Report" form.
- K. Pump Access Hatch and Frame
 1. Material: Structural aluminum or Type 316 stainless steel.
 2. Design
 - a. Liveload: 300-pounds per square foot.
 - b. Regular extruded angle section frame.
 - c. Hatch cover (diamond pattern) opens 90° (degrees) and locks automatically with stainless steel positive locking arm and release handle. Hatch cover shall be permanently embossed "CONFINED SPACE" and painted lettering shall not be acceptable. Each door shall be equipped with a recessed hasp enclosure.
 3. Frame attachments (all Type 316 stainless steel)
 - a. Upper guide rail holders
 - b. Lift cable holder
 4. Hatch hinges: heavy-duty Type 316 stainless steel hinges with tamper proof fasteners.
 5. Accessories
 - a. Lifting handle: Type 316 stainless steel.
 6. Finish: Mill finish with bituminous coating applied to exterior of frame.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All materials and equipment shall be installed as shown on the Drawings and as recommended by the manufacturers.

- B. Additional items of construction, such as concrete work, interior grouting, piping, vents, valves, controls, and other items necessary for the complete installation of the system shall conform to specific details on the Drawings and shall be constructed of materials conforming to the applicable portions of these Specifications.

3.02 INSPECTION, TESTING AND CERTIFICATION

- A. Inspection, Testing and Certification shall comply with Section 01650 "Pump Station Start-Up and Testing."

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TABLE 11305-A-1

SUBMERSIBLE PUMPS SCHEDULE FOR PUMP STATION # 3116		
1. Manufacturer	Flygt	ABS
2. Model Number	CP 3102 MT3	XFP100C CB1
3. Impeller Number	432	PE 35/4
4. No. of Pumps Required	2	2
5. Pump Size, Inches	4	4
6. Primary Capacity, GPM / Total Head, Feet	400 @ 29	400 @ 29
7. Run-out Capacity, GPM / Total Head, Feet	550 @ 22	550 @ 22
8. Shut-off / Total Head, Feet	48	48
9. Motor, HP (NEMA Code)	5.0	4.7
10. Maximum Speed, RPM	1745	1730
11. Explosion Proof Motor Required (yes or no)	No	No
12. Voltage, Volts	230	230
13. Phase	3	3
14. Frequency, Hertz	60	60
15. Service	Raw Unscreened Sewage	Raw Unscreened Sewage
16. Minimum solid sphere size	3-inch	3-inch
17. Minimum Pump Efficiency at Primary Capacity, %	67	67
18. Submergence Requirement, Inches	11.0	12.1
19. Minimum Height of Base Elbow, Inches	15.75	14.6
20. Distance from Pump Volute to Base Plate, Inches	3.37	4.2

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TABLE 11305-A-2

SUBMERSIBLE PUMPS SCHEDULE FOR PUMP STATION # 3117		
1. Manufacturer	Flygt	ABS
2. Model Number	CP 3102 MT3	XFP100E CB1
3. Impeller Number	432	PE 45/4 E
4. No. of Pumps Required	2	2
5. Pump Size, Inches	4	4
6. Primary Capacity, GPM / Total Head, Feet	320 @ 35	320 @ 35
7. Run-out Capacity, GPM / Total Head, Feet	500 @ 22	500 @ 22
8. Shut-off / Total Head, Feet	53	53
9. Motor, HP (NEMA Code)	5.0	6.0
10. Maximum Speed, RPM	1745	1770
11. Explosion Proof Motor Required (yes or no)	No	No
12. Voltage, Volts	230	230
13. Phase	3	3
14. Frequency, Hertz	60	60
15. Service	Raw Unscreened Sewage	Raw Unscreened Sewage
16. Minimum solid sphere size	3-inch	3.15 -inch
17. Minimum Pump Efficiency at Primary Capacity, %	56	56
18. Submergence Requirement, Inches	10.24	12.9
19. Minimum Height of Base Elbow, Inches	15.75	14.6
20. Distance from Pump Volute to Base Plate, Inches	3.34	4.6

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TABLE 11305-A-3

SUBMERSIBLE PUMPS SCHEDULE FOR PUMP STATION # 3216		
1. Manufacturer	Flygt	ABS
2. Model Number	CP 3127 MT3	XFP100E CB1
3. Impeller Number	484	PE 75/4 E
4. No. of Pumps Required	2	2
5. Pump Size, Inches	4	4
6. Primary Capacity, GPM / Total Head, Feet	360 @ 48	360 @ 48
7. Run-out Capacity, GPM / Total Head, Feet	500 @ 42	500 @ 42
8. Shut-off / Total Head, Feet	80	80
9. Motor, HP (NEMA Code)	10.0	10.1
10. Maximum Speed, RPM	1720	1760
11. Explosion Proof Motor Required (yes or no)	No	No
12. Voltage, Volts	230	230
13. Phase	3	3
14. Frequency, Hertz	60	60
15. Service	Raw Unscreened Sewage	Raw Unscreened Sewage
16. Minimum solid sphere size	3-inch	3.15-inch
17. Minimum Pump Efficiency at Primary Capacity, %	58	58
18. Submergence Requirement, Inches	12.0	12.9
19. Minimum Height of Base Elbow, Inches	15.75	14.6
20. Distance from Pump Volute to Base Plate, Inches	3.12	4.6

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SECTION 13423
LEVEL MEASUREMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes the following:
 - 1. Cord type float switch.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, see Appendix D for manufacturers offering products which may be incorporated in Work.

2.02 FLOAT SWITCH (CORD TYPE)

A. Free cable acting float switch shall be furnished to automatically detect liquid level change. Liquid rise of 1-inch from rest position shall operate float switch and reset will occur when liquid level drops 1-inch.

B. Float switch shall consist of polypropylene casing, internal weight, flexible 2-conductor cable with a PVC Type STO, and mercury switch. Inside float housing will be a (normally open black, /closed red) mercury switch encapsulated.. Electrical load for switch contacts shall be rated 4.5 amps at 115 volt AC..

C. Three-conductor cable shall be 8 AWG with 41-strands per conductor made for heavy flexing service and underwater use. .

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 13430
PUMP STATION CONTROL PANELS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Intrinsically safe isolator relays.
 2. Terminal blocks.

1.02 SUBMITTALS

- A. Shop Drawings covering the items included under this Section shall be submitted in accordance with Section 01300, "Submittals."

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements
1. Codes, Ordinances, and Industrial Standards: Design, testing, assembly, and methods of installation for materials, electrical equipment, and accessories proposed under this Section shall conform to National Electric Code and to applicable State and local requirements.
 2. UL listing and labeling of custom-built panels (UL 508) shall be adhered to under this Contract.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with specified requirements, approved manufacturers are listed in Appendix D "Orange County Utilities, Standards and Construction Specifications Manual", dated February 11, 2011.

2.02 CONTROL PANEL

- A. Panel Construction
1. The Contractor shall furnish and install all the necessary panels, meter cabinets, disconnects, conductors, conduits, and other associated electrical components for a complete electrical system. All work shall conform to the latest national and local codes and be in strict conformance with Orange County standards as previously identified. All material and equipment shall be Underwriters Laboratories (UL) listed. All coordination for service and metering shall be accomplished by the Contractor at no additional cost to the County. The Work shall include complete testing of all equipment, components and wiring to demonstrate proper functioning of the system.

2. The manufacturer of the control panel shall be UL certified and provide data to indicate that the manufacturer has a minimum of 3-years experience in the building of pump control panels.
3. The duplex pump control panel shall be housed in a NEMA 12/3R, Type 316, 14-gauge stainless steel enclosure, with drip shield and door gasket. The control panel door shall be operated by a 3-point latch. An additional remote access terminal strip with thirty additional terminal blocks shall be added for SCADA. Enclosure shall have provisions for padlocking the door and a dead front inner door unit for mounting controls. All exterior hardware and hinges shall be stainless steel. All LCD screens shall have an aluminum sunshield painted white with hinged flap covering the screen surrounding the manufacturer's enclosure.
4. There shall be permanently affixed to the interior side of the enclosure door both a nameplate and a 10-inch by 12-inch pocket for log sheet storage. The nameplate shall contain the following information:
 - a. voltage
 - b. phase
 - c. rated horsepower
 - d. rpm
 - e. date manufactured
 - f. pump and control panel manufacturer's name
 - g. pump data
 - h. impeller data
 - i. operating point including design flow and head
 - j. kilowatt input
 - k. amperes at the operating point and at least 2 other points on the pump curve
 - l. pump serial numbers.
5. The control panel enclosure shall be UL 50 type NEMA 3R listed. Overhead T-8 fluorescent lighting shall be controlled by a single pole switch installed inside of the control panel. Light shall be mounted on the inside of the door.
6. The control panel shall consist of a main circuit breaker and generator breaker with mechanical interlock, an emergency power receptacle, a circuit breaker and magnetic starter for each pump motor, and 20-ampere, 120 volt circuit breakers as required. The main circuit breaker and generator circuit breaker shall be equal in rating. Each panel shall contain an additional 20-ampere breaker for SCADA purposes. All circuit breakers shall be operable through the dead front inner door. Additional multi-lug assemblies shall be provided to prevent more than 1-wire per lug. All circuit breakers shall be molded case. The control panel shall respond to liquid level float switches and other approved methods specified by Appendix D "List of Approved Products", to automatically start and stop pumps as well as sound an alarm upon high or low wetwell levels. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the "lead" and "lag" pumps after each pumping cycle. A float type liquid level control system shall continuously monitor wetwell liquid level and control operation of the low-level cutoff for the pumps and shall operate off a 24-VAC circuit.

7. The control panel shall operate a minimum of 2 electrical submersible pumps at the power characteristics specified. The control function shall provide for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump shall automatically start to handle this increased flow. As the flow decreases, pumps shall be cut off at the elevation as shown on the Drawings. Pumps shall alternate positions as lead pump at the end of each cycle. A failure of the alternator shall not disable the pumping system. The alternator shall include a safe, convenient method of manual alternation and also have provisions to prevent automatic alternation without disturbing any wiring. Should the "pump off" regulator fail, the system shall keep the station in operation.
8. The control panel shall be compatible with both of the manufacturers' pumps listed in Table 11305-A - Submersible Pumps Schedule.

B. Power Supply and Main Disconnect

1. Power supply to the control panel shall be 240 volt, 3-phase, 4-wire (Delta) or 480 volt, 3-phase, 4-wire (Y). Minimum service shall be 100-amperes. Single-phase power shall not be accepted.
2. A lockable, non-fused disconnect shall be used for service main disconnects at all stations. In all pump stations, a main disconnect shall be installed between the meter and the panel. Provide dual lugs on load side of disconnect for connection of TVSS equipment. Exception: At pump stations with a generator and transfer switch, provide molded case circuit breaker located ahead of transfer switch for service main disconnect.
3. Disconnect shall be rated for the maximum available fault current from the utility serving the pump station with electrical power.
4. On all 480 volt systems, an additional UL approved lockable, non-fused, safety type switch utility service disconnect shall be installed ahead of the meter.
5. Contractor shall be responsible for coordination of the electrical service with the utility providing power for the installation.

C. Motor Circuit Protectors

1. Each pump motor shall be protected by a 3-pole molded case circuit breaker (See Appendix D "List of Approved Products"). The motor circuit breaker shall be operated by a toggle type handle and shall have a quick make, quick break over-center switching mechanism that is mechanically trip free from the handle so that the contacts cannot be held closed against a short circuit and abnormal currents which cause the motor circuit breaker to trip. Tripping shall be clearly indicated by the handle automatically assuming a position midway between the normal "on" and "off" positions. All latch surfaces shall be ground and polished. All poles shall be so constructed that they open, close, and trip simultaneously. Motor circuit breaker must be completely enclosed in a high strength glass polyester molded case. Ampere ratings shall be clearly visible. Contacts shall be of non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes. A manual push to trip button shall be provided for manual exercising of the trip mechanism.

D. Motor Starter and Selector Switches

1. The panel shall contain a motor starter for each motor. The motor starter shall be across-the-line non-reversing magnetic starter with individual mechanical overload protection on each power leg with reset installed through the dead front inner door unit. Provide solid-state soft start overloads with user selectable bypass contactor for motors greater than 50-horsepower. Local power company regulations shall govern.
2. Selector switches shall be installed on the face of the inner dead front door unit. Selector switch shall be a heavy-duty oil tight "Hand Off Auto" 3-position switch to control the operation mode of each pump motor starter.
3. Motor Disconnect: Where pump motor disconnect and starter is not mounted within site of pump wetwell, (where electrical equipment is mounted within a building or other enclosure) provide additional NEMA 4X stainless steel non-fused disconnect for each pump within site of pump location.

E. Pump Alternator: A solid-state alternator shall be provided to change the pump starting sequence on each pumping cycle. A 3-position alternator test switch shall be provided to control the alternation operation. Switch positions to include the "auto" to provide normal automatic sequence, "off" position to disable alternator, and "test" position with a spring return to allow the alternating of the pump sequence to check alternator operation.

F. Lights and Alarms

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

G. Emergency Power Receptacle: This item shall be required on all stations up to and including 200-ampere main service as approved in Appendix D "List of Approved Products."

H. Additional Control Panel Requirements

1. Wiring
 - a. All power wires shall be THW or THWN 75°C insulated stranded copper conductors and shall be appropriately sized for the given load application. All control circuit wire shall be type THW/THWN stranded. All wiring within the enclosure shall be neatly routed by the use of slotted type wiring duct with snap on type covers.
 - b. Interior wiring shall be neatly bundled with nylon ties and include sufficient loop across the hinges to prevent wire damage, with each end of conductor marked (ID), color: red, 24 volt; white, neutral; black, 120 volt.

2. Terminal Points: Terminal points of all terminal strips shall be permanently identified. All terminal numbers and identifying nomenclature shall correspond to and be shown on electrical diagrams. All wiring shall be permanently identified with heat shrink preprinted labels and be shown on electrical schematic diagrams.
3. Engraved and/or etched Nameplates: All equipment enclosures, circuit breakers, control switches, indicator pilot lights and other control devices shall be identified with permanently affixed legend plates and lamicooid type engraved nameplates where applicable. Nameplates may also be permanently etched into dead front cover of control panel.
4. Surge Protective Device (SPD) A surge protective device shall be included and wired to protect motors and control equipment from lightning induced line surges. All surge protectors shall be UL approved and installed per respective power company requirements and manufacturer's specifications. TVSS shall be connected to a dedicated circuit breaker located within the pump control panel. and be mounted in a separate NEMA 4X enclosure. SPD circuit breaker shall be sized per manufactures recommendation. On larger 480 volt stations with MCC construction, a SPD shall be installed on the MCC or Main Control Panel as applicable. If a transformer and 120/240 volt panel is installed, a second SPD shall be included for the low voltage (120/240 volt) panel.
 - a. The TVSS unit shall be UL listed and labeled as per UL 1449 Current edition.
 - b. The unit shall meet "Testing Requirements" of IEEE 62.41 and 62.45.
5. Elapsed Time Meters: Elapsed time meters shall be 115 volt not reset type and shall totalize pump running time in hours and tenths of hours to 99999.9 hours.
6. Convenience Receptacle: On the face of the dead front inner door unit, there shall be installed a 20-ampere 120 volt, duplex convenience receptacle. It shall be provided with its own single pole, 20-ampere circuit breaker for protection. Ground fault interrupt type shall be required.
7. SCADA Circuit Breaker: A 20A-1P, 120-VAC circuit shall be provided for connection to SCADA equipment provided for the pump station.
8. Control Terminal Blocks: Control terminal blocks shall be of the clamp screw type, rated for 600 volts. Amperage rating shall accommodate the control circuit amperage. An additional 30-space terminal strip shall be installed in the cabinet for future use, with RTU equipment.
9. Control Power Transformers
 - a. On 480 volt control panels, there shall be a control 480/120 volt power transformer with a minimum size of 2.52 KVA to provide 120-VAC power for: coils for starters, 20-ampere duplex receptacle, indicator pilot lights, alarm horn, alarm light, pump alternator, elapsed time meters, SCADA control panel, etc. The secondary side shall have 1 leg fused and the other grounded.
 - b. A 120/24-VAC 75 VA control power transformer shall provide power for float switches.
10. Control Relay: The level control relays shall operate from 24-VAC. They shall be enclosed, plug in 8-pin type with octal style screw terminal sockets.
11. Electrical Schematic: There shall be permanently affixed to the interior side of the exterior enclosure door an electrical schematic diagram and a copy supplied to County personnel at start up. The schematic shall be laminated and include the rated amperage and voltage for all components.

12. Phase Monitor: For all 240-volt stations an 8-pin plug in type phase monitor shall be provided for protection of electrical components due to phase loss. Adequate dummy pin protection shall be provided to prevent accidental interchanging of the 8-pin phase monitor with the 8-pin alternator. All 480-volt stations shall have surface mount type phase monitors. An approved breaker shall provide phase monitor protection. Fuses shall not be used for phase monitor protection.
13. Panel Support: Main support posts shall be minimum 3-inch, schedule 40, Type 316 stainless steel with Type 316 stainless steel cap. All other control panel support brackets and hardware shall be Type 316 stainless steel. Hardware shall include U-channel strut systems, brackets, nuts, bolts, washers, toggle bolts, clamps, straps, etc.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 15062
DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 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.

1.02 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.

1.03 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.

1.04 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 2 - PRODUCTS

2.01 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 to 12-inch), Class 250 (16-inch to 24-inch) and Class 200 (30-inch to 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-pound 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-inch diameter 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-foot 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, and 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.

2.02 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.

2.03 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-feet, 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 1-foot above the pad and have a finished depth of burial of not less than 2-feet or more than 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 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 2 (two) 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 3 - EXECUTION

3.01 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 benchmarks 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.

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 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 are intended to be standard types of PVC pipe and ductile iron fittings for use in transporting wastewater, reclaimed water, and water.

1.02 QUALITY ASSURANCE

- A. Qualifications: All of the PVC pipe and 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 County may select an independent testing laboratory to inspect the material at the production facility for compliance with these specifications. The County will pay for the cost of facility inspection requested by the County.

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Materials and Shop Drawings
- 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. PVC pipe shall be covered with black plastic with a minimum thickness of 15-mil. Joint gaskets shall be stored in a clean, dark and dry location until use.
- 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. 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 County or it shall 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 to prevent 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.
- C. 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.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 MATERIALS

A. Polyvinyl Chloride (PVC) Pipe

1. Standards: AWWA C900/C905 and ASTM D1784/D3034/F679 (Gravity Sewer)
2. Compounds: Class 12454-A or Class 12454-B
3. PVC Gravity Pipe and Fittings: PVC gravity pipe (6-inch to 15-inch), shall conform to ASTM D3034, maximum SDR 35. PVC gravity pipe (18-inch to 36-inch), shall conform to ASTM F679 and uniform minimum "pipe stiffness" at 5% (percent) deflection shall be 46-psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI Bell Plastic Pipe Association standard is UNI B.
4. PVC Pressure Pipe and Fittings: All PVC pipe of nominal diameter 4 to 12-inches shall be manufactured in accordance with AWWA Standard C900 and greater than 12-inches shall be manufactured in accordance with AWWA Standard C905. The PVC pipe shall have a minimum working pressure rating of 100-psi and shall have a maximum dimension ratio of 18. Pipe shall be the same outside diameter as ductile iron pipe.
5. Dimension Ratio/Thickness: (unless otherwise shown on the Drawings)
 - a. Raw Wastewater:
 - (1) Pressure Systems: DR 18
 - (2) Gravity Systems: DR 35 (ASTM D3034) or PS 46 (ASTM F679)
 - b. Treated Wastewater: DR 18
 - c. Reclaimed Water: DR 18
 - d. Raw Water: DR 18
 - e. Potable Water: DR 18
 - f. Irrigation Piping: Schedule 40 or SDR 21
6. Joints:
 - a. Push-on integral bell elastomeric gasket joints:
 - (1) Standards: ASTM D3212/D3139/F477 and UNI-B-1
 - (2) Gaskets:
 - (a) Potable and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) rieber type.
Wastewater Service: Styrene Butadiene Rubber (SBR) rieber type for C900 / C905 pipe. Styrene Butadiene Rubber (SBR) ring type for gravity systems.
 - (b)
 - (3) Pipe Markings: Pipes shall have a manufacturer's home-mark on the spigot. On field cut pipe, the Contractor shall provide home-mark on the spigot in accordance with manufacturer's recommendations.
 - b. Solvent weld (nominal diameter less than 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) Restrained joint devices shall be made specifically for PVC pipe and meet or exceed the requirements in ASTM F-1674.
 - (2) Manufacturers: Uni-flange mechanical joint restraints and bell restraints (for all sizes); Meg-a-lug system as manufactured by EBBA Iron (sizes 12-inches or less), or acceptable equal.
 - (3) Design pressure rating equal to or above test pressure as specified herein.
 - d. Pipe Length:
 - (1) Pressure systems: 20-feet maximum nominal length
 - (2) Gravity systems: 13-feet minimum nominal length
- B. Fittings - Pressure Systems (nominal diameter 4-inches and greater):
- 1. Materials: Ductile iron
 - 2. Joints: Mechanical Joint, Minimum 350-psi pressure rating
 - 3. Gaskets:
 - a. Water and Reclaimed Water Service: Styrene Butadiene Rubber (SBR) ring type
 - b. Wastewater Service: Neoprene rubber ring type
 - 4. Exclusions: Standard double bell couplings will not be acceptable where the pipe will slip completely through the coupling.
 - 5. All fittings shall conform to either ANSI/AWWA C110/A21.10 and/or C153/A21.53, latest revision, and shall be ductile iron.
 - 6. All fittings shall have a date code cast (not printed or labeled), with identification of the date, factory and unit at which it was cast and machined. Fittings shall have distinctly cast on them the pressure rating, nominal diameter of openings, manufacturer's name, the country where cast, and deflection angle. Ductile iron fittings shall have the letters "DI" or "Ductile" cast on them.
 - 7. All potable water main fittings shall have NSF certification and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications.
 - 8. All ductile iron fittings shall have exterior coatings, including markings and colors, and interior linings in conformance with Section 15062 "Ductile Iron Pipe and Fittings."
- C. Fittings - Pressure Systems (nominal diameter less than 4-inches)
- 1. Material: Polyvinyl Chloride (PVC)
 - 2. Joints: Slip fitting tapered socket with solvent weld
 - 3. Solvent: Sure Guard 12 or acceptable equal
 - 4. Exclusions: Plastic saddle and flange joint fittings shall not be used

2.03 LOCATION MARKERS, LOCATION WIRE AND IDENTIFICATION MARKINGS

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 the 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-feet, 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 1-foot above the pad and have a finished depth of burial of not less than 2-feet or more than 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 3M Dynatel 1420 or 3M Dynatel 1420E Electronic Marker System Marker Locator, or acceptable equal. The Contractor shall furnish 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 18-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 2 (two) 10-gauge wires shall be pulled along with the pipe.

C. Identification Markings:

1. Pipe furnished in solid color or white with color lettering as indicated below.
 - a. Lettering along top 90° (degrees) of pipe, minimum 3/4-inch in height with appropriate wording appearing 1 or more times every 21-inches along the entire length of the pipeline.

- (1) Raw Wastewater: Safety Green
- (2) Reclaimed Water: Purple (Pantone 522C)
- (3) Potable Water: Safety 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:
 - a. Installation shall be in accordance with lines and grades shown on the Drawings. For pressure systems, deflection of joints shall not exceed 75% of that recommended by the manufacturer.
 - b. 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 on pipe shall result in rejection of pipe and removal from site. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation.
 - c. 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.
 - d. 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.
 - e. 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 color stripe and pipe text shall be viewed from the top of pipe when installed. When installing PVC pipe, no additional joints will be installed until the preceding pipe joint has been completed and the pipe carefully embedded and secured in place.

- f. Locating Wire: Locating wire, for electronically locating pipe after it is buried, or installed by trenchless technology shall be attached along the length of and installed with the pipe. This is applicable to all sizes and types of pressure mains. At a minimum, the tracing wire is to be attached to the pipe with nylon wire ties. The wire itself shall be 10-gauge single strand solid core copper wire with non-metallic insulation. The insulation shall be color coded for the type of pipe being installed. Continuous continuity must be maintained in the wire along the entire length of the pipe run. Permanent splices must be made in the length of the wire using wire connectors approved for underground applications as listed in the uniform electric code handbook. The coiled wire shall extend to a minimum of 12-inches above the surface and be connected to a test station box at valve locations.
- g. PVC Pressure Pipe Installation and Training: PVC pipe shall be installed in accordance with standards set forth in the UNI-BELL "Handbook of PVC Pipe", AWWA C605, and AWWA Manual M-23. The pipe shall be laid by inserting the spigot end into the bell flush with the insertion line or as recommended by the manufacturer. At no time shall the bell spigot end be allowed to go past the "insertion line" or "homing mark" for pressure pipe applications and homing mark shall be visible.
- h. Field Cutting: PVC pipe can be cut with a handsaw or power driven abrasive disc making a square cut. The end shall be beveled with a beveling tool, wood rasp or power sander to the same angle as provided on the factory-finished pipe. The insertion line on the spigot shall be remarked to the same dimensions as the factory-marked spigot.
- i. All Contractor pipe crews utilizing PVC pressure pipe shall be trained on an annual basis by Uni-Bell in coordination with the County and attended by the manufacturer's representative of the respective approved Manufacturers in Appendix D "List of Approved Products." The Uni-Bell PVC training session will consist of proper handling, storage, installation, and compaction as well as County requirements regarding PVC pipe and deflection. Every person handling, installing or backfilling PVC pipe shall not be permitted to install County owned and / or maintained pipe without training.
- j. Approved manufacturers representatives (Appendix D "List of Approved Products"), not present at the hosted Uni-Bell training session or individuals of pipe crews not in attendance shall be trained on every project site. On-site project training shall be for each manufacturer of pipe utilized on-site, per crew and per project. Specifically each crewmember shall be trained on every project by every pipe manufactures representative regardless of previous on-site training. Every person handling, installing or backfilling PVC pipe shall not be permitted to install County owned and / or maintained pipe without training.
- k. PVC Gravity Pipe Installation: Gravity sewer pipe shall be installed to the homing mark, no tolerance. Any noticeable separation shall be removed and reinstalled. The homing mark may be disregarded to meet the maximum of 1-inch separation between bell and spigot requirement. Joints:

1. 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.
- C. Thrust Restraint
 1. 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 shall be in accordance with the lengths listed in the table as shown on the Drawings.
- D. Installation of Pipes on Curves:
 1. No joint deflection or pipe bending is allowed in PVC pipe. The maximum allowable tolerance in the joint due to variances in installation is 0.75° (degrees) (3-inches per joint per 20-foot stick of pipe). No bending tolerance in the pipe barrel shall be acceptable. Alignment change shall be made only with sleeves and fittings.

3.02 CLEANING AND FIELD TESTING

- A. 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 15065
STAINLESS STEEL PIPE AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope: This section specifies stainless steel pipe and fittings.
- B. Types of Service: Stainless steel piping specified in this Section shall be used for raw sewage discharge piping in the pump station wetwell.

1.02 QUALITY ASSURANCE

- A. References: This Section contains references to the following documents. They are a part of this Section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this Section as if referenced directly. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

Reference	Title
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, 250, and 800
ANSI B16.11.80	Forged Steel Fittings, Socket Welding and Threaded
ANSI B31.1	Power Piping
ANSI B36.19M	Stainless Steel Pipe
ASME Section IX (1989)	Boiler and Pressure Vessel Code; Welding and Brazing Qualifications
ASTM A182/A182M	Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service
ASTM A193/A193M	Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM A194/A194M	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A240	Heat-Resisting Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A276	Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A312/A312M	Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A320/A320M	Alloy Steel Bolting Materials for Low Temperature Service
ASTM A403/A403M	Wrought Austenitic Stainless Steel Piping Fittings
ASTM A409/A409M	Welded Large Diameter Austenitic Steel Pipe for Corrosive or High Temperature Service

ASTM A480/A480M	General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip
ASTM A774/A774M	As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures
ASTM A778	Welded, Un-annealed Austenitic Stainless Steel Tubular Products

- B. Qualifications: All shop fabricated stainless steel pipe and fittings shall be furnished by a single manufacturer who is experienced and qualified in the manufacture and fabrication of the items to be furnished. The pipe and fittings shall be shop-fabricated and field-installed in accordance with common industry wide practices and methods and shall comply with these specifications. Only weld procedures which have been qualified under ASME Section IX and only welders who have successfully completed performance qualification tests per ASME Section IX on these qualified procedures shall be utilized.
- C. Testing: Factory testing shall conform to the requirements of ASTM A312, ASTM A409 HT-0, or ASTM A778, depending on the size and type of stainless steel pipe provided.

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Shop fabrication drawings showing details of materials, piping, fittings, couplings, dielectric connections, joint locations and details, and types and locations of supports.
- C. Certifications specified in the following documents:
 1. ASTM A403, paragraph 14.1
 2. ASTM A774, paragraph 14.1
 3. ASTM A778, paragraph 14.1
 4. ASTM A409, paragraph 17.1
- D. Test results as specified in this Section.
- E. Names and qualification records of proposed welders.
- F. Other data necessary to show conformance of the piping system to these specifications.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 PIPE

- A. Unless otherwise specified, stainless steel piping 3-inches and larger shall be manufactured from ASTM A240 annealed and pickled sheets and plates, Type 316L, in accordance with ASTM A778 or ASTM A409 HT-0. Only extra-low carbon (ELC) materials with 0.030% maximum carbon shall be used. Pipe shall be manufactured to nominal pipe sizes as listed in ANSI B36.19 and shall have nominal wall thickness corresponding to schedule 40S.

2.03 FITTINGS

- A. Unless otherwise specified, stainless steel fittings 3-inch and larger shall be butt weld type manufactured in accordance with ASTM A774 of the same material and in the same thicknesses as the pipe. Long radius elbows less than 24-inches in diameter shall be smooth flow. All short radius, special radius, reducing, and long radius elbows 24-inches and greater in diameter shall be of mitered construction. Reducers shall be straight tapered cone type. Tees, crosses, laterals, and wyes shall be shop-fabricated from pipe.

2.04 FLANGED CONNECTIONS

- A. Connections shall be flanged as specified in Section 15062 "Ductile Iron Pipe and Fittings" and be capable of being mated to ductile iron pipe flanges or pump base elbow.

2.05 GASKETS

- A. Gaskets shall be as specified in Section 15062 "Ductile Iron Pipe and Fittings."

2.06 BOLTS

- A. Bolts, nuts, and washers for stainless steel flange assemblies shall be Type 316 stainless steel with bolts and nuts conforming to ASTM A193 Grade B8M.

2.07 PIPE SUPPORT SYSTEMS

- A. Unless otherwise specified, all hangers, rods, structural attachments, and other components of support systems for stainless steel pipe shall be of the same materials as the pipe.

2.08 FINISH

- A. After all shop operations have been completed, pipe and fittings shall be pickled and passivated in the manufacturer's plant, and scrubbed and washed until discoloration and possible iron picked up from manufacturing process are removed. The standard finish for 16-gauge through 8-gauge material shall be No. 1 or 2B per ASTM A480; 3/16-inch and heavier plate material shall be No. 1-mil finish or better per ASTM A480.

PART 3 - EXECUTION

3.01 PIPE CUTTING, THREADING, AND JOINTING

- A. Pipe cutting, threading, and jointing shall conform to the requirements of ANSI B31.1. All pipe threads shall be lubricated with Teflon tape.

3.02 WELDING

- A. General: Piping with wall thickness up to 11-gauge (0.120-inch) shall be welded with the TIG (GTAW) process. Unless otherwise specified, heavier walls shall be properly beveled and have a root pass with the TIG (GTAW) process followed by subsequent passes with the TIG (GTAW), MIG (GMAW), or Metallic Arc (SMAW) process. Filler wire of ELC grades only shall be added to all welds to provide a cross section at the weld equal to or greater than the parent metal. Weld deposit shall be smooth and evenly distributed and have a crown of no more than 1/16-inch on the I.D. and 3/32-inch on the O.D. of the piping. Concavity, undercut, cracks, or crevices shall not be allowed. Butt welds shall have full penetration to the interior surface, and inert gas shielding shall be provided to the interior and exterior of the joint. Excessive weld deposits, slag, spatter, and projections shall be removed by grinding. Welds on gasket surfaces shall be ground smooth.
- B. Field Welding: Field welding shall be minimized to the greatest extent possible by prefabrication of pipe systems at the factory. Pipe butt welds may be performed at the job site providing the butt welds are performed only with an inert gas shielded process and that other applicable specified welding requirements are rigidly adhered to. All residue, oxide, and heat stain is to be removed from any type of field weld and the affected adjacent areas by the use of stainless steel wire brushes. The field weld shall then be cleaned with an agent such as Eutectic Company's "Eucleen" or equal followed by complete removal of the agent.
- C. Preparation of Surfaces to Be Welded: Surfaces of joints to be welded shall be free from mill scale, slag, grease, oil, paint, rust, and other foreign material. Joints to be welded shall be wire-brushed with stainless steel wire brushes and precisely fitted before welding.
- D. Weather Conditions: Welding shall be done only when the surfaces are completely free of any moisture. Welding of the pipe shall not be done during periods of high winds or rain unless the areas being welded are properly shielded.
- E. Tack Welds, Clips, and Other Attachments: Nicks, gouges, notches, and depressions in the base metal in the area of the joint shall be repaired before the joint weld is made. Tack welds, clips, and other attachments shall be removed and defects repaired, except where the tack welds occur within the weld area and these tack welds do not exceed the size of the completed weld. Cracked tack welds shall be removed. Areas to be repaired shall be ground to clean metal and then repaired by building up with weld metal. The repaired areas shall be ground smooth to form a plane surface with the base metal.

- F. Defects and Repairs: Welds with cracks, slag inclusions, porosity, undercutting, incomplete penetration, or which are otherwise deficient in quality or made contrary to any provisions of these specifications shall be removed by chipping or grinding throughout their depth to clean base metal. Calking or peening of welds to correct defects shall not be done. Welds found deficient in dimension but not in quality shall be enlarged by additional welding after thoroughly cleaning the surface of previously deposited metal and the adjoining plate. Weld deposits, slag, weld spatter, and projections into the interior of the pipe shall be removed by grinding.

3.03 MARKING, SHIPPING, AND STORAGE

- A. Pipe, fittings, and fabrications shall be properly marked with type, gauge, and heat number. Fabricated piping shall have openings plugged and flanges secured for storage or transport after fabrication. Fabricated piping shall be piece-marked with identifying numbers or codes which correspond to the Contractor's layout and installation drawings. The marks shall be located on the spools at opposite ends and 180° (degrees) apart. Pipe spools shall be loaded, blocked, and lagged as necessary to ensure protection from damage during shipping. Stainless steel pipe and fittings shall be stored per manufacturer's recommendation. Dents, gouges, and scratches in stainless steel pipe and fittings are not acceptable and are reason for rejecting pipe and fittings.

3.04 FABRICATION/INSTALLATION REQUIREMENTS

- A. The piping supplier and the Contractor shall use extreme care to avoid the contact of any ferrous materials with the stainless steel piping during manufacturing, fabricating, handling, and installation stages. All saws, drills, files, and wire brushes shall be used for stainless steel piping only. Pipe storage and fabrication racks shall be nonferrous, stainless steel, or rubber-lined. Nylon slings or straps shall be used for handling stainless steel piping. After installation, the Contractor shall wash and rinse all foreign matter from the piping surface. All welded joints shall be treated with a pickling solution, brushed with stainless steel wire brushes, and rinsed clean. If rusting of embedded iron occurs, the Contractor shall pickle the affected surface with Oakite Deoxidizer SS, or equal, scrub with stainless steel brushes, and rinse clean.

3.05 COATINGS

- A. Painting of the stainless steel pipe is not required.

END OF SECTION

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SECTION 15100
ANCILLARY EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Provide all valves and appurtenances, ready for operation, as shown on the Drawings and as specified herein.

1.02 QUALITY ASSURANCE

- A. All valves, appurtenances, and ancillary equipment shall be products of well-established reputable firms who are fully experienced, reputable and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.03 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."

PART 2 - PRODUCTS

2.01 GENERAL

- A. All valves, appurtenances, and ancillary equipment shall be of the sizes shown on the Drawings and specified herein.
- B. All valves and appurtenances shall have the name of the maker and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.
- C. All valves, appurtenances, and ancillary equipment shall be as specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 AIR RELEASE VALVES

- A. For Water Service and Reclaimed Water Service
 - 1. General: Water mains shall be equipped with combination air release valves located as shown on the Drawings. Valves shall be made to remove air at high points where elevation changes exceed 5-feet. Automatic air release valves shall be located at high points for pipe systems greater than 12-inches in diameter.

2. Water and Reclaimed Water Combination Air Release Valves: The valve body shall be 316 stainless steel, 316 stainless steel float, bronze water diffuser Buna-N or Viton seat and stainless steel trim.
3. Fittings from the main to the air release valve shall be threaded and made of brass.

B. For Wastewater Service

1. General: Wastewater force mains shall be equipped with combination air release valves located as shown on the Drawings. Valves shall be made to remove air at high points where elevation change is 2-feet or greater, located in an enclosure as detailed on the Drawings.
2. Wastewater Combination Air Release Valves: The valve body shall be conical in shape and shall be 316 stainless steel with a funnel shape lower body to automatically drain sewage back into the system. All internal parts shall be corrosion resistant 316 stainless steel or non-metallic plastic materials.
3. On flanged connections 316 stainless steel bolts, nuts and washers are to be used along with the proper sized gasket.

C. Air release valves shall be installed in an enclosure.

2.03 TAPPING SLEEVES AND VALVES

A. General: Tapping sleeves shall be mechanical joint sleeves.

B. Mechanical Joint Sleeves: Sleeves shall be cast of gray-iron or ductile-iron and have an outlet flange with the dimensions of the Class 125 flanges shown in ANSI B16.1 and properly recessed for tapping valve. Glands shall be gray-iron or ductile iron. Gaskets shall be vulcanized natural or synthetic rubber. Bolts and nuts shall comply with ANSI/AWWA C111/ANSI A21.11. Sleeves shall be capable of withstanding a 200-psi working pressure.

C. Fabricated Mechanical Joint Tapping Sleeves: Sleeves shall be of split mechanical joint design with separate end and side gaskets. Sleeves shall be fabricated of high strength steel, meeting ASTM A283 Grade C or ASTM A-36. Outlet flange shall meet AWWA C-207, Class "D" ANSI 150-pound drilling and be properly recessed for the tapping valve. Bolts and nuts shall be high strength low alloy steel to AWWA C111 (ANSI A21.11). Gasket shall be vulcanized natural or synthetic rubber. Sleeve shall have manufacturer applied fusion-bonded epoxy coating, minimum 12-mil thickness.

D. Tapping Valves: Tapping valves shall be resilient seated gate valves flange by mechanical joint ends. Valves shall be compatible with tapping sleeves as specified above and specifically designed for pressure connection operations.

1. Tapping valves with alignment lip shall be placed vertical where possible for Water and Reclaimed Water.

2. Tapping Valves 16-inch and larger shall be AWWA C515 resilient seated only (16-inch and 24-inch no gearing required) above 24-inch shall be installed vertically with a spur gear actuator. When tapping existing mains, valves 24-inch and above shall be furnished with NPT pipe plugs for flushing the tracks.

2.04 VALVE BOXES FOR BURIED VALVES

- A. Standard 2-piece Cast Iron Valve Box: Required for mains less than 6-feet below finished grade and less than or equal to 12-inches in diameter.
 1. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by the County's Representative.
 2. The barrel shall be 2-piece, screw type only, having 5-1/4-inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with locking cast iron covers. Coat buried cast iron pieces with coal tar epoxy.
- B. Valve Box Assembly: Valve box assemblies with operating nut extension is required for any size main that is 6-feet or greater below finished grade or if mains are greater than 12-inches in diameter.
 1. Valve boxes shall be 1 complete assembled unit composed of the valve box and extension stem that attaches and locks to the 2-inch wrench nut. The extension shall be high strength, corrosion resistant steel construction, and permanently attached to the operating nut.
 2. The operating nut extension insert shall be 1 complete assembled unit with a self-adjusting extension stem system that fits inside a standard valve box that will accommodate variable trench depths 6-feet and greater as shown in the Drawings. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil.
 3. 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 6-foot and greater as shown in the Drawings.
- C. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The material shall be at minimum galvanized square steel tubing. The stem assembly shall have a built-in device that prevents the stem assembly from disengaging at its fully extended length. The extension stem must be capable of surviving a torque test to 1,000-foot-pounds without failure.
- D. Valve boxes shall have locking cast iron covers utilizing a 5-sided nut with a special wrench needed to open. Covers shall have "WATER", "SEWER", or "RECLAIMED WATER" cast into the top, as applicable
- E. Concrete Collar: Each valve installed in an unimproved area (outside of pavement, driveways or sidewalks) shall require a 24-inch by 24-inch by 6-inch concrete pad or collar as shown in the Drawings.

- F. 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 by 4-inch by 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:
 - 1. Size of the valve
 - 2. Type of valve
 - 3. Service
 - 4. Direction and number of turns to open
- G. Valve markers are to be made of schedule 80 PVC and have decal applied containing information as shown on the Drawings. The marker shall be the same color as the pipe being marked.

2.05 LINE STOPPING ASSEMBLIES

- A. Sleeves used to line-stop existing mains shall be provided and installed at locations as shown on the Drawings. Line-stopping 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 ordering sleeve.
- B. The line-stopping equipment shall consist of a resilient sealing element, which shall be attached to and transported by a plug inserter perpendicularly into the pipe. The linear actuator shall extend and retract the Line-Stopper into and out of the pipe. When retracted from the pipe, the element and inserter shall be contained within the stopper housing.
- C. The hollow cylindrical sealing element shall be molded of natural rubber. The lower interior chamber of the element shall be enlarged into a hemispherical cavity to allow symmetrical deformation into sealing conformity with the bore of the pipe.
- D. The linear actuator shall be hydraulic and shall have a self-contained hand operated pump. The actuator shall exert a force sufficient to perpendicularly deform the cylindrical element into axially symmetrical sealing contact with the bore of the pipe. Design of actuator shall provide adequate stroke and means to continually align the line-stop bullet stopping assemblies in sizes 14-inch through 20-inch with pressure rating to 250-psig.
- E. Equalization of pressure across the sealed element shall not be required to retract the element from the pipe. No equalization fittings shall be required downstream of the line-stopper.
- F. The line-stopping equipment shall be accurately aligned on the 4-inch through 8-inch fittings by locating in the external threads of the fitting nozzle. With sizes 10-inch and 12-inch the location shall be made on the centering groove of the fitting flange.
- G. Line-stopping equipment must be capable of function and acceptance of multiple stopper heads and shall be compatible with existing system fittings.

2.06 FIRE HYDRANTS AND VALVE ASSEMBLIES

- A. Fire hydrants shall be 5-1/4-inch minimum valve opening and shall comply with the current AWWA Standard Specifications C502-54 for 150-psi working pressure. Fire hydrants shall be of ample length for 3-1/2-foot depth of bury with necessary extensions to place safety flange the required 3-inches above finished grade. Each hydrant shall be made in at least 2 sections bolted together. All interior working parts of the hydrant shall be removable from the top of the hydrant to allow repairs without removing the hydrant barrel after it has been installed. It shall be provided with 2 (two) 2-1/2-inch hose nozzles and 1 (one) 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. Drain or weep holes shall be permanently plugged by the manufacturer.
- B. Fire hydrant painting and coating shall meet the requirements of Section 09900 "Painting." Fire hydrants shall be painted silver in accordance with the present Orange County standards. Three (3) operating wrenches shall be furnished for every 10 hydrants installed or relocated.
- C. 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 Specification Section 15111 "Plug Valves."
- D. All hydrants shall have a 24-inch to 48-inch square by 6-inch thick reinforced concrete shear pad as shown in the Drawings.
- E. Fire hydrants shall be located in the general location as shown on the Drawings. Final field location of all hydrants shall be as approved by the County. All hydrants shall be located no less than 5 and no more than 10-feet from the edge of pavement of the adjacent roadway and no less than 5-feet from any physical feature which may obstruct access or view of any hydrant unless otherwise approved by the County.

2.07 SERVICE SADDLES

- A. Stainless Steel Service Saddles: Shall be 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 3-inches wide.
- B. PVC Pipe Service Saddle
 1. One-inch and 2-inch services utilize brass body saddle with controlled OD for 12-inches and smaller pipe.
 2. One-inch and 2-inch taps on existing pipes larger than 12-inches shall use controlled OD epoxy or nylon coated ductile iron body with stainless steel 18-8 type 304 straps.
 3. Four-inch or larger services shall be mechanical tapping sleeves.
- C. Ductile Iron Pipe Service Saddle
 1. One-inch services shall be direct tapped.

2. Two-inch service shall use a controlled OD service tapping saddle with stainless steel straps and a ductile iron body that is either nylon or epoxy coated
3. Four-inch or larger services shall be mechanical tapping sleeves.

D. HDPE Pipe Service Saddle

1. One-inch and 2-inch shall utilize controlled O.D. tapping saddle with epoxy or nylon coated stainless steel 18-8 type 304 double straps.
2. Four-inch or 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. Concrete Pressure Pipe Service Saddle

1. Tapped concrete pressure pipe shall be in accordance with AWWA M-9, using a strap-type saddle made specifically for concrete cylinder pressure pipe.

F. Steel Pipe Service Saddle

1. Welded-on steel sleeves shall be used for all sizes and applications.

2.08 CORPORATION STOPS AND CURB STOPS

- A. Corporation Stops: Shall be brass body reduced port type compatible with the polyethylene tubing and threaded in accordance with AWWA C800, AWWA C901, and shall comply with NSF-61.
- B. Curb Stops: Shall be brass body reduced port type compatible with the polyethylene tubing and threaded in accordance with AWWA C800, AWWA C901, and shall comply with NSF-61.

2.09 WATER MAIN AND RECLAIMED WATER MAIN SERVICE PIPE

- A. Polyethylene Service Pipe: One-inch and 2-inch service lines shall be polyethylene tubing conforming to AWWA C901 and AWWA C800. Tubing shall be approved 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 Ratio) 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.
- B. Ductile Iron Service Pipe: Services 4-inch and larger shall be DIP. If the existing main is on the same side of the street as the property to be serviced, the service pipe shall be DIP from the point of connection to the existing main to the meter assembly. If the existing main is on the opposite side of the street as the property to be serviced, at a minimum, the segment of pipe immediately upstream from the meter assembly shall be DIP.
- C. No service pipe shall terminate under a driveway.

2.10 PRESSURE GAUGES

- A. Pressure gauges shall be installed on each pump station discharge pipe as indicated on the Drawings.
- B. Pressure gauge shall be direct mounted, diaphragm (type) gauge, stainless steel case, stainless steel sensing element, liquid filled, with a 4-1/2-inch diameter dial and furnished with a clear glass crystal window and 1/4-inch shut-off (isolation) valve. Gauges shall be weatherproof.
- C. The pressure gauge face dial shall be white finished aluminum with jet-black graduations and figures and shall indicate the units of pressure measured in psi. Gauges shall be provided with pressure at normal operation at the mid range of the gauge.
- D. As wastewater flows through the housing, the cylinder shall transmit pressure through the sensing liquid. Gauge outlet in the spool or ring shall be threaded, 1/4-inch, per ANSI B2.1.
- E. Nipples for connecting gauges to piping shall be Schedule 80S, Grade TP 316 seamless stainless steel, conforming to ASTM A 312. Fittings shall conform to ASTM A 403, Class WP316. Threads shall conform to ANSI B2.1. Size of pipe nipple shall match the gauge connection size.

2.11 TIE RODS

- A. 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.

2.12 BACK FLOW PREVENTION

- A. Reduced Pressure Backflow Preventer shall conform to the requirements of ASSE 1013, rated to 180°F and supplied with full port ball valves. The main body and access covers shall be bronze and meet ASTM B 584, the seat ring and all internal polymers shall be NSF Noryl and the seat disc elastomers shall be silicone.
- B. Dual check valves shall be required and shall be accessible for maintenance without removing the relief valve or the entire device from the line.
- C. The bottom of the preventer shall be installed a minimum of 12-inches above grade and not more than 30-inches above grade.

2.13 FLANGED COUPLING ADAPTERS

- A. All adapters shall be harnessed with the bolts across the joint (flange to flange or flange to lug) designed for the pipe test pressure.

- B. Adapter Size: Conform in size and bolt hole placement to ANSI standards for steel and/or cast iron flanges 125 or 150-pound standard unless otherwise required for connections.
- C. Exposed Sleeve Type
 - 1. Material: Steel
 - 2. Coating: Enamel
 - 3. Bolting: Carbon steel
 - 4. Acceptable Manufacturers: Dresser Manufacturing Co. - Style 128 for cast iron ductile iron and steel pipes with diameters of 2-inches through 96-inches, or equal.
- D. Buried Sleeve Type
 - 1. Material: Cast iron
 - 2. Bolting: Type 304 stainless steel conforming to ASTM A 193, Grade B8 for bolts, and ATM A 194, Grade 8 for nuts and washers. Bolts and nuts greater than 1-1/8-inches shall be carbon steel, ASTM A 307, Grade B, with cadmium plating, ASTM A 165, Type NS.
 - 3. Acceptable manufacturers: Dresser Manufacturing Co. - Style 127 locking type for cast iron, ductile, iron, asbestos cement and steel pipes with diameters of 3-inches through 12-inches, or equal.
- E. Split Type
 - 1. Material: Malleable or ductile iron.
 - 2. Design: For use with grooved or shouldered end pipe.
 - 3. Coating: Enamel
 - 4. Acceptable Manufacturers: Victaulic Company of America - Style 741 for pipe diameters of 2-inches through 12-inches, Victaulic Company of America - Style 742 for pipe diameters of 14-inches through 16-inches, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All ancillary equipment shall be installed in the locations shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the County before installation.
- B. After installation, all ancillary equipment shall be tested as specified for adjacent piping. If any joint or equipment proves to be defective, it shall be repaired and retested to the satisfaction of the County.
- C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures, which have a direct bearing on the location and shall be responsible for the proper location of these valves and appurtenances during the Construction of the structures.

D. Notification and Connections to Existing Mains

1. The Contractor shall submit a completed "System Connection" form to the County to schedule the connection. The request shall be made a minimum of 5-working days prior to the proposed tie-in to the existing main for pressure connections and 10-working days prior to the proposed tie-in to the existing main for non-pressure connections. In this request, the Contractor shall provide the following information:
 - a. Points of connection, fittings to be used and method of flushing and disinfection if applicable
 - b. Estimated construction time for said connections
 - c. Identify pressure and non-pressure connections
2. Connections shall only be made on the agreed upon date and time. If the Contractor does not perform the Work in the agreed upon manner or schedule, the Contractor shall be required to reschedule the connection by following the procedure outlined above.

E. Pressure Connections: Sufficient length of 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 will be repaired at the Contractor's expense.

1. Prior to the tap, the Contractor shall assemble all materials, tools, equipment, labor, and supervision necessary to make the connection.
2. The Contractor shall excavate a dry and safe working area pit of sufficient size to enable the necessary Work.
3. The inside of the tapping sleeve and valve, the outside of the main and the tapping machine shall be cleaned and swabbed or sprayed with 1% liquid chlorine solution prior to beginning installation for water system pressure connections and must comply with AWWA C-651-99 or most current version.
4. 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 under the observation of County personnel to 150-psi for 30-minute duration to ensure that no leakage will occur.
5. For pressure connections 4-inch through 20-inch installation, the minimum diameter cut shall be 1/2-inch less than the nominal diameter of the pipe to be attached. For larger taps, the allowable minimum diameter shall be 2 to 3-inches less than the nominal diameter of the pipe being attached. After the tapping procedure is complete, the Contractor shall submit the coupon to the County.
6. The tapping valve shall be placed horizontally for pressure connections to wastewater force mains. A plug valve shall be attached to the tapping valve after the tapping procedure is complete. The tapping valve shall be left in the open position prior to backfilling.
7. Adequate restrained joint fittings shall be provided to prevent movement of the installation when test pressure is applied.
8. The Contractor shall be responsible for properly backfilling the work area pit after the Work is completed.

F. Non-Pressure Dry Connections

1. For water service connections, no customer shall be without service for more than 6-hours. For wastewater connections, provide bypass operations per Section 01516 "Collection System Bypass." This accommodation to customers may include scheduling after Normal Working Hours.
2. The Contractor shall be ready to proceed by pre-assembling as much material as possible at the site to minimize the length of service interruption.
3. Needed pipe restraints must be installed prior to the initiation of the shutdown.
4. The excavation shall be opened and needed site preparations must be completed before the initiation of the connection work.
5. County shall postpone a service cut-off if the Contractor is not ready to proceed at the scheduled time.
6. Only County personnel shall operate the valves needed to perform the shutdown on the existing system.

3.02 PAINTING

- A. All exterior surfaces of iron body valves shall be clean, dry, and free from rust and grease before coating.
- B. For valves installed underground or in valve vaults, all exterior ferrous parts of valve and actuator shall be coated at the factory with a thermally bonded epoxy coating in accordance with AWWA C550, latest revision.
- C. For aboveground service, the exterior ferrous parts of all valves shall be coated in weatherproof paint. The color of the finish coats shall be in accordance with the Orange County Utilities Standards.

END OF SECTION

SECTION 15105

CHECK VALVES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Scope of Work: Furnish, install, and test check valves including all appurtenances required as shown on the Drawings and as specified herein.
- B. General Design
 - 1. Valves larger than 2-1/2-inch diameter shall meet or exceed the requirements of AWWA C-508.
 - 2. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of sewage, water, sludge, chemicals, air, etc., depending on the applications.
 - 3. All valves and appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.
 - 4. For all buried valves in which the operating nut is deeper than 4-feet from the finish ground surface, an extension rod with 2-inch operating nut and upper guide shall be installed permanently in the riser section. Extend nut to 1-foot below finish grade.

1.02 QUALITY ASSURANCE

- A. All gate valves of same type and style shall be manufactured by one manufacturer.
- B. All equipment furnished under this Specification shall be new and unused and shall be a standard product which has a successful record of reliable service in similar installations for a minimum of 5-years.

1.03 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Shop Drawings and submittals shall be submitted to the County/Professional Engineer for review and acceptance prior to construction for the following:
 - 1. Certified Shop Drawings showing details of construction, dimensions (including laying length), and weight.
 - 2. Descriptive literature, bulletins, and/or catalogs showing all valve parts and describing material of construction by material and specification, e.g., AISI.
 - 3. Valve coatings and linings, if any.
 - 4. A complete bill of materials for all equipment.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Shipping

1. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed.
2. Factory assembled parts and components shall be dismantled for shipment unless permission is received in writing from the County/Professional Engineer.
3. Finished surfaces of all exposed openings shall be protected by wooden blanks, strongly built and securely bolted thereto.
4. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
5. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage, and handling.
6. Each box or package shall be properly marked to show its net weight in addition to its contents.

B. Storage

1. Store valves and accessories in an area on the construction site protected from weather, moisture, or possible damage.
2. Do not store valves or accessories directly on the ground.

C. Handling

1. Handle valves and accessories to prevent damage of any nature.
2. Carefully inspect all materials for:
 - a. Defects in workmanship and materials
 - b. Removal of debris and foreign material in valve openings and seats
 - c. Proper functioning of all operating mechanisms
 - d. Tightness of all nuts and bolts

1.05 WARRANTY AND GUARANTEES

- A. The manufacturer's warranty period shall be concurrent with the Contractor's for 1-year, unless otherwise specified, commencing at the time of final acceptance by the County.
- B. The Contractor shall be responsible for obtaining certificates for equipment warranty for all equipment which lists for more than \$500.00 (major equipment). The County reserves the right to request warranties for equipment not classified as "major". The Contractor shall still warrant equipment not considered to be "major" in the Contractor's 1-year warranty period even though certificates of warranty may not be required.
- C. In the event that the equipment manufacturer or supplier is unwilling to provide a 1-year warranty commencing at the date of substantial completion, the Contractor shall obtain from the manufacturer a 2-year warranty commencing at the time of equipment delivery to the job site. This 2-year warranty from the manufacturer shall not relieve the Contractor of the 1-year warranty starting at the time of County acceptance of the equipment.

- D. The County shall incur no labor or equipment cost during the guarantee period.
- E. Guarantee shall cover all necessary labor, equipment, and replacement parts resulting from faulty or inadequate design, improper assembly or erection, defective workmanship and materials, leakage, breakage, or other failure of equipment or components furnished by the manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Ball Check Valves, 2-1/2-inches and smaller.
 - 1. Valves shall be all bronze construction with screwed ends.
 - 2. Minimum valve working pressure shall be 150-psi.
 - 3. Valves shall be as manufactured by Crane, Watts, or equal.
- B. Rubber Flapper Swing Check Valves (Sewage/Sludge and Low Pressure Effluent Pumping Application; i.e., less than 50-psi).
 - 1. Valves shall have a cast iron body and cover meeting ASTM A126, Class B specifications.
 - 2. Flapper shall be Buna-N reinforced and shall be easily removed without any need to remove the valve from line.
 - 3. Ends shall be flanged, 125-pound ANSI B16.1. The flapper shall be Buna-N having an "O" ring seating edge and be internally reinforced with steel.
 - 4. Valve shall provide drip-tight shutoff.
 - 5. Each check valve shall be provided with an NEMA 4X limit switch mounted on the horizontal centerline of the body seat.
 - 6. Provide a manually operated backflow device which shall positively lock open flapper during full backflow.
 - 7. The FLEX portion of the disc shall have a 20-year warranty.
 - 8. Valves shall be manufactured by Apco Valve and Primer Corp., Series 100, Val-Matic Valve and Manufacturing Corp., Swing Flex, or equal.
- C. Swing Check Valves
 - 1. Swing check valves shall conform to AWWA C508.
 - 2. The valve body shall be 2-piece cast iron conforming to ASTM A126 with flanged ends conforming to ANSI B16.1. The area throughout the valve body shall be equal to the full pipe area.
 - 3. The valve disc shall be ductile iron with bronze or resilient seating face. The disc shall be partially balanced with a short travel to resist slamming.
 - 4. The seat ring and disc ring shall be ASTM B763 Alloy 84400 bronze, with beveled edges, firmly clamped or screwed into the valve body. Seat rings and disc rings shall be field replaceable.
 - 5. The hinge pin shall be of stainless steel with bronze bushings, allow free movement of the disc without binding, and shall be guaranteed not to stick in the closed position.
 - 6. The valve shall be designed for a minimum working pressure of 150-psi.
 - 7. Valves shall be supplied with an outside lever and adjustable weight.

8. Valves 4-inches and larger shall be 8-mil epoxy lined.

D. Cushioned Swing Check Valves (Potable Water and High Pressure Effluent Application greater than 50-psi).

1. All materials shall be as follows:

Table 15105-1
Materials of Construction

PART	MATERIAL	ASTM or SAE
Body, Cover, Disc	Cast Iron	A 126 GR.B
Disc Arm	Ductile Iron	A 536
Seat	Aluminum bronze or Stainless Steel	B 148 A 276
Seat Ring	Buna-N rubber or Metal	
Hinge Shaft	Stainless Steel	Type 303

2. Valve body shall have integral flanges.
3. The seat shall be centrifugally cast bronze with an o-ring seal and be locked in place with stainless steel lock screws and be field replaceable without the use of special tools.
4. The shaft shall be single and continuous stainless steel, extending both sides of the body with a lever and weight, using a side-mounted air cushion cylinder.
5. The air cushion cylinder shall be constructed of corrosion resistant material and the piston shall be totally enclosed. The cylinder assembly shall be externally mounted to the valve body and will permit adjustability to cushion the closure of the check valve.
6. The valve shall prevent backflow of water on normal pump shut-off or power failure and shall be watertight.
7. A valve position indicator and micro switch shall be provided to remotely indicate open/close position of check valve.
8. Valve body area shall equal or exceed the full pipe area.
9. Valve shall be Series 6,000 air cushioned swing check valve as manufactured by APCO or acceptable equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install valves and accessories in strict accordance with manufacturer's instructions and recommendations, as shown on the Drawings and/or as directed by the Owner.
- B. Carefully erect all valves and support them in their respective positions free from distortion and strain.

- C. Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.
- D. Support all valves connected to pumps and equipment, and in piping systems that cannot support valves.
- E. Repair any scratches, marks and other types of surface damages, etc., with original prime coating as supplied by the factory.
- F. Apply finish coating in accordance with Division 9.

3.02 DEMONSTRATION AND TESTING

- A. Demonstration, start-up (adjustment) and testing shall demonstrate that all valves have been properly installed and that check valves operate properly.

END OF SECTION

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SECTION 15110
PLUG VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

Wastewater force mains shall have plug valves installed as shown on the Drawings. This Section specifies plug valves, manual actuators and associated valve boxes.

1.02 QUALITY ASSURANCE

A. References

Reference	Title
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A276	Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A436	Austenitic Gray Iron Castings
ASTM A536	Ductile Iron Castings
AWWA C504	Rubber Seated Butterfly Valves

B. Proof-of-Design Tests

The Contractor shall furnish the County three (3) certified copies of a report from an independent testing laboratory certifying successful completion of proof-of-design testing conducted in accordance with AWWA C504, Section 5.2, except that where the word "disc" appears in the standard, it is understood to mean "plug." In lieu of testing the valves at an independent testing laboratory, proof-of-design testing may be performed at the valve manufacturer's laboratory, but must be witnessed by a representative of a qualified independent testing laboratory, and all test reports must be certified by the laboratory representative. Proof-of-design testing shall have been performed on at least 3 (three) 6-inch diameter valves, with all 3 (three) test units demonstrating full compliance with the test standards. Failure to satisfactorily complete the test shall be deemed sufficient evidence to reject all valves of the proposed make or manufacturer's model number.

1.03 SHOP DRAWINGS AND SUBMITTALS

A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."

- B. **PRODUCT DATA:** The following information shall be provided in accordance with 1.03 of Section 01300 "Submittals."
1. Manufacturer's product data
 2. Proof-of-design test reports specified in paragraph 1.02 B

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 MANUFACTURERS

Plug valves meeting the requirements of this Section shall be supplied from the approved manufacturers as listed in Appendix D "List of Approved Products."

2.03 MATERIALS

Materials of construction shall be as follows:

Component	Material
Body	Cast iron, ASTM A126, Class B
Plug	Cast iron, ASTM A126, Class B, or cast iron ASTM A436 (Ni-resist), or ductile iron, ASTM A536
Plug facing	Neoprene
Body seats	
3-inches and larger	Nickel
Packing	Buna V-flex or TFE

2.04 MANUFACTURE

- A. **Plug Valves:** Valves shall be straight-flow non-lubricated resilient plug type suitable for drip tight, bi-directional shutoff at the specified valve design pressure.
1. Plug valves shall be eccentric, ball centric or full port. All valves shall open counter-clockwise.
 2. All buried valves shall be fitted with valve boxes as specified in Paragraph 2.03.B of this Section. One 2-inch square tee-handled valve wrench, made by the valve manufacturer, of suitable length to operate all valves within valve boxes shall be furnished for every 5 valves installed.
 3. Plug valves shall be installed complete with extension stems, buried gear actuators, and 2-inch operating nuts (buried) or operating hand wheels (exposed), as required for normal operation. All valve nuts shall be brought up to 1-foot below the proposed finish grade.

4. 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.
5. Ball centric/eccentric plug valves shall be of the non-lubricated type. The port area for valves 4-inches to 20-inches shall have a minimum 80% nominal pipe diameter and valves 24-inches and larger shall have a minimum port area of 70% of nominal pipe diameter unless noted on the Drawings as "full port". Plug valves denoted as full port shall have a port area equal to the full area of the nominal pipe diameter.
6. Minimum pressure rating of valves 4-inches to 12-inches shall be 175-psi; valves 14-inches to 72-inches shall be 150-psi. Valve bodies shall be cast iron ASTM A126, Class B and fusion-bonded epoxy coated.
7. Valve ends shall be mechanical joint (buried) or flanged (exposed) as indicated on the Drawings. Valve flange drilling for valves 3-inches and larger shall be per ANSI B16.1, Class 125. 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% nickel. Packing shall be adjustable and safely replaceable without disassembling the valve. Bushing shall be 316 stainless steel in both upper and lower journals and shall 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.
8. Actuators: Manual valves shall have lever or gear actuators and tee wrenches, extension stems, and floor stands as indicated on the Drawings. Valves 6-inch and larger shall be equipped with buried service rated gear actuators. Buried valves shall have a 2-inch square operating nut. All gearing shall be enclosed in a steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. Actuator shafts shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. Exposed nuts, bolts and washers shall be 316 stainless steel. Valve packing adjustment shall be accessible without disassembly of the actuator.
9. Valve Testing: Plug valves shall be tested in accordance with AWWA C504. Each valve shall meet the performance, leakage, and hydrostatic tests described in AWWA C504. The leakage test shall be applied to the face of the plug tending to unseat the valve. The manufacturer shall furnish certified copies of reports covering proof-of-design testing as described in AWWA C504.

B. Valve Boxes

1. All valves installed underground shall have cast iron 2-piece valve boxes. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by the County. The barrel shall be screw type only, with a 5-1/4-inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with locking cast iron covers. Covers shall have "SEWER" cast into the top for all wastewater mains which shall be so constructed as to prevent tipping or rattling.

2. A valve box with an operating nut extension is required for any size main that is 6-feet or greater below finished grade. The extension shall be high strength, corrosion resistant steel construction and permanently attached to the operating nut. The operating nut extension insert shall be one complete assembled unit with a self-adjusting extension stem system that fits inside a standard valve box. 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. The valve box assembly shall be adjustable to accommodate variable trench depths 6-foot and greater as shown in the Drawings.
3. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The material shall be 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 foot-pounds without failure.
4. The valve boxes shall have locking lids.
5. Extension sections shall be cast or ductile iron only.
6. Valve boxes in non-paved areas shall be installed with a valve collar as shown in the Drawings. The protective concrete collar with a bronze identification disc shall be constructed of Class B concrete as shown on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLING VALVES AND BOXES

- A. 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 plug shaft installed horizontally with the plug rotating upward to the top of the valve. Any valve that does not operate correctly shall be removed and replaced. Seats shall face in the direction as recommended by the manufacturer.
- B. Valve Boxes: Valve boxes and risers 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 ductile iron 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.

END OF SECTION

SECTION 16010
ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The Work covered under this Division of the Specifications is intended to include the furnishing of all materials, equipment and labor necessary for or reasonably incidental to, the installation of a complete and fully operative electrical system as indicated on the Drawings and specified in this Section.
1. The Work shall consist generally of, but is not limited to, the following major items:
 - a. Circuit Protective Devices
 - b. Conduit and Wiring
 - c. Equipment Connections
 - d. Temporary power
- B. Work Not Included: The following work is not included in this Section:
1. Furnishing of pump control panels.
- C. Fees and Permits
1. Obtain all permits required for the Work and include the cost of same in bid.
 2. The Contractor shall also include in the bid, the cost for the power company service.

D. Certificate of Inspection

The Contractor shall pay for a final inspection made of the complete electrical installation and shall deliver a certificate of approval of the complete Work to the County before receiving final payment.

E. Service

Voltage and Phase as indicated on the Drawings. Secondary metered electrical power underground or overhead as indicated on the Drawings. Serving electrical utility company is as noted on the Drawings.

1.02 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."
- B. Submit to the County as provided in the General Conditions, Shop Drawings, manufacturer's literature and technical data on the proposed electrical systems before commencing work.

C. Shop Drawings

1. Submit copies of manufacturer's drawing of surge protection devices, circuit protective devices, panel boards, conduit, wire, wiring devices, and any other special electrical equipment to be installed, and shall receive the County's acceptance before ordering the same for installation.
2. All Shop Drawings shall be submitted in a 3-ring binder with each specification section indicated with tabs.
3. If Shop Drawings are submitted intermittently and not in 3-ring binders, they will not be reviewed and they will be returned to the Contractor for proper submittal.
4. Acceptable Equivalent
 - a. Any manufacturer and/or catalog number listed on the Drawings or in the Project Manual shall be construed to mean "or acceptable equivalent" as listed in Appendix D "List of Approved Products."
 - b. Any substitutions to be considered as "Acceptable Equivalent" shall be submitted with both the cut of the proposed substitution and a cut of the specified equipment to the County in writing, and returned to the Contractor at least 10-days prior to bid opening.
 - c. No substitutions shall be submitted or will be allowed after the contract has been awarded.

1.03 QUALITY ASSURANCE

A. Qualifications of manufacturers, materials and equipment

1. Material and equipment, except as herein otherwise noted, shall be new and conform to standards specified herein defined to include conduits, cable, wiring materials and devices and panel boards.
2. Materials and equipment shall be of an approved design.
 - a. Similar materials shall be of one manufacturer wherever possible.
3. Equipment offered under these Specifications shall be limited to products regularly produced and recommended for service ratings in accordance with manufacturer's catalogs, engineering data, or other comprehensive literature made available to the public and in effect at the time of opening of bids.
4. Install equipment in strict accordance with manufacturer's instruction for type, capacity and suitability of each piece of equipment used.
 - a. Obtain these instructions, which shall be considered a part of these Specifications.

B. Qualifications of supervisor, workmanship and installers

1. The Contractor shall have a Master Electrician constantly supervising the Work covered by these Specifications, and so far as possible shall keep the same foreman on the job from start to finish.
 - a. The workmanship of the entire job shall be excellent and only experienced and competent workers shall be employed for the Work.

1.04 CODES AND REGULATIONS

- A. Work shall be installed in accordance with the regulations and requirements of the National Electrical Code NFPA No. 70; Life Safety Code NFPA No. 101, Standard Building Code as well as all rules, state and local codes, regulations and requirements of the telephone and power companies.
- B. Where conduits and/or cables penetrate wetwell walls, the penetrations shall be sealed in accordance with NFPA 70, Article 500.
 - 1. The above shall be ascertained and fully coordinated before the installation of any material, equipment, and the like, and any discrepancy shall be immediately brought to the attention of the County in writing, and the Contractor shall receive a disposition of same before proceeding with the Work.
 - 2. Furnish, without additional charge, any additional materials and labor that may be required for compliance with these codes, law, rules, regulations or requirements even though the work is not mentioned in these Specifications or shown on the Drawings.
- C. Material and equipment shall bear the label of approval of the National Board of Fire Underwriters Laboratory.

1.05 INSPECTIONS

- A. All work and materials covered by these Specifications and shown on the Drawings shall be subject to inspection at any and all times by the County.
- B. If the County finds that any material does not conform with these Specifications, the Contractor shall within 3-days after being notified by the County; remove the material from the premises, and if said material has been installed, the entire expense of removing and replacing same, including any cutting and patching that may be necessary, shall be borne by the Contractor.
- C. Tests

The County reserves the right to inspect and test any portion of the equipment during the progress of this Work.

- 1. The Contractor shall test the entire system in the presence of the County when the Work is completed to insure that all portions are free from short circuits and grounds.
- 2. All equipment, material and labor necessary to conduct the above tests shall be furnished at the Electrical Contractor's expense.

1.06 PRODUCT HANDLING

- A. Protection of Equipment, Material and Work: The Contractor shall effectively protect and pay for protection of the work, materials or equipment, as is liable to injury during the construction period.
 - 1. Openings into any part of the conduit system as well as associated fixtures, equipment, and the like, both before and after being set in place, shall be securely covered or otherwise protected to prevent obstruction of the conduit, or injury due to carelessness or maliciously dropped tools or materials, grit, dirt, or any foreign matter.
 - a. The Contractor will be held responsible for all damage done until the Work is fully and finally accepted.
 - 2. Cover conduit ends with capped bushings.
- B. Repair of damage: In the event of damage, repair shall be made immediately, to the County's satisfaction and at no additional cost to the County.
- C. Special Handling: Special care, storage and handling of new and existing lighting fixtures shall be taken to minimize breakage of lenses and lamps shipped with fixtures.
 - 1. Immediately replace any breakage with the exact lens or lamp.

1.07 JOB CONDITIONS

- A. Accuracy of Data: The data given herein and on the Drawings are as exact as could be secured.
 - 1. The Specifications and Drawings are for the assistance and guidance of the Contractor.
 - 2. Exact locations, distances, levels, and the like, will be governed by the building field conditions and the Contractor shall use the data contained herein with this understanding.
- B. Drawings
 - 1. The electrical drawings are diagrammatic, but shall be followed as closely as actual construction and work of other Contractors will permit.
 - 2. Deviations from diagrammatic electrical drawings required by either building construction or the work of other Contractors shall be made by the Contractor at his/her expense.
 - 3. It is not the intention of the Drawings or specifications to indicate each piece of conduit and fittings required for the satisfactory operation of the installation and whereby one is indicated, but not specified, or specified but not indicated on the Drawings, it shall be considered to be both specified and indicated.
- C. Measurements
 - 1. Review the Contract Drawings and Specifications and visit the job site to ascertain all conditions, including conduit runs, interfacing, interferences, conflicts, discrepancies, etc., and shall report the same to the County for clarification 10-days prior to submittal of the bid.

2. Failure to comply with this condition shall constitute an acceptance of the conditions and any necessary changes will be at Contractor's expense.
3. The Contractor shall make all measurements necessary for his/her work and shall assume responsibility for their accuracy.
4. Install necessary pull boxes, manholes and junction boxes as may be required to accomplish the distribution system indicated on the riser diagram.

D. Structural difficulties: Should any structural difficulties prevent the setting of cabinets, running conductors, and the like, at points indicated on the Drawings, the necessary deviation will be as determined by the County shall be made without additional cost.

E. Cooperation with Other Contractors

1. The Contractor shall arrange all parts of his/her work in proper relation to the work of other Contractors.
2. Where interferences occur, the Contractor shall, before installing the work involved, consult with the County as to exact location and level of his/her work.
3. The County's decision will be final.
4. The Contractor shall be responsible for arrangement of his/her work and equipment and maintenance of proper headroom under this Work.
5. Should work installed under this Section require any modifications to avoid interference with the other work, such changes shall be made without additional cost.
6. The County's decision as to determination or allocation or responsibility where conditions require changing of work, shall be final.
7. If any work of the Contractor is dependent for its proper execution on contiguous work, examine such work and report in writing any defect thereon or conditions rendering it unsuitable.
8. The beginning of work, without making such report, shall constitute an acceptance of such work, and any defects in his/her own work consequently shall be his/her responsibility.

1.08 TEMPORARY SERVICE

- A. Temporary power: Provide, maintain and remove after construction is completed, a temporary, receptacle and power system in accordance with the progress schedule.
 1. Receptacles: Ground fault interrupter type.
 2. Three Phase Power for Testing Motors: Provided at all necessary points.
- B. Temporary telephone service: Each respective trade shall be responsible for providing and maintaining their telephone services.

1.09 CLEANING

- A. Keep the premises free of debris and unusable materials resulting from the Work, and immediately upon completion of the Work remove such debris and material from the site and leave floors broom clean in areas affected by the Work.

1.10 GUARANTEE

- A. Leave the electrical installation in proper working order and without charge, replace any work or materials which develop defects within 1-year from date of final inspection and acceptance by the County.

1.11 DEFINITIONS

- A. In this Division "provide" is used as a term contraction meaning "to furnish, install and connect up completely in the specified or in an approved manner for the item and/or material described."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 16110

RACEWAYS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

- A. Extent of raceway work is indicated by drawings and schedules.
- B. Types of raceway specified in this Section include the following:
 - 1. Liquid tight flexible metal conduit
 - 2. Rigid non-metallic conduit (PVC)
 - 3. Rigid aluminum conduit
- C. Electrical non-metallic tubing (ENT) is not acceptable.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience that will allow for quality and successful manufacture of raceway systems of types and sizes required for this Project.
- B. Installer's Qualifications: Firms shall have sufficient experience to allow for quality and successful installation of electrical raceway work required for this Project.

1.04 CODES AND STANDARDS

- A. NEMA Compliance: Comply with applicable requirements of NEMA Standards Publications pertaining to raceways.
- B. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL listed and labeled.
- C. NEC Compliance: Comply with applicable requirements of NFPA-70 pertaining to construction and installation of raceway systems.
- D. Comply with NECA "Standard of Installation."
- E. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

1.05 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."
- B. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions for each type of raceway system required. Include data substantiating that materials comply with requirements.
- C. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 NON-METALLIC CONDUIT

- A. General: Provide non-metallic conduit and fittings of types, sizes, and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, which comply with provisions of NFPA-70 for raceway.

B. Electrical Plastic Conduit

1. Extra Heavy Wall Conduit: Schedule 80, UL rated, construct of polyvinyl chloride compound C 200 PVC, and UL listed in accordance with NFPA-70 Article 347 for direct burial, or above ground use. Conduits shall be UL listed and marked for use with conductors having 90°C insulation. Use conduits, couplings, bushings, elbows, nipples, and other fittings meeting the requirements of NEMA TC 2 and TC 3, Federal Specification W C 1094, UL, NEC, and ASTM specified tests for the intended use. Use only conduit with a factory formed bell on 1 end. Conduit that requires the use of couplings for straight runs will not be acceptable. Minimum size 3/4-inch exposed, 1-inch embedded or buried.

C. Conduit and Tubing Accessories: Provide conduit and accessories of types, sizes, and materials, complying with manufacturers published product information, which mate and match conduit.

D. Conduit Bodies: Provide extra heavy PVC conduit bodies of types, shapes and sizes as required to fulfill job requirements and NFPA-70 requirements. Construct conduit bodies with threaded conduit entrance ends, removable covers, either cast or of galvanized steel and corrosion resistant screws.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering conduit bodies which may be incorporated in the Work include, but are not limited to the following:

1. Appleton Electric; Div. of Emerson Electric Co.
2. Arrow Hart Div.; Crouse Hinds Co.
3. Bell Electric Div.; Square D Co.
4. Killark Electric Mfg. Co.
5. O Z/Gedney Div.; General Signal Co.
6. Spring City Electrical Mfg. Co.

2.03 RIGID ALUMINUM CONDUIT

A. Meet requirements of ANSI C80.1 and UL6.

B. Material: Type 6063, copper free aluminum alloy.

C. Available Manufacturers

1. Appleton Electric, Div. Of Emerson Electric Co.
2. Arrow Hart Div; Crouse Hinds Co.
3. Bell Electric Div.; Square D Co.
4. O-Z/Gedney Div.; General Signal Co.

D. Minimum size shall be 3/4-inch unless noted otherwise or permitted by the following: 1/2-inch may be used for connections to individual instruments, outlets, wiring devices and indoor lighting fixtures.

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

- A. Liquid-tight Flexible Steel Conduit (LFS): UL listed liquid tight consisting of an extruded thermoplastic cover over a galvanized steel core. Minimum size 3/4-inch unless for equipment with 1/2-inch knockout.
- B. Fittings and Conduit Bodies: NEMA FB-1; galvanized steel compression type with O-ring.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install raceways as indicated; in accordance with manufacturer's written installation instructions, and in compliance with NFPA-70, and NECA's "Standards of Installation."
- B. Coordinate with other work including wires/cables, boxes and panel work, as necessary to interface installation of electrical raceways and components with other work.
- C. Install conduits concealed below grade or in slabs. Where conduits turn up and/or cannot be concealed, route conduits exposed.
- D. Mechanically fasten together conduits, enclosures and raceways for conductors to form continuous system. Connect to electrical boxes, fittings and cabinets to provide firm mechanical assembly.
- E. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
- F. Cap conduits or plug flush conduits during construction to prevent entrance of dirt, trash, and water. Cap or plug empty conduits designated as "future", "spare", or "empty" and include a pulling line accessible at both ends. Use anti-seize compound on cap and plug threads prior to installation.
- G. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- H. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offset parallel.
- I. Use raceway fittings compatible with raceway and suitable for use and location. Fitting sizes shall be such that the enclosed conductors do not exceed the permissible percentage of fitting area/volume.

- J. Install miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings, and plugs that have been specifically designed and manufactured for their particular application. Install expansion fittings in raceways every 200-foot linear run or wherever structural expansion joints are crossed.
- K. Use roughing in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.
- L. Provide nylon pull cord in all empty conduits. Test conduits required to be installed, but left empty; test with ball mandrel. Clear any conduit, which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.

3.02 CONDUIT INSTALLATION

- A. Use Schedule 80 PVC throughout above grade and for turn ups including elbows and bends and where required.
- B. Use rigid aluminum above grade between control panel and conduit seals.
- C. Cut conduits straight and properly ream.
- D. Field bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.
 - 1. Size conduits to meet NFPA-70, except no conduit smaller than 3/4-inches shall be embedded in concrete or installed below grade.
 - 2. Fasten conduit terminations in sheet metal enclosures by threaded hubs, and terminate with insulating bushings.
 - 3. Complete installation of electrical raceways before starting installation of cables/wires within raceway.

3.03 CONCEALED CONDUITS

- A. Install coupling full depth to ensure watertight integrity.
- B. Install underground conduits minimum of 24-inches below finished grade.

3.04 CONDUITS IN CONCRETE SLAB

- A. Place conduits between bottom reinforcing steel and top reinforcing steel.
- B. Place conduits either parallel, or at 90° (degrees) to main reinforcing steel.
- C. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.
- D. Conduits crossing in slab must be reviewed for proper cover by the County.

E. Embedded conduit diameter is not to exceed 1/3 (one-third) of slab thickness.

F. Install conduits as not to damage or run through structural members.

3.05 NON METALLIC CONDUITS

A. Make solvent cemented joints in accordance with recommendations of manufacturer.

B. Install PVC conduits in accordance with NFPA-70 and in compliance with local practices.

3.06 CONDUIT FITTINGS

A. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.

B. Install insulated type bushings for terminating conduits. Bushings shall have cast flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing. Bushings shall be "O.Z" type or "B" or equal.

C. Bushings shall have screw type grounding terminal.

D. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, and plugs to be specifically designed for their particular application.

END OF SECTION

SECTION 16120
WIRES AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this Section.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete and operable installation of all electrical conductors, wire and cables and associated splices, connectors, and termination for wiring systems rated 600 volts or less. All electrical conductors shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings.

1.02 DESCRIPTION OF WORK

- A. Extent of electrical wires and cable work is indicated by drawings and schedules.
- B. Types of electrical wire, cable, and connectors specified in this Section include the following:
 - 1. Copper conductors
 - 2. 2 and/or 4 bolt connectors
 - 3. Wire nut connectors
- C. Applications of electrical wire, cable, and connectors required for project are as follows:
 - 1. For power distribution circuits
 - 2. For control and equipment circuits
 - 3. For motor branch circuits

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience that will allow for quality and successful manufacture of electrical wire and cable products of types, sizes and ratings required for items required for this Project.
- B. Installer's Qualifications: In addition to the requirements specified in Division 16 an independent testing firm shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907 quality and successful installation of wire and cable products for this Project.
- C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to construction, installation and color-coding of electrical wires and cables.

- D. UL Compliance: Comply with applicable requirements of UL Std. 83, "Thermoplastic Insulated Wires and Cables" and Std. 486A, "Wire Connectors and Soldering for Use With Copper Conductors".
- E. UL Compliance: Provide wiring/cablings and connector products, which are UL, listed and labeled.
- F. NEMA/ICEA Compliance: Comply with NEMA/ICEA Std. Pub/No's WC5, Thermoplastic Insulated Wires and Cable for the "Transmission and Distribution of Electrical Energy", and WC30, "Color Coding of Wires and Cables", pertaining to electrical power type wires and cables.
- G. IEEE Compliance: Comply with applicable requirements of IEEE Standards 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Standard. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring.
- H. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8, and D-573. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F.)
- I. FOIST Compliance: Comply with Federal Specifications J C 30, "Electrical Cable and Wire (Power, Fixed, Installation)", and W-S-610, "Splice Conductor."
- J. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code", Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NTRL) as defined in OSHA Regulation 1910.7.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Product Data: Submit manufacturer's data on electrical wires, cables, and conductors.
- C. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.

- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA specified type wire and cable reels.
- B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- C. Handle wire and cable carefully to avoid abrasing, puncturing, and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to the following:
 - 1. Wire and Cable
 - a. Alpha Wire Corporation
 - b. Apex Wire and Cable Corp.
 - c. American Insulated Wire Corp.
 - d. American Wire and Cable Co.
 - e. Anaconda-Ericson Inc., Wire and Cable Div.
 - f. Beldon Div.; Cooper Industries
 - g. Brand-Rex Div.; Pyle National Co.
 - h. Cablec
 - i. Cerro Wire and Cable Corp.
 - j. Cleveland Insulated Wire Co.
 - k. Dekoron
 - l. Konite
 - m. Penn

- n. Pirelli
 - o. Phelps Dodge Cable and Wire Co.
 - p. Rome Cable Corp.
 - q. Southwire Corp.
 - r. Triangle PWC, Inc.
2. Connectors
- a. AMP, Inc.
 - b. Anderson
 - c. Appleton Electric Co.; Emerson Electric Co.
 - d. Burndy Corporation
 - e. Brand-Rex Div.; Pyle National Co.
 - f. Electrical Products Div.; Midland Ross Corp.
 - g. General Electric Co.
 - h. Ideal Industries, Inc.
 - i. 3M Company
 - j. Monograms Co.
 - k. O-Z/Gedney Co.
 - l. Pyrotenax
 - m. Southport Industries Inc.
 - n. Square D Company
 - o. Thomas and Betts Corp.

2.03 WIRES, CABLES, AND CONNECTORS

- A. General: Provide electrical wires, cables, and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, for a complete installation, and for application indicated. Except as otherwise indicated, provide copper conductors with conductivity of not less than 98% at 20°C (68°F.)
- B. Building Materials: Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper wire selection as determined by installer to comply with project's installation requirements, NFPA-70 and NEMA standards. Select from the following UL types, those wires with construction features, which fulfill project requirements.
1. Type THW/THHN/ THWN, dual rated: For dry or wet locations; maximum operating temperature 75°C (167°F.) Insulation, flame retardant, moisture and heat resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper. NEMA WC-5 thermoplastic insulated building wire. 98% conductivity copper, 600V PVC insulated with nylon jacket, 75/90 wiring type. Minimum size #12 AWG. For control circuits minimum size #14 AWG.
 2. Type XHHW: For dry and wet locations; maximum operating temperature 90°C (194°F.) Insulation, flame retardant, cross-linked synthetic polymer; conductor, annealed copper.

3. Type 1 (600 Volt Multi-Conductor Control Conductor Cable, Type TC)
 - a. General: Multi conductor control circuit interconnection cable with ground. Suitable for installation in open air, in cable trays, conduit or other approved raceways. Minimum cable temperature rating 90°C dry locations, 75°C wet locations. Passes vertical tray flame test.
 - b. Individual Conductors: No. 14 AWG, 7-strand copper.
 - c. Insulation and Jackets: Provide conductors having 15-mil PVC insulation with 4-mil nylon jacket, and UL listed as Type THHN/THWN.

2.04 CABLES FOR VARIABLE FREQUENCY MOTORS

- A. General: All AC motors rated 600 volt (maximum) which are powered from AC Variable Frequency Drives (VFDs), so as to permit variable speed operation, shall be wired with shielded multiconductor Variable Frequency Drive Cable, specifically manufactured for that application in exposed applications. When in conduit, 600V THHN/THWN copper wire is acceptable
- B. Conform to NEC Article 336.
- C. Ratings
 1. 1,000 Volt UL flexible motor supply cable
 2. XLPE insulated, XHHW-2 90°C Wet/Dry
- D. Suitable for Class 1, Div. 2 hazardous locations.
- E. Suitable for direct burial, cable tray installation and conduit installation.
- F. Full-sized ground wire or equivalent.
- G. Overall shield with full-sized drain wire or equivalent.
- H. Belden Part No. 295XX, or approved equal.

2.05 TYPE 2 (600 VOLT NO. 16 AWG TWISTED, SHIELDED PAIR INSTRUMENTATION CABLE, TYPE TC)

- A. General: Single pair instrumentation cable designed for noise rejection for process control, computer, or data log applications. Suitable for installation in cable trays, conduit, or other approved raceways. Minimum cable temperature rating shall be 90°C dry locations, 75°C wet locations.
- B. Individual Conductors: Bare soft annealed copper, Class B, 7-strand concentric per ASTM B 8; 20 AWG, 7-strand tinned copper drain wire.
- C. Insulation and Jacket: Each conductor 15-mil nominal PVC and 4-mil nylon insulation. Pair conductors pigmented black and red. Jacket flame-retardant and sunlight and oil resistant PVC with 45-mil nominal thickness. Shield 1.35-mil aluminum/mylar overlapped to provide 100% coverage.

D. Dimension: 0.31-inch nominal OD.

2.06 TYPE 3 (600 VOLT NO. 16 AWG, MULTIPLE TWISTED SHIELDED PAIRS WITH A COMMON OVERALL SHIELD INSTRUMENTATION CABLE, TYPE TC)

A. General: Twisted, shielded pairs of instrument cables, grouped in a single cable, designed for use as instrumentation, process control, and computer cable. Suitable for installation in cable tray, conduit or other approved raceways. Minimum cable temperature rating shall be 90°C dry locations, 75°C wet locations.

B. Conductors: Bare soft annealed copper Class B, 7-strand, concentric per ASTM B 8. Tinned copper drain wires. Pair drain wire size AWG 20, group drain wire size AWG 18.

C. Insulation and Jacket: Each conductor 15-mil PVC and 4-mil nylon insulation. Pair conductors pigmented black and red with red conductor numerically printed for group identification. Outer jacket flame retardant and sunlight and oil resistant PVC with nominal thickness as shown in table. Individual pair shield 1.35-mil aluminum/mylar. Group shield 2.35-mil aluminum/mylar, overlapped for 100% coverage.

D. Dimensions as noted in table below:

No. of Pairs	Max. Outside Dimension (inches)	Nominal Jacket Thickness(mils)
4	0.50	45
8	0.77	60
12	0.82	60
24	1.16	60

2.07 TYPE 4 (600 VOLT NO. 16 AWG, SINGLE TWISTED, SHIELDED TRIAD INSTRUMENTATION CABLE)

A. General: Twisted, shielded triad instrument cables, designed for use as instrumentation, process control, and computer cable. Suitable for installation in cable tray, conduit or other approved raceways. Minimum cable temperature rating shall be 90°C dry locations, 75°C wet locations.

B. Conductors: Bare soft annealed copper Class B, 7-strand, concentric per ASTM B 8. Tinned copper drain wires. Triad drain wire size AWG 18.

C. Insulation and Jacket: Each conductor 15-mil PVC and 4-mil nylon insulation. Triad conductors pigmented black, white and red. Outer jacket flame retardant and sunlight and oil resistant PVC with nominal thickness. Individual triad shield 1.35-mil aluminum/mylar.

2.08 EQUIPMENT GROUNDING CONDUCTORS

- A. Provide stranded copper conductors, as indicated or as required by NEC, for equipment grounding.
- B. Provide conductors bare.

2.09 CONNECTORS

- A. General: Provide UL type factory-fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements, NFPA-70 and NEMA standards. Select from the following those types, classes, kinds and styles of connectors to fulfill project requirements:
 - 1. Type: Pressure
 - 2. Type: Crimp
 - 3. Type: Threaded
 - 4. Class: Insulated
 - 5. Kind: Copper (for CU to CU connection)
 - 6. Style: Butt connection
 - 7. Style: Elbow connection
 - 8. Style: Combined "T" and straight connection
 - 9. Style: "T" connection
 - 10. Style: 2 or 4 bolt parallel connection. Use of split bolt connectors is prohibited
 - 11. Style: Tap connection
 - 12. Style: Pigtail connection
 - 13. Style: Wire nut connection

PART 3 - EXECUTION

3.01 INSTALLATION OF WIRES AND CABLES

- A. General: Install electrical cables, wire and wiring connectors as indicated, in compliance with applicable requirements of NFPA-70, NEMA, UL, and NECA's "Standard of Installation" and in accordance with recognized industry practices.
- B. Coordinate wire/cable installation work including electrical raceway and equipment installation work, as necessary to properly interface installation of wires/cables with other work.
- C. Install UL type wiring in conduit, for feeders and branch circuits.
- D. Pull conductors simultaneously where more than 1 is being installed in same raceway.
- E. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulator.

- F. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips, which will not damage cables or raceways.
- G. Keep conductor splices to a minimum.
- H. Install splices and tapes, which possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- I. Use splice and tap connectors, which are compatible with conductor material.
- J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A and B.
- K. Use only stranded conductors. Exception: Solid conductors size #12 and #10 AWG may be used for receptacle branch circuit wiring and lighting.
- L. Use #10 AWG conductor for 20-ampere, 120-volt branch circuit home runs longer than 75-feet, and for 20-ampere, 277-volt branch circuit home runs longer than 200-feet.
- M. Neatly train and lace wiring inside boxes, equipment, and panel boards. Support to prevent conductor movement under fault conditions.
- N. All underground wiring shall be suitable for wet locations per NEC.
- O. Discrete control 120-VAC and 4-20mA signals must not be run in same conduit. Discrete control 120-VAC and 4-20mA signal wiring in control panels and cabinets shall be separated from each other and when required, should cross perpendicular with each other to reduce signal noise.
- P. Avoid unnecessary splices. Splice only in accessible junction or outlet boxes.
- Q. Make all connections with solderless lugs.
- R. Use mechanical connectors for low voltage splices, taps, fixture and motor connections.
- S. Use insulated spade type crimp on connectors for strap screw device terminals.
- T. Where possible use connectors with integral, insulating covers. Otherwise tape uninsulated conductors and connectors to 150% of the insulation value of conductor.
- U. Thoroughly clean wires before installing lugs and connectors.
- V. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

3.02 FIELD QUALITY CONTROL

- A. Prior to energization of circuitry, check installed wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled.
- B. Prior to energization, test wires and cables for electrical continuity and for short circuits.
- C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION

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SECTION 16135
ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete and operable installation of boxes, bushings and locknuts. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings.

1.02 DESCRIPTION OF WORK

- A. Extent of electrical box and associated fitting work is indicated by drawings and schedules.
- B. Types of electrical boxes and fittings specified in this Section include the following:
 - 1. Outlet boxes
 - 2. Junction boxes
 - 3. Pull boxes
 - 4. Bushings
 - 5. Locknuts

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience that will allow for quality and successful manufacture of electrical boxes and fittings of types, sizes and capacities required for manufacture of electrical boxes and fittings required for use in this Project.
- B. Installer's Qualifications: Firms shall have sufficient experience that will allow for quality and successful installation of electrical boxes and fittings required for this Project.
- C. NFPA-70 Compliance: Comply with NFPA-70 as applicable to construction and installation of electrical wiring boxes and fittings.
- D. UL Compliance: Comply with applicable requirements of UL 50, UL 514 Series, and UL 886 pertaining to electrical boxes and fittings which are UL listed and labeled.

- E. NEMA Compliance: Comply with applicable requirements of NEMA Standard Publication Numbers OS1, OS2, and Pub.250 pertaining to outlets and device boxes, covers and box supports.
- F. Comply with NECA "Standard of Installation."
- G. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled." As defined in the "National Electrical Code", Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Product Data: Submit manufacturer's data on electrical boxes and fittings.
- C. A copy of this specification section with addendum updates included, and all referenced and applicable sections with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 FABRICATED MATERIALS

- A. Outlet Boxes: Provide corrosion resistant cast metal rain tight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast metal face plates with spring-hinged watertight caps suitably configured for each application, including face plate gaskets and corrosion resistant plugs and fasteners.
 - 1. Manufacturers: Subject to compliance with requirements, provide rain tight outlet boxes of 1 of the following:
 - a. Appleton Electric; Emerson Electric Co.
 - b. Arrow Hart Div.; Crouse-Hinds Co.
 - c. Bell Electric; Square D Co.
 - d. Harvey Hubbell, Inc.
 - e. OZ/Gedney; General Signal Co.
 - f. Pass and Seymour, Inc.
- B. Junction and Pull Boxes: Provide NEMA 4X Stainless Steel junction and pull boxes, with screw-on covers; of types, shapes, and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
 - 1. Manufacturers: Subject to compliance with requirements, provide junction and pull boxes of 1 of the following:
 - a. Adalet-PLM Div.; Scott Fetzer Co.
 - b. Appleton Electric; Emerson Electric Co.
 - c. Arrow Hart Div.; Crouse Hinds-Co.
 - d. Bell Electric; Square D Company
 - e. OZ/Gedney Co.; General Signal Co.
 - f. Spring City Electrical Mfg. Co.
- C. Bushings, Knockout Closures and Locknuts: Provide corrosion resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.
 - 1. Manufacturers: Subject to compliance with requirements, provide bushings, knockout closures, locknuts and connectors of 1 of the following:
 - a. Adalet-PLM Div.; Scott Fetzer Co.
 - b. AMP, Inc.
 - c. Arrow Hart Div.; Crouse-Hinds Co.
 - d. Appleton Electric Co.; Emerson Electric Co.
 - e. Bell Electric; Square D Co.
 - f. Midland Ross Corp.

- g. Midwest Electric; Cooper Industries, Inc.
- h. OZ/Gedney Co.; General Signal Co.
- i. RACO Div.; Harvey Hubbell, Inc.
- j. Thomas and Betts Co. Inc.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

- A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NFPA-70 and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
- C. Provide weather tight outlets at all locations.
- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Install electrical boxes in those locations, which ensure ready accessibility to enclosed electrical wiring.
- F. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
- G. Provide electrical connections for installed boxes.
- H. Subsequent to installation of boxes, protect boxes from construction debris and damage.

3.02 GROUNDING

- A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

END OF SECTION

SECTION 16142
ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this Section.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete and operable installation of all electrical connections for wiring systems rated 600 volts or less. All electrical connections shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings.

1.02 DESCRIPTION OF WORK

- A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.
- B. Applications of electrical power connections specified in this Section include the following, but not limited:
 - 1. From electrical source to control panel
 - 2. From control panel to motors and control devices
- C. Electrical connections for equipment, not furnished as integral part of equipment, are specified in Division 15 and other Division 16 sections, and are work of this Section.
- D. Refer to Division 15 sections for motor starters and controller furnished integrally with equipment; not work of this Section.
- E. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this Section.
- F. Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this Section.
- G. Refer to Division 15 or Division 13 sections as applicable for control system wiring; not work of this Section.
- H. Refer to sections of other Divisions for specific individual equipment power requirements, not work of this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience and be regularly engaged in manufacture of electrical connectors and terminals, of types and rating required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties, whose products have been in satisfactory use in projects with similar service as this Project.
- B. Installer's Qualifications: Firms shall have sufficient experience to allow for quality and successful installation utilizing electrical connections for equipment for this Project.
- C. NFPA-70 Compliance: Comply with applicable requirements of NFPA-70 as to type of products used and installation of electrical power connections (terminals and splices), for junction boxes, motor starters and disconnect switches.
- D. IEEE Compliance: Comply with Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to connections and terminations.
- E. ANSI Compliance: Comply with applicable requirement of ANSI/NEMA and ANSI/EIA standards pertaining to products and installation of electrical connections for equipment.
- F. UL Compliance: Comply with UL Std.486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL listed and labeled.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Product Data: Submit manufacturer's data on electrical connections for equipment products and materials.
- C. A copy of this specification section with addendum updates included, and all referenced and applicable sections with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.

- F. Failure to include a copy of the marked-up specification sections along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of product):
 1. Adalet PLM Div., Scott and Fetzer Co.
 2. Allen Stevens Conduit Fittings Corp.
 3. AMP Inc.
 4. Appleton Electric Co.
 5. Arrow Hart Div., Crouse Hinds Co.
 6. Burndy Corp.
 7. General Electric Co.
 8. Harvey Hubbell Inc.
 9. Ideal Industries, Inc.
 10. Pyle National Co.
 11. Reliable Electric Co.
 12. Square D Company
 13. Thomas and Betts Corp.

2.03 MATERIALS AND COMPONENTS

- A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to; pressure connectors, terminals (lugs), electrical insulating tape, heat shrinkable insulating tubing, cables ties, solderless wire nuts, and other items and accessories as needed to complete splices and terminations of types indicated.

2.04 CONDUIT, TUBING AND FITTINGS

- A. General: Provide conduit, tubing, and fittings of types, grades, sizes, and weights (wall thickness) indicated for each type service. Where types and grades are not indicated, provide proper selection to fulfill wiring requirements, and comply with NFPA-70 requirements for raceways. Provide products complying with Section 16110 "Raceways" and in accordance with the following listing of conduit, tubing and fittings:
 1. Schedule 80 PVC conduit
 2. Schedule 80 PVC fittings

3. Liquid-tight flexible metal conduit
4. Liquid-tight flexible metal conduit fittings
5. Rigid aluminum conduit
6. Rigid aluminum conduit fittings

2.05 WIRES, CABLES AND CONNECTORS

- A. General: Provide wires, cables, and connectors complying with Section 16120 "Wires and Cables."
- B. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match, including sizes and ratings, of wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F)
- C. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications.
- D. Electrical Connection Accessories: Provide electrical insulating tape, heat shrinkable insulating tubing and boots, wire nuts and cable ties as recommended for use by accessories manufacturers for type services indicated.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect area and conditions under which electrical connections for equipment are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer and/or owner as applicable.

3.02 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NFPA-70, and NECA's "Standard of Installation" to ensure that products fulfill requirements.
- B. Coordinate with other work, including wires/cables, raceways and equipment installation, as necessary to properly interface installment of electrical connections for equipment with other work.
- C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

- D. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity ratings, than electrical insulation rating of those conductors being spliced.
- E. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes, which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.
- F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque-tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, bean type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.
- G. Provide liquid tight flexible conduit for connections of motors and other electrical equipment where subject to movement and vibration.
- H. Fasten identification markers to each electrical power supply wire/cable conductor which indicates their voltage, phase and feeder number in accordance with Section 16195 "Electrical Identification." Affix markers on each terminal conductor, as close as possible to the point of connection.

3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION

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SECTION 16180
OVER CURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

- A. Extent of over-current protective device work is indicated by drawings and schedules.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete installation of all electrical equipment and systems with over-current protection. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings. Types of over-current protective devices in this Section include the following:
 - 1. Circuit Breakers
 - a. Molded Case
- C. Refer to other Division 16 sections for cable/wire and connector work required in conjunction with over-current protective devices; not work of this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience in the manufacture of over-current protective devices, of types, sizes, and ratings required, for quality and successful manufacture of over-current and protective devices for use in this Project.
- B. Installer: Firms shall have sufficient experience to allow for quality and successful installation of over-current and protective devices required for this Project.
- C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to construction and installation of over-current protective devices.
- D. UL Compliance: Comply with applicable requirements of UL 489, "Molded Case Circuit Breakers and Circuit Breaker Enclosures." Provide over-current protective devices which are UL listed and labeled.
- E. NEMA Compliance: Comply with applicable requirements of NEMA Standard Publication Numbers AB 1, AB 2, and SG 3 pertaining to molded case and low voltage power type circuit breakers.

- F. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled." As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Product Data: Submit manufacturer's data on over-current protective devices, including amperes, voltages, and current ratings, interrupting ratings, current limitations, internal inductive and non-inductive loads, time current trip characteristic curves, and mounting requirements.
- C. A copy of this specification section with addendum updates included, and all referenced and applicable sections with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections along with justification(s) for any requested deviations to the specification requirements with the submittal, shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type and rating of over-current protective device.)
 - 1. Circuit Breakers: (See Appendix D "List of Approved Products".)

2.03 CIRCUIT BREAKERS

- A. General: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information and as required for a complete installation.
- B. Molded Case Circuit Breakers: Provide factory assembled, molded case circuit breakers of frame size indicated. Provide breakers with permanent thermal and instantaneous magnetic trips in each pole, and with fault current limiting protection, ampere rating as indicated. Construct with over center, trip free, toggle type operating mechanisms with quick make, quick break action and positive handle trip indication. Provide push to trip button on cover for mechanical tripping circuit breakers. All latch surfaces shall be ground and polished. All poles shall be so constructed that they open, close and trip simultaneously. Circuit breakers must be completely enclosed in a high strength polyester molded case. Ampere rating shall be clearly visible. Contacts shall be on non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes. Construct breakers for mounting and operating in any physical position and operating in an ambient temperature of 40°C. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated. Mount individual circuit breakers complying with requirements for circuit breakers in this Section in enclosure required for the location, unless otherwise indicated. Provide circuit breakers with handles that can be locked in the OFF position. Interlock enclosure and circuit breaker to prevent opening the cover with the circuit breaker in the ON position. Provide thermal magnetic circuit breaker, unless otherwise shown, for one-pole and two pole breakers, breakers operating at 240V or less, and 3 (three) pole branch circuit breakers operating at 480V.

PART 3 - EXECUTION

3.01 INSTALLATION OF OVER CURRENT PROTECTIVE DEVICES

- A. Install over current protective devices as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NFPA-70 and NEMA standards for installation of over current protective devices.
- B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of over current protective devices with other work.

- C. Fasten circuit breakers without causing mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cabling.
- D. Set field adjustable circuit breakers for trip settings as indicated, subsequent to installation of units.

3.02 ADJUST AND CLEAN:

- A. Inspect circuit breakers operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

3.03 FIELD QUALITY CONTROL

- A. Prior to energizing of over current protective devices, test devices for continuity of circuitry and for short circuits. Correct malfunctions in units, and then demonstrate compliance with requirements.

END OF SECTION

SECTION 16190
SUPPORTING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

- A. Extent of supports, anchors, sleeves and seals is indicated by drawings and schedules and/or specified in other Division 16 sections.
- B. Types of supports, anchors, sleeves and seals specified in this Section include the following:
 - 1. C clamps
 - 2. Nuts and bolts
 - 3. One-hole conduit straps
 - 4. Round steel rods and associated hardware
 - 5. Support channels

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall sufficient experience in the manufacture of supporting devices, of types, sizes, and ratings required for quality and successful manufacture of supporting devices for use in this Project.
- B. Installers Qualifications: Firms shall sufficient experience to allow for quality and successful installation of supporting devices required for use in this Project.
- C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to construction and installation of electrical supporting devices.
- D. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.
- E. UL Compliance: Provide electrical components which are UL listed and labeled.
- F. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled." As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittal."
- B. Product Data: Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions, for each type of support, anchor, sleeve and seal.
- C. A copy of this specification section with addendum updates included, and all referenced and applicable sections with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 MANUFACTURED SUPPORTING DEVICES

- A. General: Provide supporting devices which comply with manufacturer's standard materials, design, and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of supporting device meets indicated requirement, selection is Installer's option.
- B. Supports: Provide supporting devices of types, sizes and materials indicated; and having the following construction features:
 - 1. C Clamps: Stainless Steel: 1/2-inch rod size; approximately 70-pounds per 100-units.
 - 2. I Beam Clamps: Stainless steel, 1-1/4-inch x 3/16-inch stock; 3/8-inch cross bolt; flange width 2-inches; approximately 52-pounds per 100-units.
 - 3. One-Hole Conduit Straps: For supporting 3/4-inch rigid metal conduit; stainless steel; approximately 7-pounds per 100-units.

4. Hexagon Nuts: For 1/2-inch rod size; stainless steel; approximately 4-pounds per 100-units.
 5. Threaded round Steel Rod: Stainless Steel; 1/2-inch dia.; approximately 67-pounds per 100-feet.
 6. Offset Conduit Clamps: For supporting rigid metal conduit; stainless steel.
- C. Anchors: Provide anchors of types, sizes, and materials indicated, with the following construction features:
1. Lead Expansion Anchors: 1/2-inch; approximately 38-pounds per 100-units.
 2. Toggle Bolts: Springhead; stainless steel 3/16-inch by 4-inches; approximately 5-pounds per 100-units.
 3. Manufacturers: Subject to compliance with requirements, provide anchors of one of the following:
 - a. Ideal Industries, Inc.
 - b. Joslyn Mfg. and Supply Co.
 - c. McGraw Edison Co.
 - d. Star Expansion Co.
 - e. U.S. Expansion Bolt Co.
- D. Sleeves and Seals: Provide sleeves and seals of types, sizes and materials indicated, with the following construction features:
1. U Channel Strut Systems: Provide U channel strut system for supporting electrical equipment, 12-gauge stainless steel, of types and sizes indicated; construct with 9/16-inch dia. holes, 8-inch on center on top surface, and with fittings which mate and match with U channel.
 2. Manufacturers: Subject to compliance with requirements, provide channel systems of one of the following:
 - a. Allied Tube and Conduit Corp.
 - b. B Line Systems, Inc.
 - c. Greenfield Mfg. Co., Inc.
 - d. Midland Ross Corp.
 - e. OZ/Gedney Div.; General Signal Corp.
 - f. Power Strut Div.; Van Huffel Tube Corp.
 - g. Unistrut Div.; GTE Products Corp.

PART 3 - EXECUTION

3.01 INSTALLATION OF SUPPORTING DEVICES

- A. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

END OF SECTION

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SECTION 16195
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. Division 16 Basic Electrical Materials and Methods section apply to work specified in this Section.

1.02 DESCRIPTION OF WORK

- A. Extent of electrical identification work is indicated by drawings and schedules.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for identification of electrical materials, equipment, and installations. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings.

Types of electrical identification work specified in this Section include the following:

- 1. Electrical power, control and communication conductors
- 2. Operational instructions and warnings
- 3. Danger signs
- 4. Equipment/system identification signs

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience in the manufacture of electrical identification products of types required, for quality and successful manufacture of electrical identification products for this Project.
- B. NFPA-70 Compliance: Comply with NFPA-70 as applicable to installation of identifying labels and markers for wiring and equipment.
- C. UL Compliance: Comply with applicable requirements of UL Standard 969, "Marking and Labeling Systems" pertaining to electrical identification systems.

- D. NEMA Compliance: Comply with applicable requirements of NEMA Standard Publication Numbers WC 1 and WC 2 pertaining to identification of power and control conductors.
- E. Listing and Labeling: provide disconnect switches specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled." As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Product Data: Submit manufacturer's data on electrical identification materials and products.
- C. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.
- D. A copy of this specification section with addendum updates included, and all referenced and applicable sections with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- E. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- F. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- G. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide electrical identification products of one of the following (for each type marker):
 1. Alarm Supply Co., Inc.
 2. American Labelmark Co., Labelmaster Subsidiary
 3. Brady, W.H. Co.
 4. Calpico Inc.
 5. Carlton Industries, Inc.
 6. Champion American, Inc.
 7. Cole Flex Corp.
 8. Direct Safety Co.
 9. George Ingraham Corp.
 10. Griffolyn Co.
 11. Ideal Industries, Inc.
 12. LEM Products, Inc.
 13. Markal Co.
 14. National Band and Tag Co.
 15. Panduit Corp.
 16. Seton Name Plate Co.
 17. Standard Signs, Inc.
 18. Tesa Corp.

2.03 ELECTRICAL IDENTIFICATION MATERIALS

- A. General: Except as otherwise indicated provide manufacturer's standard product of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provides single selection for each application.
- B. Color Coded Plastic Tape
 1. General: Provide manufacturer's standard self-adhesive vinyl tape not less than 3-mil thick by 1-1/2-inches wide.
- C. Cable/Conductor Identification Bands
 1. General: Provide manufacturer's standard vinyl cloth self adhesive cable/conductor markers of wrap around type, either pre-numbered plastic coated type, or write on type with clear plastic self adhesive cover flap; numbered to show circuit identification.

D. Baked Enamel Danger Signs

1. General: Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20-gauge steel, of standard red, black, and white graphics; 14-inches by 10-inches size except where 10-inches by 7-inches is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH.

E. Engraved Plastic Laminate Signs

1. General: Provide engraving stock melamine plastic laminate lamicoïd-type engraved nameplates, complying with FS L P 387, in sizes and thickness indicated, engraved with engraver's standard letter style of sizes and wording indicated, black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
2. Thickness: 1/8-inch except as otherwise indicated.
3. Fasteners: Self-tapping stainless steel screws, except contact type permanent adhesive where screws cannot or should not penetrate substrate.

2.04 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in electrical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical system and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION

A. General Installation Requirements

1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NFPA-70.
2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit Identification

1. General: Where electrical conduit is exposed in spaces with exposed mechanical piping which is identified by color-coded method, apply color-coded identification on electrical conduit in manner similar to piping identification. Except as otherwise indicated use white as coded color for conduit.

C. Cable/Conductor Identification

1. General: Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panel boards, shop drawings, contract documents, and similar previously established identification for project's electrical work.
2. Color-Code Conductors: Secondary service, feeder, and branch circuit conductors throughout the secondary electrical system.
3. 208/120 Volt System: As follows:
 - a. Phase A: Black
 - b. Phase B: Red
 - c. Phase C: Blue
 - d. Neutral: White
 - e. Ground: Green
 - f. 480/277 Volt System: As follows:
 - g. Phase A: Brown
 - h. Phase B: Orange
 - i. Phase C: Yellow
 - j. Neutral: Gray
 - k. Ground: Green

D. Operational Identification and Warnings

1. General: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets, and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

E. Danger Signs

1. General: In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.
2. High Voltage: Install danger signs wherever it is possible under any circumstances, for persons to come into contact with electrical power of voltages higher than 110 120 volts.

F. Equipment/Systems Identification

1. General: Install engraved plastic laminate signs on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/ control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2-inch high lettering on 1-1/2-inch high sign (2-inches high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the Contract documents and Shop Drawings. Provide signs for each unit of the following categories of electrical work:
 - a. Electrical cabinets and enclosures
 - b. Access panel/doors to electrical facilities
 - c. Disconnect devices

- G. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate substrate.

END OF SECTION

SECTION 16420
SERVICE ENTRANCE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawing and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this Section.
- B. Division 16 Basic Electrical Materials and Methods sections apply to work specified in this Section.

1.02 DESCRIPTION OF WORK

- A. Extent of service entrance work is indicated by drawings and schedules.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete installation of all electrical service entrance. All equipment shall be installed, adjusted, tested and placed in operation in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings.

Types of service entrance equipment in this Section include the following:

- 1. Main Circuit Breaker and Surge Protector
- C. Refer to other Division 16 sections for wires/cables, raceways, and electrical boxes and fittings work required in connection with service entrance equipment; not work of this Section.

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience in the manufacture of service entrance equipment of types, sizes, and ratings required, for quality and successful manufacture of service entrance equipment for use in this Project.
- B. Installer's Qualifications: Firms shall have sufficient experience to allow for quality and successful installation of service entrance equipment required for this Project.
- C. NFPA-70 Compliance: Comply with NFPA-70 as applicable to construction and installation of service entrance equipment and accessories.

- D. NEMA Compliance: Comply with construction and installation requirements of the following NEMA standards for service entrance equipment and accessories:
 - 1. Std. Pub.No. AB 1; Molded Case Circuit Breakers
- E. UL Compliance: Comply with construction and installation requirements of the following UL standards for service entrance equipment and accessories:
 - 1. UL 50; Electrical Cabinets and Boxes
 - 2. UL 869; Electrical Service Equipment
 - 3. UL 1449: Transient Voltage Surge Suppressors, revised Edition, July 2, 1997
- F. Provide service entrance equipment, and accessories which are UL listed and labeled, and marked "SUITABLE FOR USE AS SERVICE EQUIPMENT".
- G. IEEE Compliance: Comply with applicable requirements of IEEE Std. 241 pertaining to service entrances.
- H. Listing and Labeling: provide disconnect switches specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals".
- B. Product Data: Submit manufacturer's data on service entrance equipment and accessories.
- C. Shop Drawings: Submit dimensioned layouts of service entrance equipment, including spatial relationship to proximate electrical equipment.
- D. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.
- E. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.

- F. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- G. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 SERVICE ENTRANCE EQUIPMENT

- A. General: Provide service entrance equipment and accessories; of types, sizes, ratings, and electrical characteristics indicated, which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified.
- B. Over current Protection Devices:
 - 1. General: Provide over current protective devices complying with Division 16 Basic Electrical Materials and Methods Section 16180 "Over Current Protective Devices".
- C. Cable/Wire:
 - 1. General: Provide cable/wire complying with Division 16 Basic Electrical Materials and Methods Section 16120 "Wires and Cables".
- D. Raceways:
 - 1. General: Provide raceways complying with Division 16 Basic Electrical Materials and Methods Section 16110 "Raceways".
- E. Surge Protection Devices (SPD's):
 - 1. Provide surge protection device in accordance with the following requirements:
 - a. Comply with UL 1449 and 1283, current Edition and IEEE 62.41, 62.45.
 - b. Units shall be listed and labeled as meeting requirements of UL 1449 current Edition. The unit shall meet "Testing Requirements" of IEEE 62.41 and 62.45.
 - c. Provide SPD redundant modules providing with phase to phase, phase to neutral phase to ground and neutral to ground protection as applicable for service voltage.

- d. Provide front panel alarm and test switch and redundant LED indicators to indicate alarm and/or normal operating conditions.
- e. Provide SPD with AC tracking filter with EMI/RKI filtering up to - 50dB from 100K Hz to 100 MHz.
- f. UL suppression voltage rating (240 / 480 volt rating).

L-N	L-G	N-G	L-L
400/800	400/800	400	800

- g. SPD unit to match station available voltage and phase.
 - h. Minimum Amperes per Mode Suppression 80,000. For Master Stations (four or more pumps) or where level control of pump station is provided using VFD's provide minimum Amperes per Mode Suppression of 150,000.
 - i. Comply with MIL STD 220A Method of Insertion Loss Measurement
 - j. NFPA-70 (NEC), National Electrical Code – Surge Protective Device Installation Practice and Grounding
 - k. ANSI/IEEE C62.41 and C62.45,
 - l. UL 67 and UL 891
 - m. Provide optional NEMA 4X enclosure and internal fusing/overload protection. Plastic NEMA 4X enclosures are acceptable for Surge Protection Devices in lieu of Stainless Steel.
2. Warranty: Minimum 10 year unlimited module replacement.
 3. Approved products: (See Appendix D "List of Approved Products")

2.03 SERVICE ENTRANCE ACCESSORIES:

- A. Wall and Floor Seals: Provide wall and floor seals complying with Division 16 Basic Electrical Materials and Methods Section 16190 "Supporting Devices" in accordance with the following listing:
 1. Wall and Floor Seals

PART 3 - EXECUTION

3.01 INSTALLATION OF SERVICE ENTRANCE EQUIPMENT

- A. Install service entrance equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that service entrance equipment fulfills requirements. Comply with applicable installation requirements of NFPA-70 and NEMA standards.
- B. Coordinate with other electrical work, including utility company wiring, as necessary to interface installation of service entrance equipment work with other work.

3.02 GROUNDING

- A. Provide equipment bonding and grounding connectors, sufficiently tight to assure a permanent and effective ground, for service entrance equipment and wiring/cabling as indicated.

3.03 SURGE PROTECTION DEVICE (SPD):

- A. Install Surge Protection Device so leads are maintained at minimum length and minimum number of bends.
- B. Install Surge Protection Device on the load side of the main disconnect with lugs furnished with breaker.
- C. All Surge Protection Devices (SPD's) shall be UL approved or NRTL approved to UL standards, and installed per respective power company requirements and manufacturer's specifications.
- D. Surge Protection Device shall be attached to the load side of the station main disconnect and be mounted in a separate NEMA 4X enclosure.

3.04 ADJUST AND CLEAN

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch up scratched or marred enclosure surfaces to match original finishes.

3.05 FIELD QUALITY CONTROL

- A. Upon completion of installation of service entrance equipment and electrical circuitry, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunction units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

END OF SECTION

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SECTION 16450

GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION OF WORK

- A. Extent of grounding work is indicated by drawings and schedules. This Section specifies the system for grounding electrical distribution and utilization equipment cabinets, motor frames, manholes, instrumentation, metal surfaces of process/mechanical equipment that contain energized electrical components, metal structures and buildings, outdoor metal enclosures, fences and gates. This Section also includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.
- B. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete installation of grounding system. All work shall be installed, adjusted and tested in accordance with these Specifications, the manufacturer's recommendations and as shown on the Drawings. Types of grounding specified in this Section include the following:
 - 1. Solid Grounding
- C. Applications of grounding work in this Section include the following:
 - 1. Underground metal water piping
 - 2. Grounding electrodes
 - 3. Grounding rods
 - 4. Service equipment
 - 5. Enclosures
 - 6. Equipment
 - 7. Fences and gates

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms shall have sufficient experience in the manufacture of electrical connectors, terminals and fittings, of types and ratings required, and ancillary grounding materials, including stranded cables, copper braid and bus, ground rods and plate electrodes, for manufacture of grounding equipment for use in this Project.

- B. Installer: Firms shall have sufficient experience to allow for quality and successful installation of grounding equipment for this Project.
- C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to materials and installation of electrical grounding systems, associated equipment and wiring. Provide grounding products which are UL listed and labeled.
- D. UL Compliance: Comply with applicable requirements of UL Standards Numbers 467 and 869 pertaining to electrical grounding and bonding.
- E. IEEE Compliance: Comply with applicable requirements of IEEE Standard 81, 142 and 241 pertaining to electrical grounding.
- F. NETA Compliance: Comply with the International Electrical Testing Association, Inc. Acceptance Testing Specifications.
- G. Testing Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7, or a full member company of the international Electrical Testing Association (NETA).
 - 1. Testing Agency Field Supervision: Use persons currently certified by NETA or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- H. Comply with NFPA 70.
- I. Comply with UL 467.
- J. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled." As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- K. See also Section 16010 Part 1 for listing of applicable reference standards.

1.04 SHOP DRAWINGS AND SUBMITTALS

- A. Submittals shall be submitted to the County/Professional for review and acceptance prior to construction in accordance with the General Conditions and specifications Section 01300 "Submittals."
- B. Product Data: Submit manufacturer's data on grounding systems and accessories.
- C. A copy of this specification section with addendum updates included, and all referenced and applicable sections with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole.

- D. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation.
- E. The County shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications.
- F. Failure to include a copy of the marked-up specification sections along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All material supplied shall be one of the products specified in Appendix D "List of Approved Products" appended to these technical specifications.

2.02 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide grounding products of one of the following:
 1. Apache Grounding; Nashville Wire Products
 2. Chance: A. B. Chance Co.
 3. B-Line Systems, Inc.
 4. Burndy Corp.
 5. Crouse-Hinds Co.
 6. Electrical Components Div.; Grould, Inc.
 7. Galvan Industries, Inc.
 8. General Electric Supply Co.
 9. Hastings Fiber Glass Products, Inc.
 10. Heary Brothers Lightning Protection Co.
 11. Kearney
 12. Ideal Industries, Inc.
 13. Lightning Master Corp.
 14. Lyncole XIT Grounding.
 15. O-Z/Gedney Co.
 16. Raco, Inc.
 17. Thomas and Betts Corp.

2.03 GROUNDING SYSTEMS

A. Materials and Components

1. General: Except as otherwise indicated, provide electrical grounding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes, and plate electrodes, bonding jumper braid, surge arrestors, and additional accessories needed for complete installation. Where more than one type unit meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products complying with NFPA-70, UL, IEEE, and established industry standards for applications indicated.
2. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirement and the greater size, rating, and quantity indications shown shall be adhered.
3. A counterpoise cable grounding system installed a minimum of 30-inches below grade, shall be installed with connections to at least the following equipment:
 - a. Wetwell cover
 - b. Valve vault cover
 - c. Control panels
 - d. Generator
 - e. Electrical system grounding electrode conductor
 - f. Main disconnect switch
 - g. Fence
 - h. Emergency bypass piping and station back flow preventer and water spigot to be bonded
 - i. Exception: Ground connection to fencing is not required for PVC coated chain link fence framing, concrete block wall, or wood fencing.
4. Provide raceways, and electrical boxes and fittings complying with accordance with the following listing:
 - a. PVC conduit
 - b. PVC conduit fittings
 - c. Liquid-tight flexible metal conduit
 - d. Liquid-tight flexible metal conduit fittings
 - e. Rigid aluminum conduit
 - f. Rigid aluminum conduit fittings

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NFPA-70.

C. Ground Rods: Steel with copper welded exterior, 3/4-inch dia. x 10-feet.

D. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

E. Comply with Division 16 Section 16120 "Wires and Cables." Conform the NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

- F. Equipment Grounding Conductors: Insulated copper with green color insulation.
- G. Grounding-Electrode Conductors: Stranded copper cable.
- H. Underground Conductors: Bare and stranded copper.
- I. Bare Copper Conductors: Conform to the following:
 - 1. Solid Conductors: ASTM B3
 - 2. Assembly of Stranded conductors: ASTM B8
- J. Ground cable shall be soft-drawn, bare annealed copper, concentric stranded, as specified.
- K. The minimum sizes shall be as follows, where American Wire Gauge (AWG) cable sizes are not shown or specified:

5 and 15 kV switchgear	2/0 or 4/0 AWG
5 kV motor starters	2/0 or 4/0 AWG
15 kV-5 kV transformers	2/0 or 4/0 AWG
5 kV-480V transformers	2/0 or 4/0 AWG
480V switchgear	2/0 or 4/0 AWG
480V switchboards	2/0 or 4/0 AWG
480V MCC and	2/0 or 4/0 AWG
Cable tray	2/0 or 4/0 AWG
Large motors 250 hp & >	2/0 or 4/0 AWG
Lighting & Power panels	2 AWG
Exposed metal cabinets	2 AWG
Electrical equipment	2 AWG
Buildings and enclosure	2 AWG
Fences and gates	2 AWG
Motors 25 hp to 250 hp	2 AWG
Motors 1 hp to 25 hp	6 AWG
- L. Grounding Bus: Bare, annealed copper bars of rectangular cross section.
- M. Braided Bonding Jumpers: Copper tape, braided Number 3/0 AWG bare copper wire, terminated with copper ferrules.
- N. Bonding straps: Soft copper, 0.05-inch (1-mm) thick and 2-inches (50-mm) wide, except as indicated.
- O. Compression connections shall be irreversible, cast copper, high conductivity as manufactured by Thomas and Betts, or equal.
- P. Bolted connectors shall be Burndy, O. Z. Gedney, or equal heavy-duty type.

- Q. Exothermic welding products shall be Erico's Cadweld Plus system with electronic ignition device and moisture resistant weld metal cup for the required mold, or equal. Connectors shall be provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combination of conductors and connected items.
- R. Provide concrete test well with cover and connect the ground grid extension using a removable connector.
- S. Copper equipment ground bars shall be Erico Eritech EGB Series or equal, sized as required for the installation.

PART 3 - EXECUTION

3.01 APPLICATION AND TESTING

- A. Contractor shall test ground rod to obtain a ground resistance value of less than 5 ohms.
- B. Maximum distance between counterpoise ground rods shall be 100-feet. Provide additional ground rods as required.
- C. Counterpoise shall be installed a minimum of 30-inches below grade.
- D. Tests: Before making connections to the ground electrode, measure the resistance of the electrode to ground using a ground resistance tester specifically designed for ground resistance testing. Perform the test not less than 2-days after the most recent rainfall, and in the afternoon after any ground condensation (dew) has evaporated. If a resistance less than the performance requirements is not obtained, provide a ground rod driven 6-inches below grade spaced 10-feet away from the ground well and connect to ground test well with Number 2/0 tinned stranded copper wire and repeat the test. If the performance requirements are still not obtained, inform the County for resolution. Testing results by a certified testing agency using fall of potential testing as described by NETA (International Electrical Testing Association).
- E. Provide a certified copy of the grounding test report to the County.
- F. Equipment grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
 - 1. Install equipment grounding conductor with circuit conductors for the items below in addition to those required by Code:
 - a. Feeders and branch circuits
 - b. Lighting circuits
 - c. Receptacle circuits
 - d. Single-phase motor or appliance branch circuits
 - e. Three-phase motor or appliance branch circuits
 - f. Flexible raceway runs

2. Metallic Raceways: Raceways, conduits and cable trays, etc. shall be made electrically continuous, and shall be bonded/grounded to earth. Utilize bonding/grounding wires, jumpers, clamps, etc. as necessary to meet requirements of NEC.
 3. Non-metallic Raceways: Install a grounding conductor in non-metallic raceways unless they are designated for telephone or data cables.
 4. Air-Duct Equipment Circuits: Install a grounding conductor to duct mounted electrical devices operating at 120 V and above, including air cleaners and heaters. Bond conductor to each unit and to air duct.
 5. Water Heater, Heat-Tracing, and Anti-frost Heater Circuits: Install a separate grounding conductor to each electric water heater, heat-tracing assembly, and anti-frost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- G. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide a Number 4 AWG minimum insulated grounding conductor from grounding-electrode system to each service location, backboard, terminal cabinet, wiring closet, and central equipment location.
1. Service and Central equipment Locations and wiring Closets: Terminate grounding conductor on a 1/4 by 2 by 12-inch (6 by 50 by 300-mm) grounding.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- H. Separately Derived Systems: Where NEC requires grounding, ground according to NEC.
- I. Metal Poles Supporting Lighting Fixtures: Ground pole to a grounding electrode in addition to separate equipment grounding conductor run with supply branch circuit.
- J. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.
- K. Grounding Electrode System: Where available on the premises, at each building or structure served, a metal underground water pipe, the metal frame of the building or structure, concrete encased electrodes, any ground ring encircling the building or structure and all made electrodes (ground rods, etc.) shall be bonded together to form the grounding electrode system. The main bonding jumper and the grounding electrode conductor shall be installed and sized per NEC except where larger sizes than required by NEC are indicated.
- L. Grounding Rods: A minimum of two (2) ground rods shall be installed where the ground rod serves as the grounding electrode per NEC. Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.
1. Drive until tops are 2-inches (50-mm) below finished floor or final grade, except as otherwise indicated.
 2. Interconnect with grounding-electrode conductors except at test wells and as otherwise indicated. Use exothermic welds or irreversible compression connections. Make these connections without damaging copper coating or exposing steel.
- M. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

- N. Grounding conductors, insulated and color coded green, shall be provided in all low voltage feeder and sub-feeder and branch circuit conduit runs, except low voltage service entrance conduit runs which contain a grounded neutral. These grounding conductors shall be connected to all metallic conduits by means of approved grounding bushings at all conduit terminations at the supply end of all feeders.
- O. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
1. Use electroplated or tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
 2. Make connections with clean, bare metal at points of contact.
 3. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
 4. Make aluminum-to-galvanized steel with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- P. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable. Irreversible compression connections may be acceptable as an alternate method.
- Q. Equipment Grounding-Wire Terminations: For Number 8 AWG and larger, use pressure-type grounding lugs. Number 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- R. Non-contact metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at both entrances and exits with the grounding conductors, except as otherwise indicated.
- S. Connections at Test Wells: Use compression-type connectors on conductors and make bolted and clamped-type connections between conductors and grounding rods.
- T. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
- U. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

END OF SECTION

APPENDIX A

GEOTECHNICAL REPORT

1. Geotechnical Investigation Report Package 10 Pump Station Rehabilitations Prepared by Antillian Engineering Associates, June 19, 2015
2. Pump Station R/R Package 10 Improvements Ground Water Sampling and Laboratory Screening Results Prepared by BFA, Inc., August 20, 2015

The attached Geotechnical Engineering Investigation and dewatering ground water sampling was accomplished for the utilization of the Design Engineer during the design phases of this project. The criteria and recommendations stated herein are not to be construed as direction from the Design Engineer to the Contractor and are hereby provided only as general information, furnished as a courtesy to the Contractor.

**GEOTECHNICAL INVESTIGATION REPORT
PACKAGE 10 PUMP STATION REHABILITATIONS
ORANGE COUNTY, FLORIDA**

AEA PROJECT No. 201409-1

Antillian Engineering Associates, Inc.
3331 Bartlett Boulevard
Orlando, Florida 32811
(407) 422-1441



June 19, 2015

BFA Environmental, Inc.
1230 East Hillcrest Street
Orlando, Florida 32803

Attention: Geoff Hennessy, P.E.

Reference: Geotechnical Investigation Report
Package 10 Pump Station Rehabilitations
Orange County, Florida
AEA Project No. 201409-1

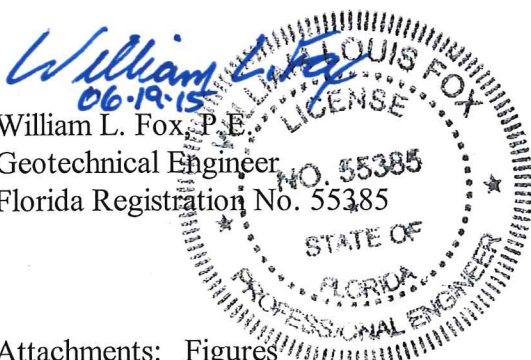
Mr. Hennessy:

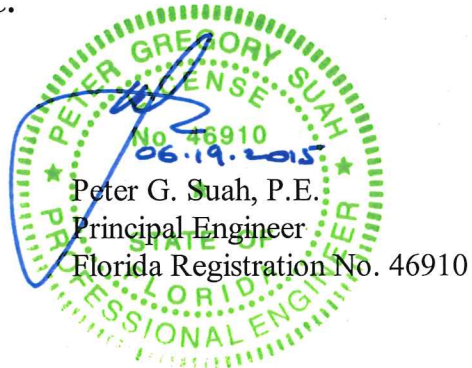
Antillian Engineering Associates, Inc. has completed geotechnical engineering investigations for the Package 10 Pump Station Rehabilitation project in Orange County, Florida. The work on this project was authorized under Orange County Utilities Continuing Contract Y14-906PH, and was done in general accordance with the scope of services presented in our proposal dated July 29, 2014. This report contains the results of those investigations and recommendations for structural design, earthwork, groundwater control and other concerns as appropriate.

It has been our pleasure to serve BFA Environmental and Orange County Utilities on this project. Please do not hesitate to call if you have any questions or if you need additional information.

ANTILLIAN ENGINEERING ASSOCIATES, INC.

State of Florida Authorization No. EB 6685


William L. Fox, P.E.
Geotechnical Engineer
Florida Registration No. 55385


Peter G. Suah, P.E.
Principal Engineer
Florida Registration No. 46910

Attachments: Figures
Appendix A: Field and Laboratory Investigations
Appendix B: Important Information About This Geotechnical Engineering Report
Appendix C: Constraints and Restrictions

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PROJECT DESCRIPTION

Orange County Utilities (OCU) is planning to rehabilitate four duplex wastewater pump stations in the south-central part of Orange County as part of the Package 10 Pump Station Rehabilitation Project. Those pump stations were identified as:

- É Pump Station 3116, at 6041 Rio Grande Avenue
- É Pump Station 3117, at 6698 Millay Drive
- É Pump Station 3216, at 5825 Padgett Circle, and
- É Pump Station 3360, at 8200 South Orange Blossom Trail

Approximate pump station locations are shown on Figure 1 and Figure 2. This project is being designed by BFA Environmental, Inc. (BFA) of Orlando, Florida. BFA retained Antillian Engineering Associates, Inc. to conduct geotechnical engineering investigations and provide evaluations and geotechnical recommendations for pump station design and construction.

AVAILABLE INFORMATION

The United States Geological Survey (USGS) quadrangle topographic map of the area and the May, 2009 USGS map "Potentiometric Surface of the Upper Florida Aquifer in the St Johns River Water Management District" were examined for general information about the project vicinity. Preliminary plan sheets and information furnished by BFA were also reviewed for additional information.

The USGS map showed the vicinity surrounding the pump station sites as nearly level to level, with ground surface elevations mapped between the Elevation 90 feet NGVD (El. 90) contour and the El. 100 contour. Land usage surrounding the sites was mapped as urban. Most of the existing roadways in the vicinity of the sites were shown on the map.

The potentiometric surface map showed the potentiometric surface of the Upper Floridan Aquifer near the El. 40 NGVD contour in the general area of the pump station sites. That is the approximate level to which the water in the Upper Floridan Aquifer would rise were it not confined by the low-permeability materials above the aquifer.

Preliminary plan sheets (Sheets 7-1 through 7-4) furnished by BFA showed the existing layouts of each pump station along with its planned components. Based on examination of these drawings and discussion with BFA, planned below-grade improvements common to each pump station included a new rectangular valve vault and new force main piping. Valve vaults would be precast concrete and were anticipated to be buried to a depth of about six feet. Force mains would be six-inch-diameter polyvinyl chloride (PVC) pipe and were anticipated to be buried to a depth of about three feet. Additional improvements to Pump Station 3116 included replacing about 26 feet of an existing 12-inch-diameter PVC sanitary sewer pipe and installing a new sanitary sewer manhole. BFA indicated that the depth of this existing pipe was about 12 feet, and that the new manhole would be precast concrete and would be buried to a depth of about three feet. Conventional open-cut or

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trenching and backfilling (cut-and-cover) construction methods would be used to install the below-grade components.

A new concrete driveway was also planned for each pump station. It was assumed that about a foot of fill would be placed to raise the grade for the driveway.

Additional information shown on the drawings and confirmed by BFA indicated that the existing wet well at each pump station would not be replaced. However, each wet well would be lined and its top would be replaced.

END OF SECTION

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FIELD INVESTIGATIONS

A reconnaissance was conducted at each pump station site to prepare for the drilling program. Test boring locations were established and staked for underground utility location and marking as required by Florida Statutes, and to facilitate identification by the drilling crew.

One test boring was drilled at each pump station on March 31, 2015. Test borings were designated using pump station number prefixes, i.e., 03116-10, 03117-10, 03216-10 and 03360-10. Approximate boring locations are shown on Figure 3 and Figure 4.

Each borehole was manually advanced to a depth of four feet using a bucket auger to reduce the likelihood of damage to unmarked utilities. Auger drilling and sampling were conducted in general accordance with ASTM D 1452. Each borehole then was advanced from four feet to its termination depth by continuous split-spoon sampling and mud-rotary drilling methods. The Standard Penetration Test (SPT) with split-spoon sampling was conducted in general accordance with ASTM D 1586. Testing and sampling were conducted continuously from four feet ten feet, then at five-foot intervals from ten feet to the indicated completion depth.

Sampler penetration resistance expressed in hammer blows per foot (the "SPT N-value"), soils recovered from the auger and in each sampler and other noteworthy conditions were logged by the field crew. The depth to groundwater in each borehole was measured and recorded on the field logs. Representative soil samples were sealed in clean, airtight containers for transportation to our Orlando office. At the completion of drilling, each borehole was backfilled with soil cuttings.

LABORATORY TESTING

The recovered soil samples were examined in our office by a geotechnical engineer who confirmed the descriptions on the field logs, classified the soils visually in accordance with the Unified Soil Classification System (ASTM D 2488) and developed a representation of the soil stratigraphy at each boring location. Representative soil samples were selected for laboratory testing, which consisted of 11 single-sieve soil gradation analyses, one Atterberg limits test series and one natural moisture content test. These test results are presented on the boring logs and on the Summary of Laboratory Test Results sheet and chart in Appendix A.

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SURFACE CONDITIONS

Each site was an existing wastewater lift station. Above-ground piping, electrical panels, utility poles and the tops of existing below-grade wet wells and vaults were visible. Numerous plastic flags, paint markings and manhole covers indicated the presence of buried sanitary sewer force mains, stormwater pipes and other underground utilities. Overhead utility lines were observed above PS 3116, PS 3117 and PS 3216. The ground surface at each site was level.

The PS 3116 site was adjacent to the southeastern corner of a two-story commercial building. Its ground surface was covered by fallen leaves. Vegetation included low shrubs and a few large trees that overhung this site.

The PS 3117 and PS 3216 sites were located in residential areas. PS 3117 was on the western side of Millay Drive. PS 3216 was on the eastern side of Padgett Circle. Single-family homes occupied the properties surrounding these sites. Ground cover at the PS 3117 site was well-maintained grass turf, while the ground surface at the PS 3216 site was covered by fallen leaves. Vegetation at the PS 3216 site included low shrubs and several large trees that overhung this site.

The PS 3360 site was on the western side of South Orange Blossom Trail, near the northeast corner of the Best Buy parking lot. It was connected to the parking lot by a concrete paved driveway. Commercial businesses occupied the properties surrounding this site. The tops of the below-grade structures were surrounded by concrete. This site was enclosed by a locked chain-link fence.

SUBSURFACE CONDITIONS

The stratigraphy, soil types and groundwater levels described below are based on the results of the field and laboratory testing programs. SPT N-values were used as empirical indications of soil condition. The Unified Soil Classification System group names and group symbols were used for soil classification. The descriptions below are general and describe the major soil types that were encountered. Detailed subsurface characteristics at each boring location are shown on the boring logs and on the Summary of Laboratory Test Results sheet and chart in Appendix A.

Pump Station 3116 (Boring 3116-1)

The soil encountered uppermost was dark brown to dark grayish brown fine sand that contained silt and was mixed with trace rock fragments and clayey sands. Its encountered thickness was about six feet. The sole SPT N-value recorded in this soil was 10 blows per foot (öbpfö), indicating that the soil was loose. Single-sieve soil gradation analysis of one sample indicated a fines content (fraction by dry weight passing the U.S. Standard No. 200 sieve) of 9 percent. Based on visual examination and laboratory testing, this soil was classified as sand with silt (öSP-SMö), and was also identified as possible backfill based on the presence of the constituents listed above.

Beneath the possible backfill was grayish brown fine sand that contained more silt. Its encountered thickness was about 22 feet. SPT N-values ranged from 4 bpf to 16 bpf, indicating that the soil was

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very loose to medium dense. Single-sieve soil gradation analysis of one sample indicated a fines content of 17 percent. Based on visual examination and laboratory testing, this soil was classified as silty sand (SMö).

Beneath the silty sand was grayish brown fine sand that contained silt. Its encountered thickness was about two feet. Actual thickness could not be confirmed because the boring was terminated in this soil without penetrating it completely. The sole SPT N-value recorded in this layer was 9 bpf, indicating that the soil was loose. Single-sieve soil gradation analysis of the sample indicated a fines content of 5 percent. Based on visual examination and laboratory testing, this soil was classified as sand with silt (SP-SM).

Groundwater was encountered in this borehole about ten feet below the existing ground surface.

Pump Station 3117 (Boring 3117-1)

Brown fine sand mixed with dark brown silty sand was encountered uppermost. Its encountered thickness was about four feet. No SPT N-values were recorded in this layer. This soil was classified visually as poorly graded sand (SPö).

Beneath the uppermost sand was dark grayish brown and very dark grayish brown fine sand that contained silt. Its encountered thickness was about 11 feet. SPT N-values ranged from weight-of-rod to 4 bpf, indicating that the soil was very loose. Single-sieve soil gradation analysis of one sample indicated a fines content of 7 percent. Based on visual examination and laboratory testing, this soil was classified as sand with silt (SP-SM).

Beneath the very loose sand with silt was a zone of grayish brown fine sand that contained more silt and was mixed with limerock fragments. Its encountered thickness was about three feet. The sole SPT N-value recorded in this layer was 16 bpf, indicating that the soil was medium dense. Single-sieve soil gradation analysis of the sample indicated a fines content of 18 percent. Based on visual examination and laboratory testing, this soil was classified as silty sand (SM).

Each soil layer described above was also identified as possible backfill based on their variations in color and composition and on the presence of the limerock fragments.

Beneath the possible backfill was grayish brown fine sand that contained silt. Its encountered thickness was about five feet. The sole SPT N-value recorded in this soil was 7 bpf, indicating that the soil was loose. Single-sieve soil gradation analysis of one sample indicated a fines content of 18 percent. Based on visual examination and laboratory testing, this soil was classified as silty sand (SM).

Beneath the silty sand was grayish brown fine sand that contained less silt. Its encountered thickness was about seven feet. Actual thicknesses could not be confirmed because the boring was terminated in this material without penetrating it completely. An SPT N-value of 7 bpf was recorded at each of two sample test intervals in this soil, indicating that the soil was loose. Single-sieve soil gradation

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analysis of one sample indicated a fines content of 10 percent. Based on visual examination and laboratory testing, this soil was classified as sand with silt (SP-SM).

Groundwater was encountered in this borehole about four feet below the existing ground surface.

Pump Station 3216 (Boring 3216-1)

Soils encountered uppermost were gray, very dark grayish brown and brown fine sand that contained trace silt. Encountered thickness was about six feet. The sole SPT N-value recorded in this soil was 14 bpf, indicating that the soil was medium dense. The soil was classified visually as poorly graded sand (SP), and was also identified as possible backfill based on its variation in color and composition.

Beneath the possible backfill was light brownish gray fine sand that contained silt. Its encountered thickness was about two feet. The sole SPT N-value recorded in this layer was 12 bpf, indicating that the soil was medium dense. This soil was classified visually as silty sand (SM).

Beneath the silty sand was gray fine sand that contained clay. Its encountered thickness was about two feet. The sole SPT N-value recorded in this layer was 13 bpf, indicating that the soil was medium dense. This soil was classified visually as clayey sand (SCö).

Beneath the clayey sand was greenish gray clay. Its encountered thickness was about five feet. The sole SPT N-value recorded in this layer was 21 bpf, indicating that the clay was very stiff. Single-sieve soil gradation analysis of the sample indicated a fines content of 64 percent. Additional laboratory testing indicated moisture content of 24 percent, liquid limit of 72 and plasticity index of 48. Based on laboratory testing, this soil was classified as high-plasticity (fatö) clay (CHö).

Beneath the clay was light gray, light brownish gray and pale brown fine sand that contained trace silt. Encountered thickness was about 17 feet. Actual thicknesses could not be confirmed because the boring was terminated in this soil without penetrating it completely. SPT N-values ranged from 9 bpf to 41 bpf, indicating that the soil was loose to very dense. Single-sieve soil gradation analysis of one sample indicated a fines content of 3 percent. Based on visual examination and laboratory testing, this soil was classified as poorly graded sand (SP).

Groundwater was encountered in this borehole about six feet below the existing ground surface.

Pump Station 3360 (Boring 3360-1)

The soil encountered uppermost was dark brown fine sand that contained silt, and was occasionally mixed with trace rock fragments and light gray sand. Its encountered thickness was about seven feet. SPT N-values recorded in this soil were 10 bpf and 6 bpf, indicating that the soil was loose. Single-sieve soil gradation analysis of one sample indicated a fines content of 8 percent. Based on visual examination and laboratory testing, this soil was classified as sand with silt (SP-SM). This soil was also identified as possible backfill based on its variation in composition and the presence of the rock fragments.

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Beneath the possible backfill was dark brown fine sand that contained silt. Its encountered thickness was about six feet. SPT N-values recorded in this soil were 12 bpf and 11 bpf, indicating that the soil was medium dense. This soil was classified visually as sand with silt (SP-SM).

Beneath the sand with silt was grayish brown fine sand that contained more silt. Its encountered thickness was about five feet. The sole SPT N-value recorded in this layer was 4 bpf, indicating that the soil was very loose. This soil was classified visually as silty sand(SM).

Beneath the silty sand was grayish brown and light brownish gray fine sand that contained less silt. Its encountered thickness was about 12 feet. Actual thicknesses could not be confirmed because the boring was terminated in this soil without penetrating it completely. SPT N-values recorded in this layer were 5 bpf and 8 bpf, indicating that the soil was loose. Single-sieve soil gradation analysis of two samples indicated fines contents of 6 percent and 7 percent. Based on visual examination and laboratory testing, this soil was classified as sand with silt (SP-SM).

Groundwater was encountered in this borehole about 13 feet below the existing ground surface.

END OF SECTION

GENERAL COMMENTS ON RECOMMENDATIONS

The following recommendations are based upon a review of the available information, the field and laboratory test results, our understanding of the proposed construction and our experience with similar projects and subsurface conditions. Soils are natural materials, so variations in composition and other physical characteristics are normal and should be expected. Because of natural variations in depth, composition and consistency of soils and the limited number of borings drilled for this investigation, unsuitable materials and other soils not encountered by the borings may exist beyond each boring location, and should be anticipated. If subsurface conditions encountered during construction differ significantly from those encountered in the borings, those conditions should be reported to us for our observation and comment.

The recommendations contained in this report are based on our understanding that conventional open-cut and trenching and backfilling (cut-and-cover) construction methods will be used to install the valve vaults and below-grade piping. If plans for the proposed construction change from those discussed in this report, we request the opportunity to review our recommendations and amend them as needed to accommodate those changes. We recommend a review of the project plans and geotechnical-related specifications by this office to ensure that the geotechnical engineering recommendations contained in this report are properly interpreted and presented in those documents.

GENERAL ASSESSMENT OF ENCOUNTERED SOILS

As discussed in the SUBSURFACE CONDITIONS section of this report, the uppermost soil encountered at the Pump Station 3116 site to a depth of about six feet was loose sand with silt mixed with trace amounts of rock fragments and clayey sands. This soil was also identified as possible backfill. Beneath the possible backfill were very loose to medium dense, but mostly loose, silty sand and sand with silt. Groundwater was encountered about ten feet below the existing ground surface.

Possible backfill was encountered uppermost to a depth of about 18 feet at the Pump Station 3117 site. The backfill was mostly comprised of fine sand and fine sand with silt. These soils were very loose to loose, as evidenced by the low SPT N-values. Loose silty sand and loose sand with silt were encountered lowermost at this site. Groundwater was encountered about four feet below the existing ground surface.

The uppermost soil encountered at the Pump Station 3216 site was loose sand to a depth of about six feet. This soil was also identified as possible backfill. Medium dense silty sand and medium dense clayey sand were encountered beneath the possible backfill to a depth of about nine feet. A layer of very stiff clay was encountered from about nine feet to about 13 feet. Fine sand that was mostly medium dense to dense was encountered lowermost. Groundwater was encountered about six feet below the existing ground surface.

Possible backfill was also encountered uppermost to a depth of about seven feet at the Pump Station 3360 site. The backfill was comprised of loose fine sand with silt mixed with rock fragments.

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Medium dense sand with silt was encountered beneath the possible backfill. Very loose silty sand and loose sand with silt were encountered lowermost. Groundwater was encountered about 13 feet below the existing ground surface.

As mentioned, planned improvements common to each pump station site included a new precast concrete valve vault buried about six feet below grade, new force main piping buried about three feet below grade and a new concrete-paved driveway. Additional improvements at the Pump Station 3116 site included replacing a portion of an existing PVC sanitary sewer pipe that was buried about 12 feet below grade, and installing a new sanitary sewer manhole buried about three feet below grade. The near-surface soil types encountered at each site are amendable for support for the lightly loaded valve vaults and sanitary manhole, as well as planned concrete-paved driveways. Similarly, these soils are suitable for support of the planned piping. Soils beneath these features and all backfill soils will need to be densified to provide adequate support. They should be prepared in accordance with the earthwork recommendations presented in this report.

The zones of very loose and loose sands encountered deeper in the profiles should not adversely affect foundation performance because of the anticipated low loading and limited depths of influence of the foundations.

VALVE VAULT DESIGN

As discussed earlier in this report, each new valve vault is expected to be buried about six feet. A groundwater level at the existing ground surface, or proposed finished grade, whichever is higher, should be used for design of each valve vault. Under this condition, we recommend using a saturated soil unit weight of 120 pounds per cubic foot (pcf) and a lateral earth pressure coefficient of 0.5. That coefficient represents the *at-rest* condition because small, enclosed structures tend to be self-bracing and unlikely to deform to the extent needed for the soil to attain the active condition. The same lateral earth pressure coefficient should be applied to surface loads around each valve vault, including nearby shallow foundations and incidental vehicular traffic. In the absence of specific load information, vehicular traffic should be represented by a uniformly distributed vertical load of 250 pounds per square foot (psf). For a groundwater level at the ground surface, the lateral earth pressure induced by the soil only may be represented by an equivalent fluid pressure of 29 pcf for structural design purposes only, to which hydrostatic pressure must be added.

The bottom of each valve vault will function as a mat foundation. Based on the planned embedment depth and the encountered soil and groundwater conditions, we estimate the net unloading of the bearing soils to be about 600 psf. As a result, the gross bearing pressure under the foundation should not exceed 600 psf in order to minimize the potential for settlement.

The weight of the valve vault (even with additional mass to resist uplift and with all equipment installed) is anticipated to be less than the weight of the soil and groundwater that was removed for its installation. Each valve vault should be designed to ensure that there is no uplift when it is empty. Uplift resistance should be derived from the weight of the structure and equipment along with

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the weight of backfill resting on any parts of the foundation that project horizontally beyond the side walls. Side friction resistance along the walls of valve vault walls should not be considered.

EARTHWORK FOR BELOW-GRADE CONSTRUCTION

All below-grade construction should be conducted in accordance with the recommendations for excavation safety and groundwater control presented later in this report. Below-grade construction will likely require temporary excavation support systems to withstand the anticipated lateral loads and limit unacceptable movement of surrounding soils and adjacent structures, particularly for replacement of the 12-inch-diameter sewer pipe at the PS 3116 site. This approach will likely require dewatering of excavations to establish and maintain dry, stable and safe work areas.

Careful attention must be paid to the selection, installation, operation, monitoring, maintenance and removal of temporary excavation support systems. They should provide sufficient working room for anticipated below-grade activities such as installation of formwork and compaction of backfill. Temporary excavation support systems should be removed so as not to disturb completed structures, the backfill nor adjacent structures. The contractor should prepare contingency plans so that the cause(s) of any observed distress to excavation support systems, surrounding soils, or adjacent structures can be identified promptly and accurately, and addressed decisively.

Pavement materials, grass and other vegetation, roots, topsoil or any other unsuitable materials within the limits of the proposed construction should be removed and either discarded or stockpiled away from the immediate work areas for reuse as appropriate, possibly as landscaping material. Any organic materials encountered deeper below the ground surface should be treated in a similar fashion.

Conventional construction equipment should be able to dig the excavations. However, since proposed work areas extend beyond the test boring locations into other areas that were not explored, roots, organic materials, debris, dense to very dense soils and cemented soils are possible and should be expected, even though those materials were not encountered in the borings. The excavations should be dug to the depths and widths needed for installation of the valve vault, manholes, piping, excavation support systems and any below-grade equipment or materials that may be needed. This work should be supervised by a geotechnical engineer or his designated representative to ensure that excavations are not being over-dug and that the bearing soils are not being disturbed. Any soft, loose or muddy materials should be carefully and completely removed to expose uniform, undisturbed soil.

Below-grade concrete foundations need uniform support to function effectively, even when lightly loaded. Exposed subgrade soils at the bearing depths should be examined and probed by a geotechnical engineer or designated representative to locate soft or yielding areas, hard spots or other non-uniform conditions. Non-uniform conditions should be treated as directed by the Engineer and the Owner in consultation with the examining geotechnical engineer.

Exposed subgrade soils at the bottoms of excavations for the valve vaults, pipes and manhole should be thoroughly and uniformly compacted to achieve not less than 95 percent of the maximum dry

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density obtained by the Modified Proctor method (ASTM D 1557) to a depth at least one foot below subgrade level. Because of the sandy nature of the soils, this work should be done just before foundation concrete is placed to reduce the risk of disturbance. Immediately after subgrade soils have been adequately compacted, a thin layer of non-structural concrete (a *õmud matõ*) may be placed on the exposed subgrade soils to protect the bearing soils from disturbance and to provide a stable, durable working surface for the remainder of the construction activity.

Backfill soils should be placed uniformly on all sides of the proposed valve vaults and manhole in loose lifts approximately eight inches thick before initiating compaction. Each lift should be compacted to not less than 95 percent of the maximum dry density obtained by the Modified Proctor method (ASTM D 1557). Trench backfill for pipes should be placed and compacted in a similar manner.

EARTHWORK FOR PAVED DRIVEWAY AREAS

All vegetation, topsoil, organic matter and debris within the driveway areas should be removed to expose clean, undisturbed soils. Clearing and grubbing should extend at least five feet beyond the edges of the driveway areas and should be expected to a depth of at least one foot.

The cleared ground surfaces should be examined and probed by a geotechnical engineer or designated representative to locate soft or yielding areas, hard spots or other non-uniform conditions. Non-uniform conditions should be treated as directed by the Engineer and the Owner in consultation with the examining geotechnical engineer. The cleared ground surfaces should be compacted to not less than 95 percent of the maximum dry density obtained by the Modified Proctor method (ASTM D 1557) to a depth of at least two feet.

It is anticipated that some filling and regrading of the site will be needed. Fill soils should be placed in uniform lifts approximately 10 to 12 inches in loose thickness and compacted to not less than 95 percent of the maximum dry density obtained by the Modified Proctor method (ASTM D 1557).

QUALITY ASSURANCE TESTING

A quality assurance program should be established to ensure that excavations, backfilling and compacting operations are in accordance with the project plans and specifications. In-place density testing should be conducted at the bottoms of excavations for the valve vaults, pipes and manhole. The moisture content of the subgrade soils, as well as all backfill and fill, should be within a range that will optimize the densification process. The contractor should be prepared to adjust the moisture content and change equipment, procedures and lift thickness as needed (at no additional cost to the Owner) in order to achieve the recommended compaction.

Backfill placed around the valve vaults and the manhole should be tested for adequate compaction at a frequency not less than one test per lift. Similarly, backfill for pipe trenches should be tested at

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a frequency not less than one test per lift per 300-foot run of pipe. Fill for site grading should be tested for satisfactory compaction at a frequency of not less than one test per lift per 5,000 square feet, or at a minimum of one test location per lift, whichever is greater.

REUSE OF EXCAVATED MATERIALS

It is anticipated that excavated soils will be reused as backfill and fill. Most of the soils encountered in the borings should be suitable for reuse, although some may be too wet or too dry and will require proper moisture conditioning to achieve the recommended degree of compaction. Fill and backfill should consist of sand with a fines content less than 12 percent that is free from debris and rubbish, topsoil, mud, muck, peat, stumps, roots, vegetable matter or other unsuitable materials that might decompose or cause excessive settlement. These soils should be non-plastic and contain no more than five percent by weight of organic matter.

Dewatering in preparation for excavation may reduce in-situ soil moisture to more favorable levels. If this is not sufficient, then excavated soils should be stockpiled to drain, spread to dry or blended with drier materials to achieve a suitable moisture condition.

Because a limited number of borings was drilled for this investigation, variations in consistency and fines content of the uppermost soils are likely, and should be expected. As a result, soil types encountered during excavations will likely vary. Possible soil types that might be encountered within the planned depths of excavation and general recommendations for their reuse are discussed below for general guidance. These guidelines should not override the project specifications. There is the possibility that other soils may be encountered during construction that do not fall into one of the categories discussed below.

Poorly Graded Sands (SP)

These soils had fines contents of 5 percent or less, and are commonly referred to as "clean" sands. They are highly desirable for use as fill and backfill in central Florida because they drain freely. That characteristic allows these soils to be placed and compacted readily, even if they have been excavated from below the groundwater level. Satisfactory levels of compaction can be achieved using a wide variety of compaction equipment and across a broad range of moisture contents. Some instability or "pumping" should be expected if these soils are compacted near saturation.

Sands with Silt (SP-SM) and Sands with Clay (SP-SC)

These soils consisted of sands with fines contents between 5 percent and 12 percent. Although these soils do not drain as freely as clean sands, they are still quite suitable for use as fill and backfill. If excavated from below the groundwater surface, they may have to be stockpiled and allowed to drain (or spread to dry) before being reused. Satisfactory compaction can be achieved using a variety of compaction equipment and across a moderate to wide range of moisture contents. However, efforts should be made during compaction to maintain the moisture content below the optimum. Some instability or "pumping" should also be expected if these soils are compacted near saturation.

Silty Sands (SM) and Clayey Sands (SC)

These soils consisted of sands with fines contents between 12 percent and 50 percent. They do not drain as well as sands with silt and sands with clay. These soils may be reused successfully as fill and backfill, but will require close attention to moisture content and careful selection of compaction equipment. Excavated silty sands and clayey sands will likely have to be stockpiled to drain and/or possibly spread to dry before being reused. Suitable compaction is generally achieved in these soils only across a narrow range of moisture contents, and this range narrows even further as the fines content increases. Silty sands and clayey sands should be compacted below the optimum moisture content to reduce the potential for moisture-related instability. Soils with more than 20 percent fines should not be reused as fill or backfill.

GROUNDWATER CONTROL

The contractor should expect that groundwater will influence proposed construction activities. The contract documents should require the contractor to verify groundwater levels before starting construction, and to be responsible for all dewatering, regardless of those groundwater levels. The contractor should be responsible for all aspects of dewatering, regardless of groundwater levels at the time of construction. That responsibility includes not just the installation and operation of an effective dewatering system, but also all permits needed to satisfy applicable environmental regulations, and all groundwater volume and quality monitoring systems.

All excavations and below-grade construction should be conducted in the dry. The contractor should be prepared to lower the groundwater level and maintain it at least two feet below the bottoms of all excavations for the duration of below-grade construction activity. Groundwater should be lowered to the recommended level prior to excavation to minimize the potential for instability of excavations, bottom heave or quick conditions within the excavation. Dewatering systems should be maintained in operation until buried pipes and any buried structures have been placed and completely backfilled in a satisfactory manner such that sufficient dead weight exists on and around buried pipes and structures to prevent uplift. Decommissioning of dewatering systems should be addressed in the contractor's dewatering submittal.

Water from dewatering pumps should be discharged as far as practically possible away from the work area to prevent return flow or erosion into the excavations. The contractor should also have submersible pumps ready on site to intercept and remove any localized inflows. The ground surface around excavations should be graded to minimize inflow of runoff.

EXCAVATION SAFETY

In accordance with the latest regulations promulgated by the Occupational Safety and Health Administration (OSHA), the sides of all excavations more than four feet deep must be sloped or supported to withstand lateral forces exerted by the existing soils. Excavation support systems must also be able to support possible hydrostatic pressures and surcharge loads. For calculating the lateral

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loads due to the site soils, we recommend a soil unit weight of 125 pcf and a lateral earth pressure coefficient of 0.4 for unbraced temporary excavation support systems. This factor should be increased to 0.5 if the system is braced. The same coefficients should be applied to loads on the ground surface from construction equipment and other vehicular traffic in the vicinity of the excavations. Traffic loads should be represented by a uniformly distributed surcharge of 250 psf.

All excavations should be kept dry so that work can proceed safely and efficiently. The design of the excavation support systems should be in conjunction with the design of the dewatering systems. As indicated in the GROUNDWATER CONTROL section, groundwater should be maintained at least two feet below the bottom of excavations for the duration of below-grade construction activity. However, dewatering systems can fail, allowing the groundwater to return to its pre-construction level and possibly fill the excavations. Subsequent rapid removal of the water by pumping out the excavation to resume work should be avoided as this could create a rapid drawdown condition which raises hydrostatic pressure in the soil outside the excavation to a maximum, and reduces soil strength to its minimum.

DRIVEWAY PAVEMENT

Pavement for the driveways should be designed in accordance with accepted procedures, using the worst-case loading that can be expected during the design life of the pavement. Shear loading from the tires of turning, heavily-loaded service trucks should be taken into consideration. Portland cement concrete pavement with a minimum thickness of ten inches should be considered for high-use areas. The pavement should be designed using a modulus of subgrade reaction of 150 pounds per cubic inch. Concrete pavements should have control joints spaced as recommended by the Florida Concrete Products Association (or other appropriate agency) to minimize the likelihood of unwanted cracking in response to excessive shrinkage or thermal stress.

END OF SECTION

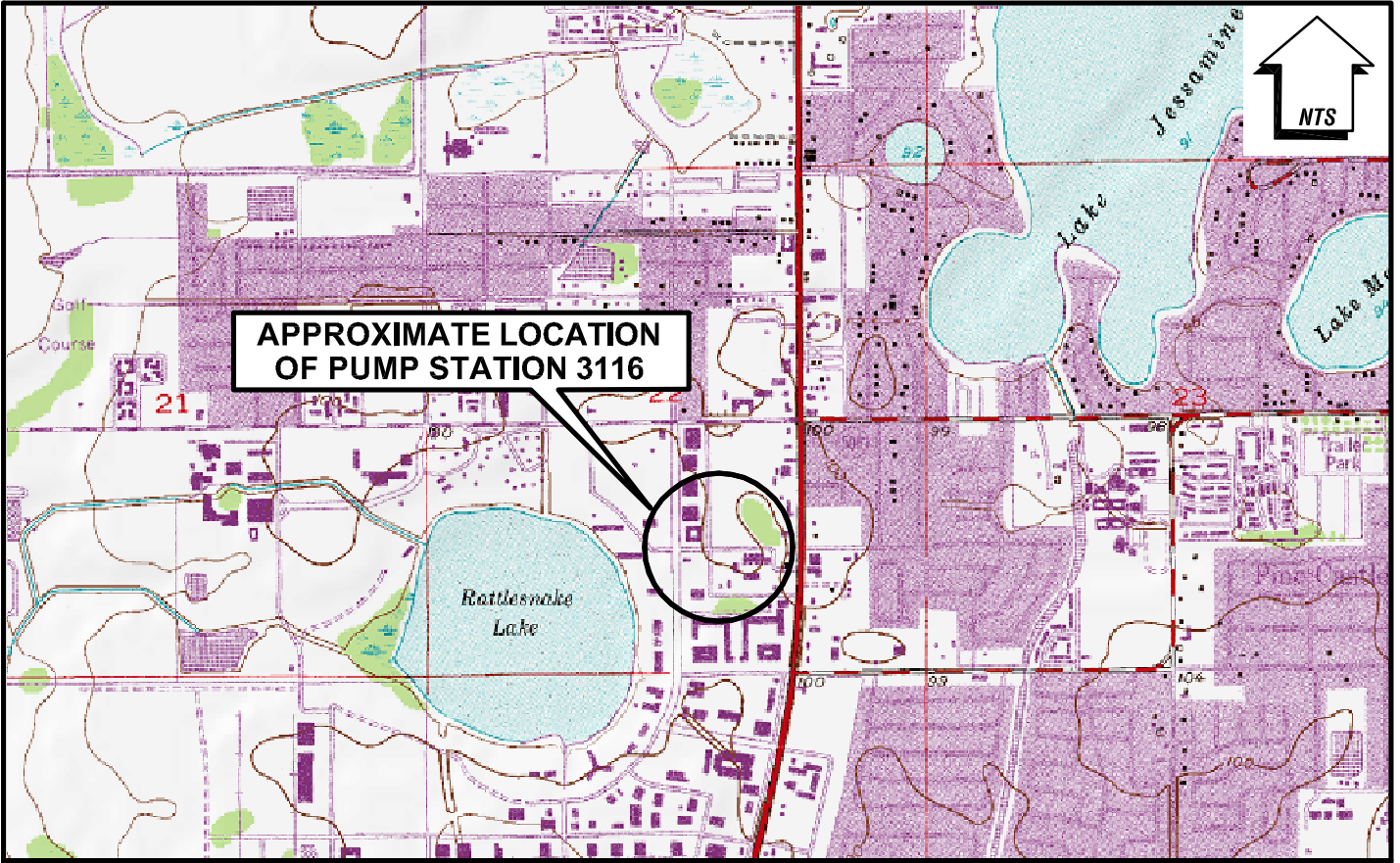
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LIMITATIONS

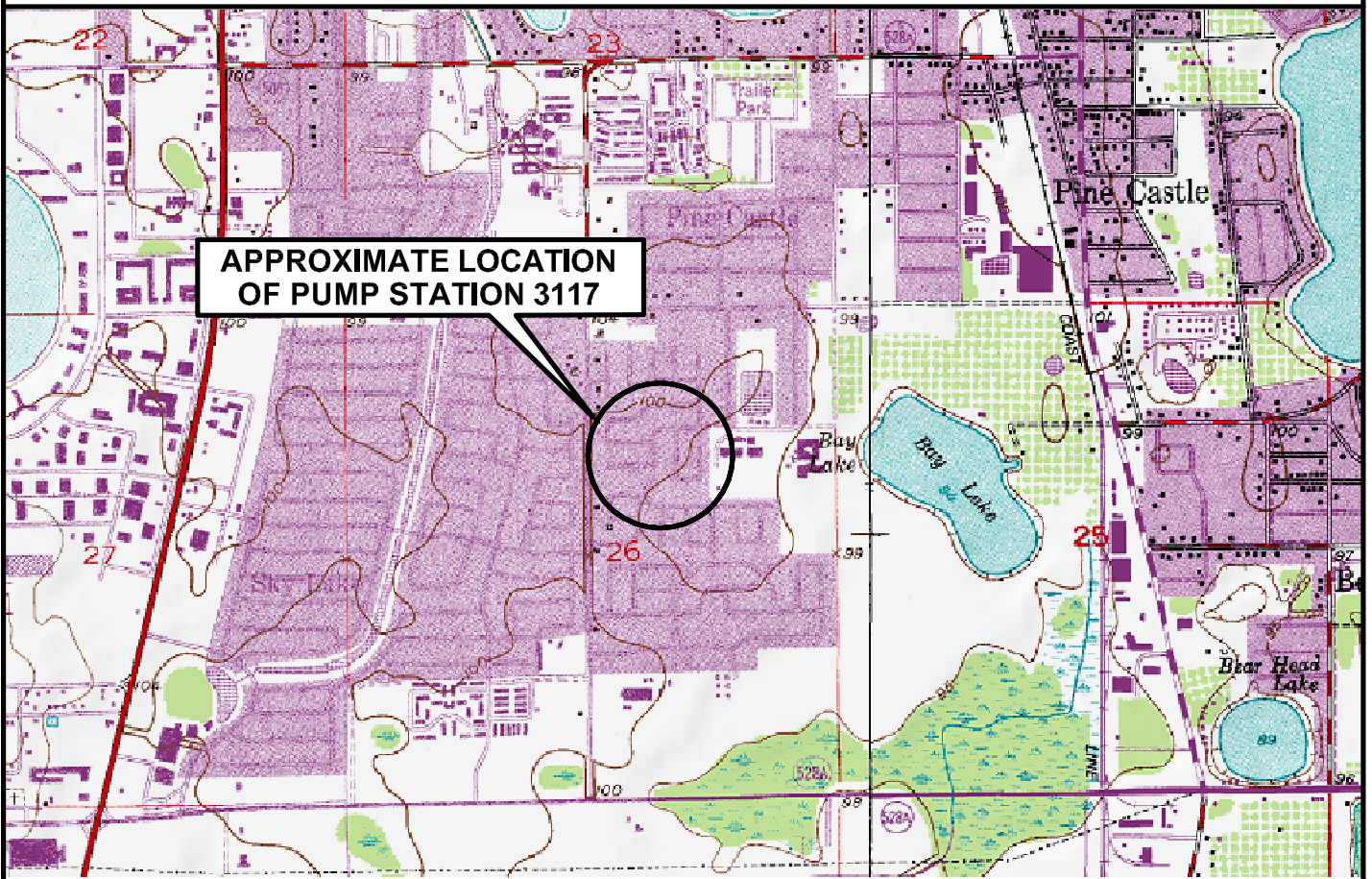
This report presents an evaluation of the subsurface conditions on the basis of accepted geotechnical procedures for site characterization. The recovered soil samples were not examined or tested in any way for chemical composition or environmental hazards. The investigation was confined to the zone of soil which is likely to be affected by the proposed construction, and did not address the potential of surface expression of deep geologic activity such as sinkholes. This type of evaluation requires a more extensive range of services than those performed for this study.

Because of the natural limitations inherent in working with the subsurface, a geotechnical engineer cannot predict and address all possible problems. During construction, geotechnical issues not addressed in this report may arise. The bulletin "Important Information About This Geotechnical Engineering Report" published by the Geoprofessional Business Administration (GBA) is presented in Appendix B to help explain the nature of geotechnical issues. Additional information is presented in Appendix C to discuss the potential concerns and the basic limitations of a typical geotechnical investigation report.

FIGURES

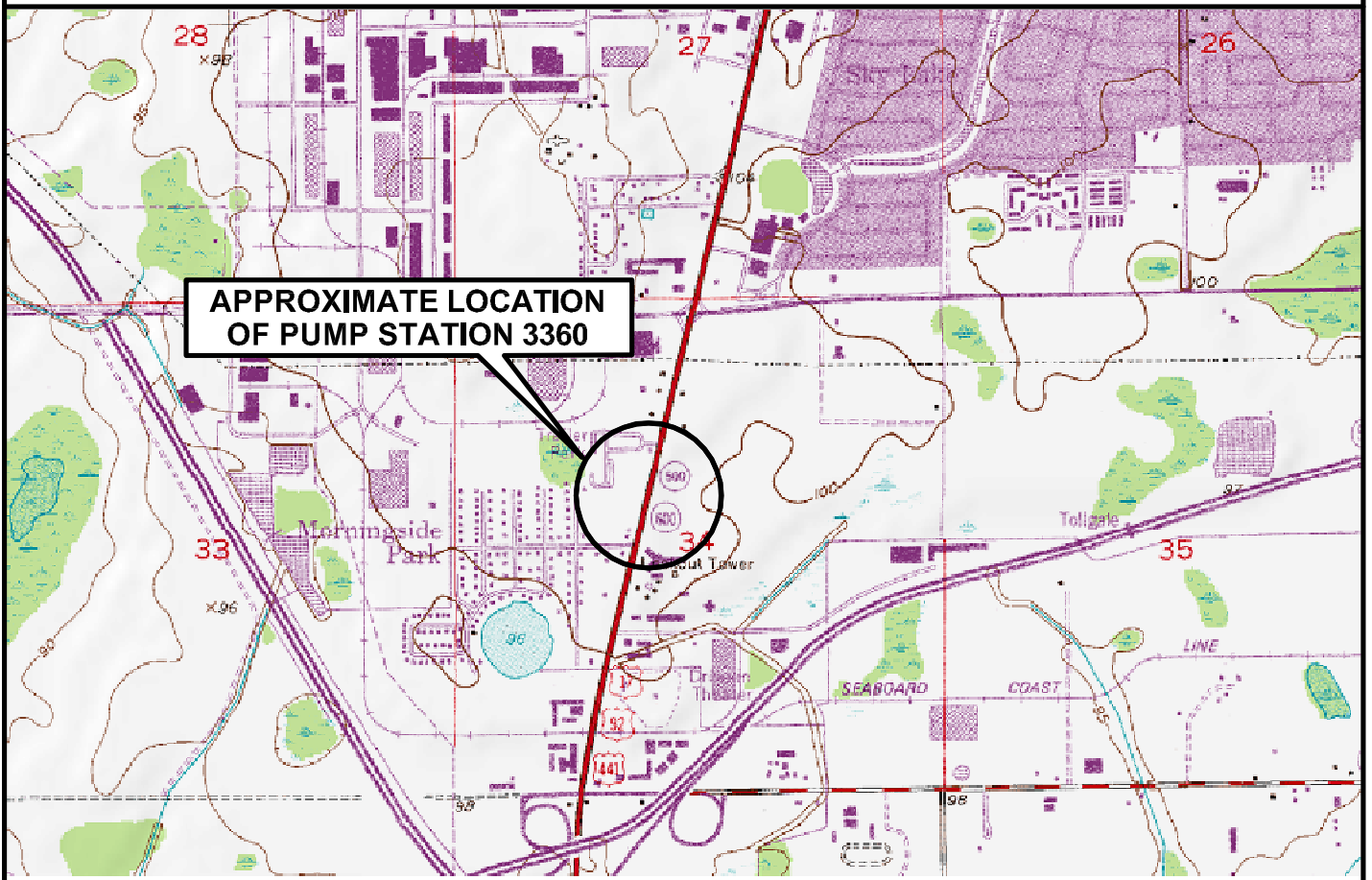
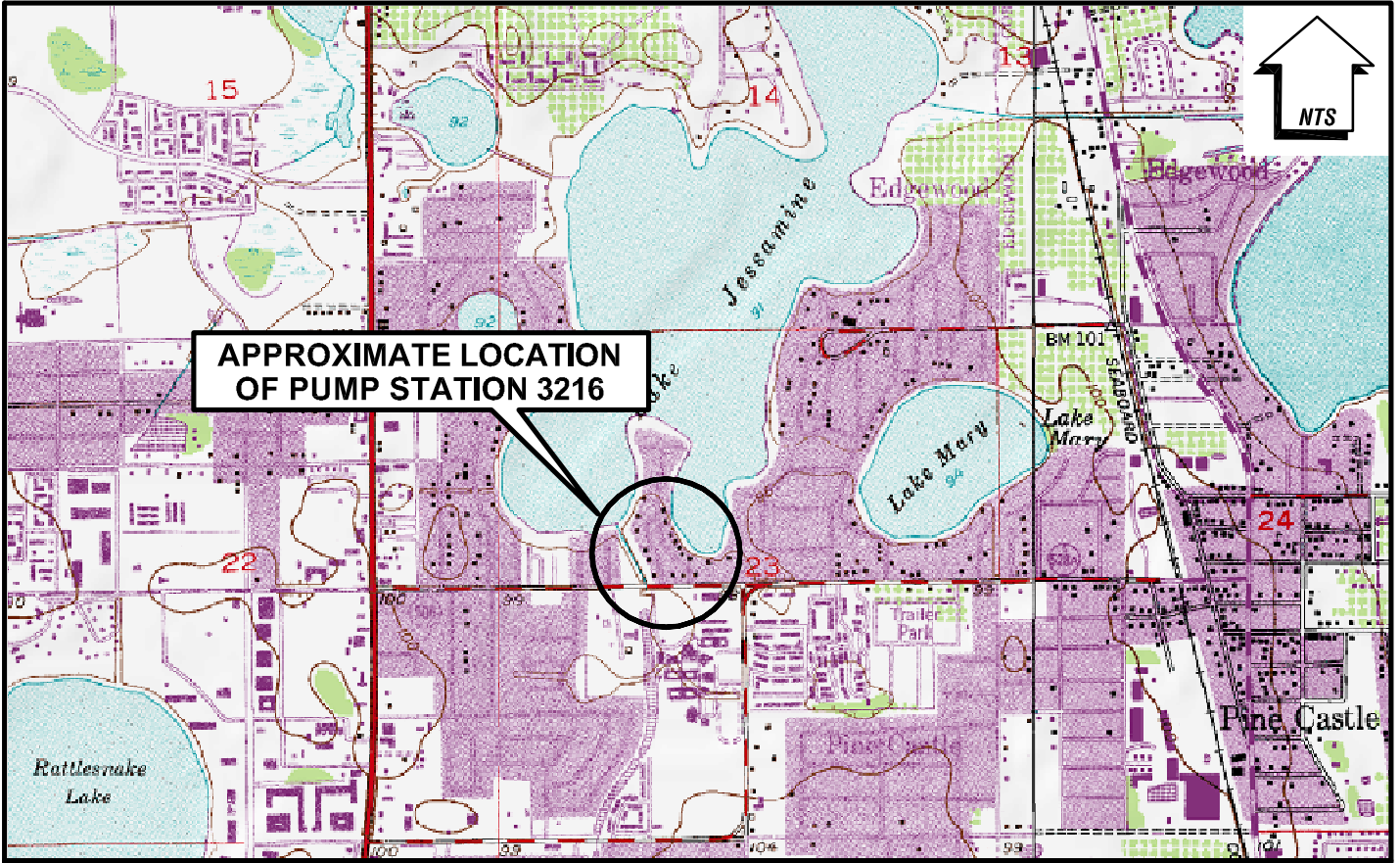


APPROXIMATE LOCATION OF PUMP STATION 3116



APPROXIMATE LOCATION OF PUMP STATION 3117

SITE LOCATION MAPS



SITE LOCATION MAPS

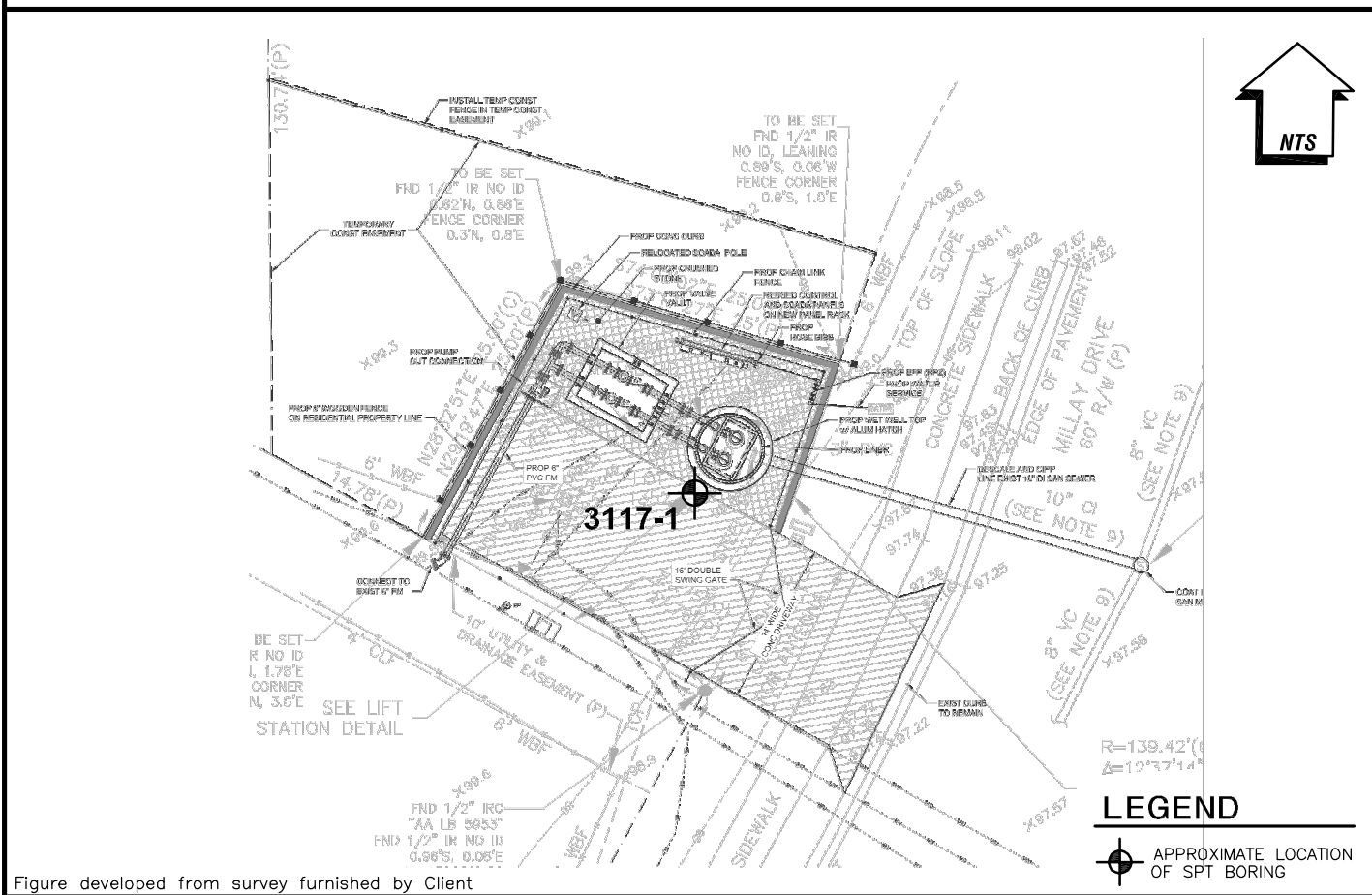
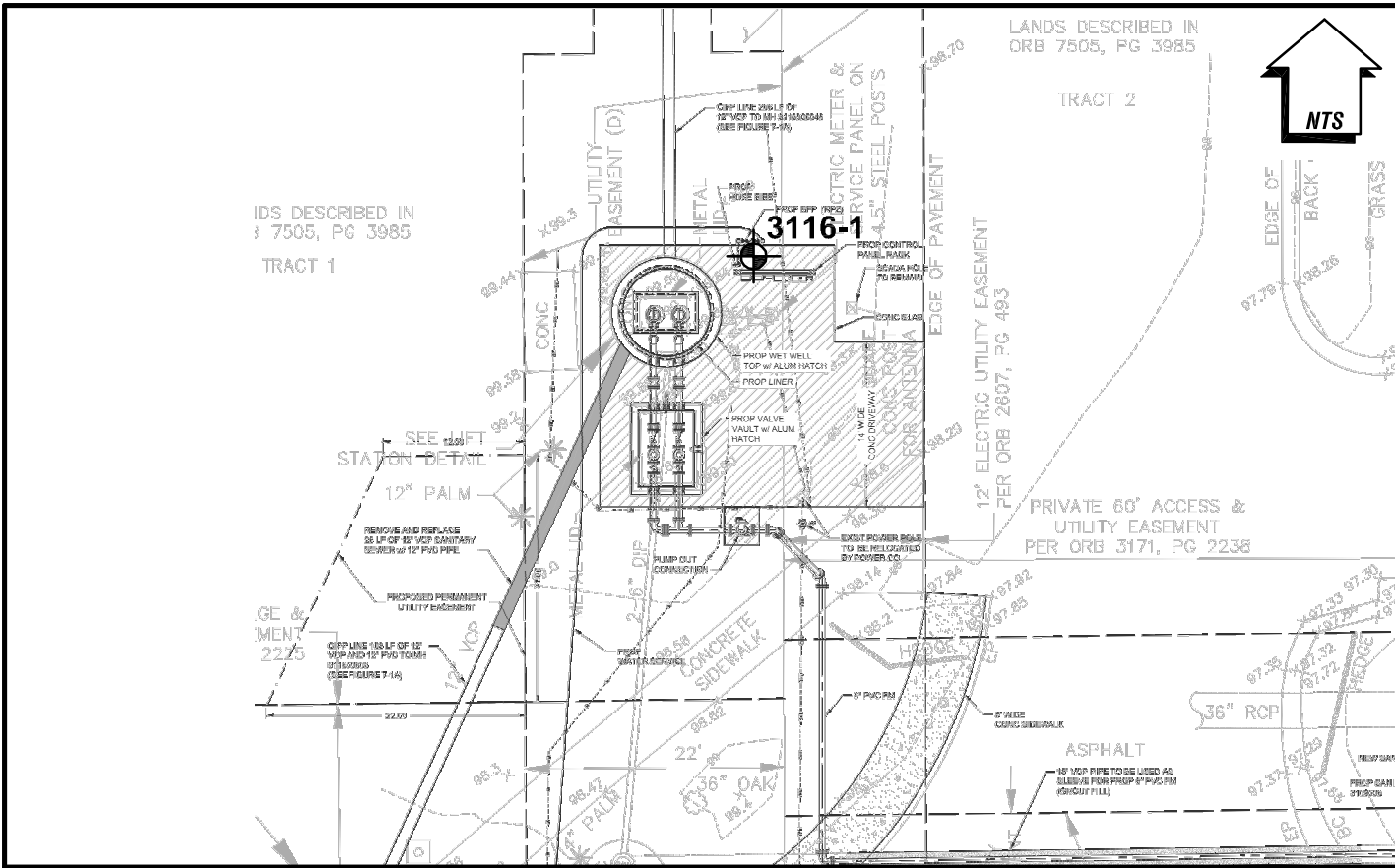


Figure developed from survey furnished by Client

EXPLORATION LOCATION PLANS

APPENDIX A

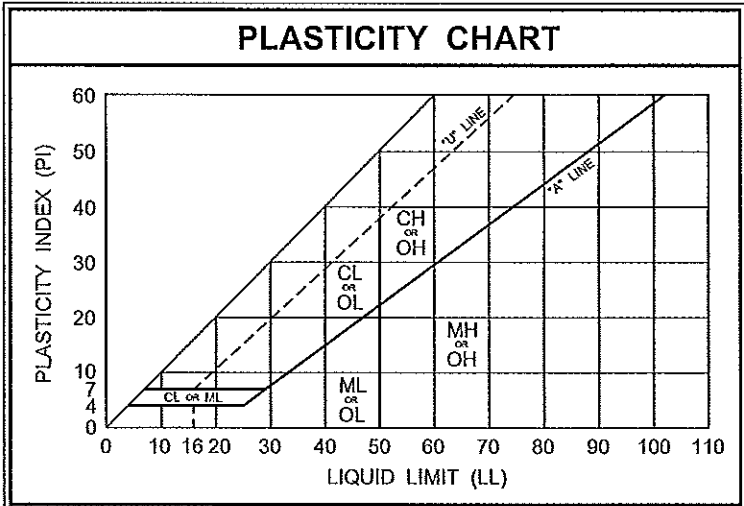


KEY TO BORING LOGS

SYMBOLS	
10	SPT N-Value (number of blows a 140-lb weight falling 30 inches required to drive a Standard Split-Spoon sampler one foot into otherwise undisturbed soil)
WR	Penetration of sampler under weight of drill rods
WH	Penetration of sampler under weight of drill rods and hammer
SS	Split Spoon sample
ST	Undisturbed thin-walled Shelby Tube sample
—	Observed change in soil type
- - -	Unobserved change in soil type
▽	Estimated seasonal high groundwater level
▼	Encountered groundwater level

SOIL CONSISTENCY	
(Based on empirical correlation with SPT N-Value)	
GRANULAR SOILS	
Very Loose - Less Than 4 blows/ft.	
Loose - 4 to 10 blows/ft.	
Medium Dense - 10 to 30 blows/ft.	
Dense - 30 to 50 blows/ft.	
Very Dense - More Than 50 blows/ft.	
FINE-GRAINED SOILS	
Very Soft - Less Than 2 blows/ft.	
Soft - 2 to 4 blows/ft.	
Firm - 4 to 8 blows/ft.	
Stiff - 8 to 15 blows/ft.	
Very Stiff - 15 to 30 blows/ft.	
Hard - More Than 30 blows/ft.	

UNIFIED SOILS CLASSIFICATION SYSTEM			
ASTM D 2487			
(Based on material passing the 3-inch (75-mm) sieve)			
MAJOR DIVISIONS		GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW Well-graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	GP Poorly graded gravels and gravel-sand mixtures, little or no fines
		GC Silty gravels, gravel-sand-silt mixtures	
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW Well-graded sands and gravelly sands, little or no fines
		SANDS WITH FINES	SP Poorly graded sands and gravelly sands, little or no fines
		SM Silty sands, sand-silt mixtures	
FINE-GRAINED SOILS	SILTS AND CLAYS Liquid limit 50% or less	ML Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	
		CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		OL Organic silts and organic silty clays of low plasticity	
	SILTS AND CLAYS Liquid limit greater than 50%	MH Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts	
		CH Inorganic clays or high plasticity, fat clays	
		OH Organic clays of medium to high plasticity	
HIGHLY ORGANIC SOILS	Pt	Peat, muck and other highly organic soils	





LOG OF BORING 3116-1

SHEET 1 OF 1

PROJECT NO: **201409-1**
 PROJECT: **OCU Package 10 Pump Stations**
 DATE: **3/31/15**
 LOCATION: **See Figure 3**

SURFACE ELEVATION: **Unknown**
 GROUNDWATER DEPTH: **10.0**
 COMPLETION DEPTH: **30.0**
 DRILLING METHOD: **Mud-rotary**

DEPTH, ft.	SAMPLES SPT N-VALUE (bpcf)	SAMPLE TYPE	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	- 200	MC %	LL	PI	OC %
0		HA	Dark brown fine SAND with silt, trace rock fragments (SP-SM)			9				
			- dark grayish brown, with trace clayey sands							
	10	SS	- loose							
5	16	SS	(POSSIBLE BACKFILL)							
			Medium dense, grayish brown silty fine SAND (SM)	6.0						
	8	SS	- loose			17				
	4	SS	- very loose							
10				6.0						
	12	SS	- medium dense							
15										
	6	SS	- loose							
20										
	14	SS	- medium dense							
25										
	9	SS	Loose, grayish brown fine SAND with silt (SP-SM)	28.0		5				
30				30.0						



LOG OF BORING 3117-1

SHEET 1 OF 1

PROJECT NO: **201409-1**
 PROJECT: **OCU Package 10 Pump Stations**
 DATE: **3/31/15**
 LOCATION: **See Figure 3**

SURFACE ELEVATION: **Unknown**
 GROUNDWATER DEPTH: **4.3**
 COMPLETION DEPTH: **30.0**
 DRILLING METHOD: **Mud-rotary**

DEPTH, ft.	SAMPLES SPT N-VALUE (bpcf)	SAMPLE TYPE	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	- 200	MC %	LL	PI	OC %
0		HA	Brown fine SAND (SP)							
4	4	SS	- mixed with dark brown silty fine sand - very loose, dark grayish brown silty fine SAND (SM)							
5	1	SS	- very dark grayish brown fine sand with silt (SP-SM)							
	WR	SS				7				
	WH	SS	- no sample recovery							
10	1	SS	- with more silt							
	WH	SS	- no sample recovery							
15	16	SS	- medium dense, grayish brown silty fine sand mixed with few limestone fragments up to 1-inch size							
			(POSSIBLE BACKFILL)							
	7	SS	Loose, grayish brown silty fine SAND, trace shell fragments (SM)	18.0		18				
20										
	7	SS	Loose, grayish brown fine SAND with silt, trace shell fragments (SP-SM)	23.0		10				
25										
	7	SS	- no shell							
30				30.0						



LOG OF BORING 3216-1

SHEET 1 OF 1

PROJECT NO: **201409-1**
 PROJECT: **OCU Package 10 Pump Stations**
 DATE: **3/31/15**
 LOCATION: **See Figure 4**

SURFACE ELEVATION: **Unknown**
 GROUNDWATER DEPTH: **5.8**
 COMPLETION DEPTH: **30.0**
 DRILLING METHOD: **Mud-rotary**

DEPTH, ft.	SAMPLES SPT N-VALUE (bpcf)	SAMPLE TYPE	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	- 200	MC %	LL	PI	OC %
0		HA	Gray fine SAND (SP)							
			- very dark grayish brown							
5	9	SS	- loose, brown (POSSIBLE BACKFILL)							
	12	SS	Medium dense, light brownish gray silty fine SAND (SM)	5.5						
	13	SS	Medium dense, gray clayey fine SAND (SC)	7.0						
	21	SS	Very stiff, light greenish gray CLAY (CH)	8.5		64	24	72	48	
15	24	SS	Medium dense, light gray fine SAND (SP)	13.0		3				
20	41	SS	- dense, light brownish gray							
25	16	SS	- medium dense							
30	9	SS	- loose, pale brown	30.0						



LOG OF BORING 3360-1

SHEET 1 OF 1

PROJECT NO: **201409-1**
 PROJECT: **OCU Package 10 Pump Stations**
 DATE: **3/31/15**
 LOCATION: **See Figure 4**

SURFACE ELEVATION: **Unknown**
 GROUNDWATER DEPTH: **13.0**
 COMPLETION DEPTH: **30.0**
 DRILLING METHOD: **Mud-rotary**

DEPTH, ft.	SAMPLES SPT N-VALUE (bpcf)	SAMPLE TYPE	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	- 200	MC %	LL	PI	OC %
0		HA	Dark brown fine SAND with silt (SP-SM) - trace rock fragments							
5	10	SS	- loose			8				
6	6	SS	- mixed with light gray fine sand (POSSIBLE BACKFILL)							
12	12	SS	Medium dense, dark brown fine SAND with silt (SP-SM)	7.0						
11	11	SS								
10										
15	4	SS	Very loose, grayish brown silty fine SAND (SM)	13.0						
15										
20	8	SS	Loose, grayish brown fine SAND with silt (SP-SM)	18.0		6				
20										
25	5	SS	- light brownish gray							
25										
30	8	SS				7				
30				30.0						

Project: **OCU Package 10 Pump Stations**

Job Number: **201409-1**

Sheet **1** of **1**

Manager: _____ Client: _____ Project Description: _____
 Location: _____

Boring Depth	Sample Description					Fines #200	Water Content	LL	PI	Organic Content	k (ft/day)	AASHTO	USCS
	#4	#10	#40	#60	#100								
3116-1 1.0	Dark brown fine sand with silt					8.7							SP-SM
3116-1 8.5	Grayish brown silty fine sand					16.5							SM
3116-1 28.0	Grayish brown fine sand with silt					5.1							SP-SM
3117-1 7.0	Very dark grayish brown fine sand with silt					7.2							SP-SM
3117-1 18.0	Grayish brown silty fine sand					17.5							SM
3117-1 23.0	Grayish brown fine sand with silt					9.6							SP-SM
3216-1 9.2	Light greenish gray clay					64.0	24	72.4	47.9				CH
3216-1 13.5	Light brownish gray fine sand					2.6							SP
3360-1 4.0	Dark brown fine sand with silt					7.7							SP-SM
3360-1 18.0	Grayish brown fine sand with silt					6.3							SP-SM
3360-1 28.0	Grayish brown fine sand with silt					7.1							SP-SM

**Summary Of
Laboratory Test Results**



APPENDIX B

Important Information about This

Geotechnical-Engineering Report

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

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

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

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

Read the Full Report

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

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

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

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

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

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

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

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

Subsurface Conditions Can Change

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

Most Geotechnical Findings Are Professional Opinions

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

A Report's Recommendations Are Not Final

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

A Geotechnical-Engineering Report Is Subject to Misinterpretation

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

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

Do Not Redraw the Engineer's Logs

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

Give Constructors a Complete Report and Guidance

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

Read Responsibility Provisions Closely

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

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

Environmental Concerns Are Not Covered

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

Obtain Professional Assistance To Deal with Mold

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

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

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



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APPENDIX C

ANTILLIAN ENGINEERING ASSOCIATES, INC. CONSTRAINTS AND RESTRICTIONS

WARRANTY

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

UNANTICIPATED SOIL CONDITIONS

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

CHANGED CONDITIONS

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

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

MISINTERPRETATION OF SOIL ENGINEERING REPORT

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

CHANGED STRUCTURE OR LOCATION

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

USE OF REPORT BY BIDDERS

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

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

STRATA CHANGES

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

OBSERVATIONS DURING DRILLING

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

WATER LEVELS

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

LOCATION OF BURIED OBJECTS

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

TIME

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

Barnes, Ferland, and Associates, Inc.

**1230 Hillcrest Street
(407) 896-8608**

**Orlando, Florida 32803
Fax (407) 896-1822**

MEMORANDUM

BFA #2014-28.02

TO: Charles Parker, P.E., Orange County Utilities Department

FROM: John Watson, P.H., Barnes Ferland and Associates, Inc.

DATE: August 20, 2015

SUBJECT: Pump Station R/R Package 10 Improvements Ground Water Sampling and Laboratory Screening Results

Orange County Utilities (OCU) is planning for the Pump Station R/R Package 10 Improvements Project (Project). The Project will involve rehabilitation and repair of four pump stations located in Orange County as follows (refer to Figures 1 through 5):

- **PS 3116 - Martin Co.** at 6041 Rio Grande Ave;
- **PS 3117- Millay Drive** at 6698 Millay Drive;
- **PS 3216 - Padgett Circle** at 5828 Padgett Circle; and
- **PS 3360- Wal Mart** at 8350 S. Orange Blossom Trail.

Objective:

The Contractor selected for the Project will need to perform construction dewatering in order to make the repairs "in the dry" as will be required by the contract documents. If all dewatering discharge is retained on Orange County's property (onsite) and not allowed to discharge into surface water or wetlands of the State (as defined in Chapter 62-620 FAC) then no permit is required by the Florida Department of Environmental Protection (FDEP). However, if the Contractor plans to discharge offsite or to surface water/wetlands of the State, then he/she is required by FDEP to submit a *Generic Permit for the Discharge of Produced Groundwater from any Non-Contaminated Site Activity - FDEP Document No. 62-621.300(2)* (attached). As part of the Generic Permit, the Contractor shall first sample, test and report to FDEP that the groundwater to be discharged does not contain contaminants above the maximum acceptable parameters listed in Table 1 of the Generic Permit. However, if any of the analytical test results exceed the screening values listed in Table 1, except TOC, the project will not qualify under the Generic Permit and the Contractor may be required to apply for an Individual Wastewater Application at least 90 days prior to the date of discharge.

Orange County recognizes the potential delays this permitting process may have on the Project if the Contractor discharges offsite or to any surface waters/wetlands of the State. This memo is to present the results of Barnes Ferland and Associates, Inc's (BFA) groundwater quality sampling and screening analysis performed for the Project. The objective of BFA's ground water sampling and screening analysis,

August 20, 2015

during this preliminary phase of the project, is to detect the presence of parameters listed in Table 1 of the Generic Permit and provide Orange County with the results prior to bidding the construction project. Additionally, BFA accessed the Contamination Locator Map on the FDEP OCULUS website to identify if contaminated sites are within or near the project site.

Methodology:

BFA obtained a total of three (3) groundwater samples, one from each pump station location. Pump Station 3360 – Wal Mart at 8350 S. Orange Blossom Trail was dry to 12 feet and was therefore not sampled. The samples were collected from temporary piezometers installed adjacent to each of the existing pump stations. For each sample location, BFA first manually excavated to the ground water table with a post-hole digger, then beyond with a stainless steel hand auger. An inert polyester filter sock was installed over the screens to reduce turbidity levels. We then inserted a 1-inch slotted/screened piezometer into the borehole and into the water table. To further reduce sample turbidity, a silica sand filter pack was added to the borehole annulus above the water table depth. Utilizing a peristaltic pump, we drew groundwater through the piezometer at a relatively high volume for approximately 45 minutes followed by a low volume withdrawal for approximately 15 minutes to reduce turbidity as much as possible prior to collecting the ground water samples. Field parameter measurements of pH, temperature, specific conductivity, dissolved oxygen, and turbidity were taken prior to sampling (see attached sampling forms). Then samples were collected, labeled and delivered on ice to Accutest Laboratory Southeast, Inc. for analysis with respect to the parameters listed in Table 1 of the Generic Permit.

Summary and Recommendations:

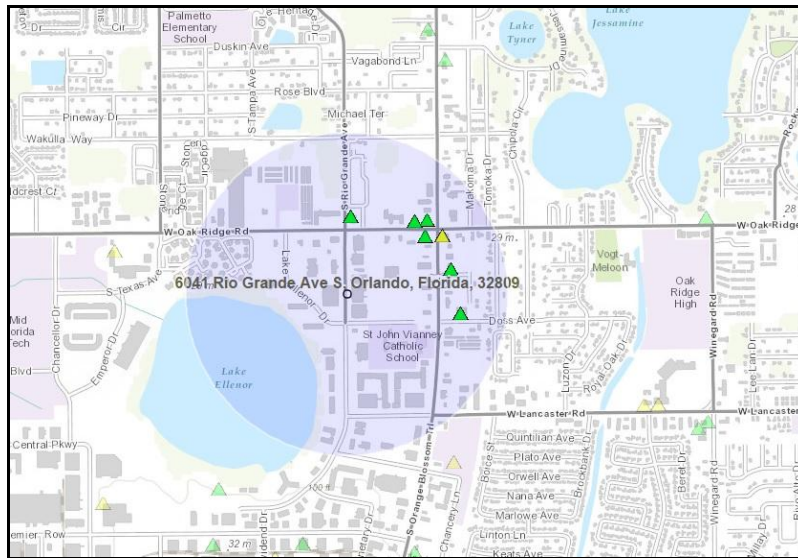
Attached is a summary table of laboratory results, followed by laboratory reports. Lab results indicate that only total organic carbon (TOC) exceeded the FDEP screening criteria listed in Table 1 of 62-621.300(2). However, these parameter concentrations may change from reported results in relation to the seasonal rainfall/recharge, so there is a possibility that the Contractor's test results could be below the FDEP screening criteria. The TOC compounds likely occur naturally and may be exempt if demonstrated by the permittee. To request this exemption, the permittee shall submit additional information with a Notice of Intent (NOI), as described in 62-621.300 paragraph (3)(b). If the Contractor's test results showed an exceedance, then the water from dewatering operations could be retained on site and allowed to percolate back into the ground. If the Contractor chose not to retain the water onsite, there are permitting requirements for discharge to surface waters.

Contaminated Site Search for Package 10 Pump Stations #3116, 3117, 3216 and 3360:

The Contamination Locator Map on the FDEP OCULUS website was used to identify if contaminated sites are within or near the project site (<1 mile radius). The FDEP website was searched for Brownfields, Petroleum, Superfund, or other waste cleanup sites that are currently under the FDEP's cleanup oversight. No contaminated sites were found at or adjacent to the four pump stations. The current cleanup status of contaminated sites can be determined by accessing the FDEP OCULUS website using the FDEP Facility IDs below at: <http://depdms.dep.state.fl.us/Oculus/servlet/login>

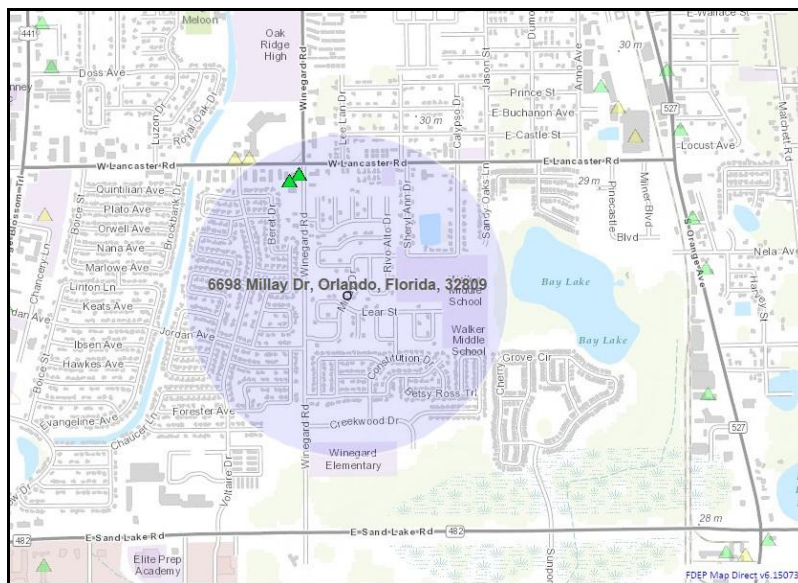
PS #3116 - Martin Co. at 6041 Rio Grande Avenue

1. AT&T OSPS 1137 Doss Ave, FDEP Facility ID No. 8627609, PENDING petroleum cleanup
2. AMOCO #185 5935 S. Orange Blossom Trail, FDEP Facility ID No. 488512657, ACTIVE petroleum cleanup
3. Mobil 5900 S. Orange Blossom Trail, FDEP Facility ID No. 8512985, PENDING petroleum cleanup
4. 711 #23884 5898 S. Orange Blossom Trail, FDEP Facility ID No. 8512591, ACTIVE petroleum cleanup
5. Cash Register Insurance 1313 W Oakridge Rd, FDEP Facility ID No. 8513131, ACTIVE petroleum cleanup
6. Sunrise Food Mart #109 1635 W Oakridge Rd, FDEP Facility ID No. 8513194, PENDING petroleum cleanup
7. Central Park Coin Laundry 5901 S. Orange Blossom Trail, FDEP Facility ID No. 489500656, PENDING other cleanup



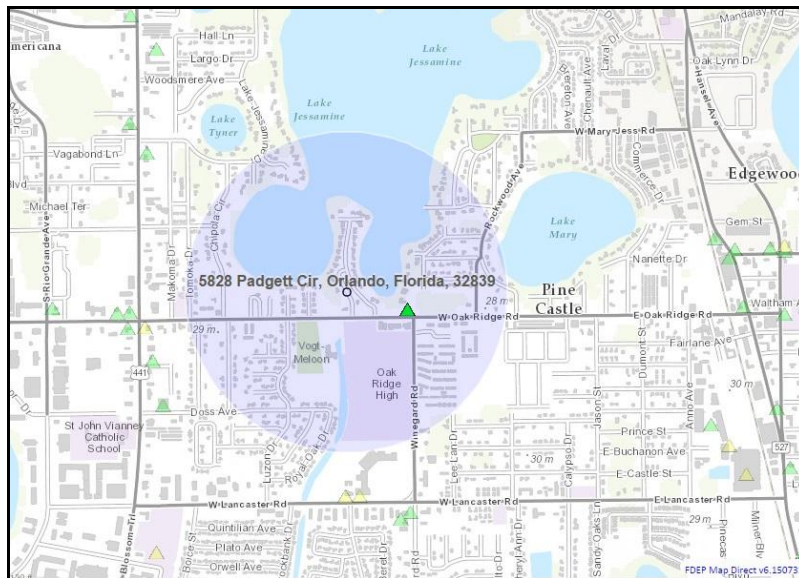
PS #3117- Millay Drive at 6698 Millay Drive

1. Former Circle K #7098 6422 Winegard Rd, FDEP Facility ID No. 8513406, PENDING petroleum cleanup
2. Sun Food Mart 600 N. Lancaster Rd & Winegard, FDEP Facility ID No. 8512793, ACTIVE petroleum cleanup



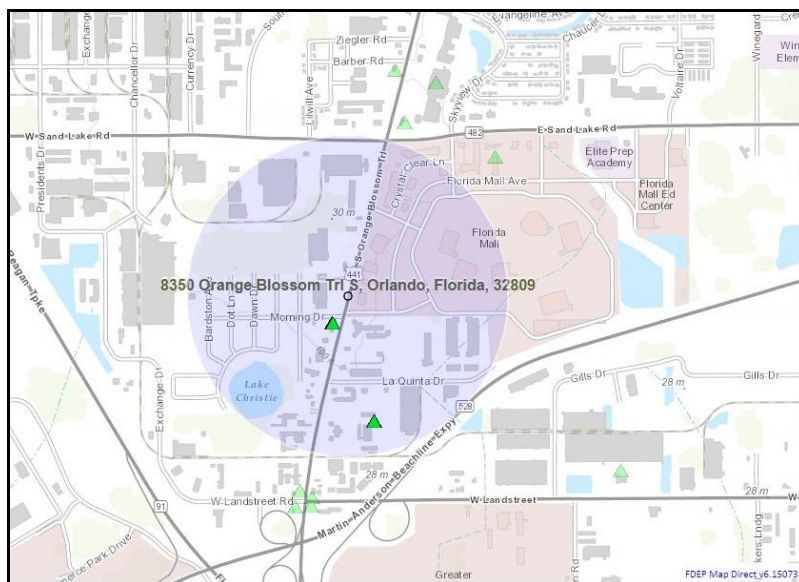
PS #3216 - Padgett Circle at 5828 Padgett Circle

1. Sunrise Food Mart #112 601 W Oakridge Rd, FDEP Facility ID No. 9803150, ACTIVE petroleum cleanup

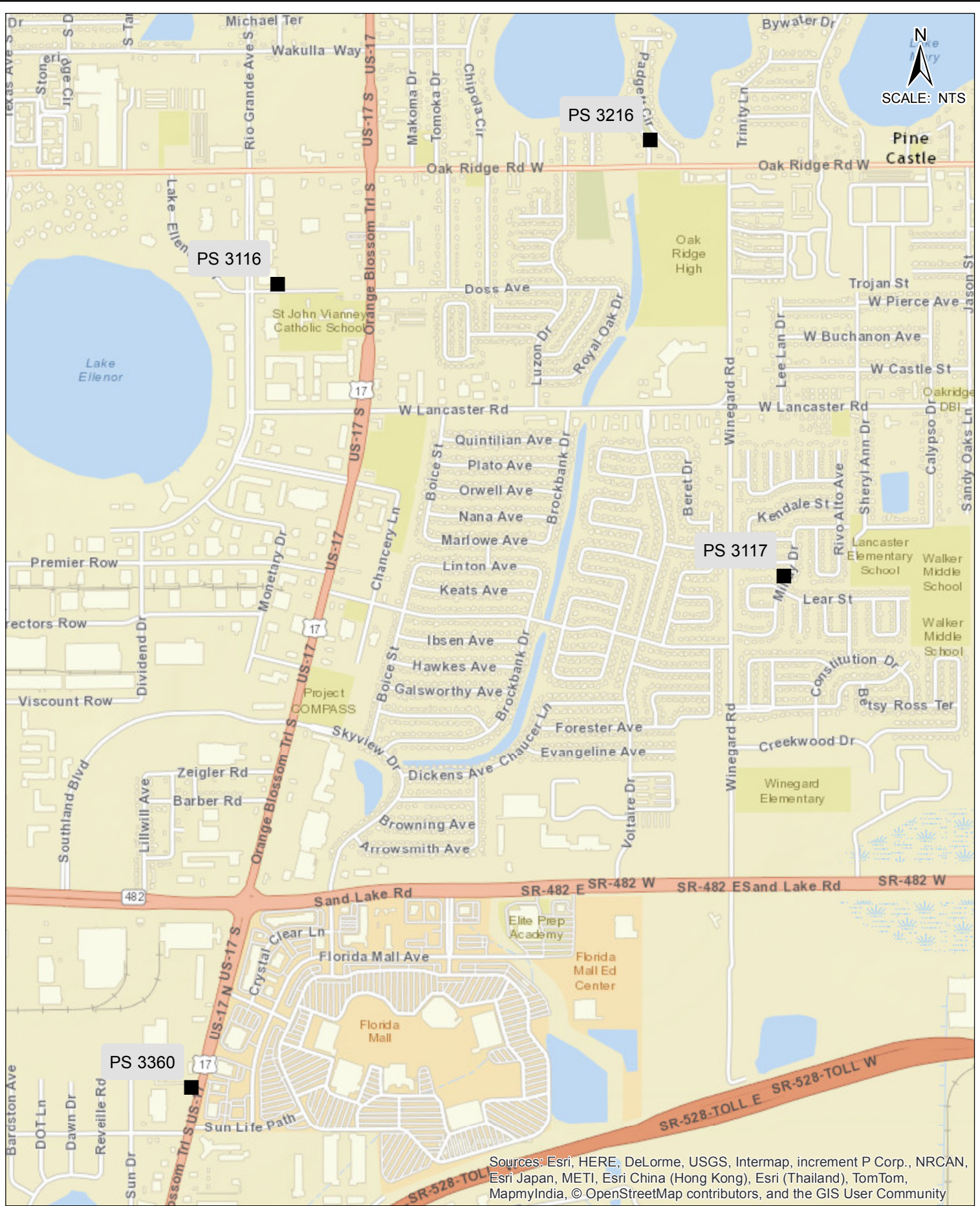


PS # 3360- Wal Mart at 8350 S. Orange Blossom Trail

1. Fountain Motors Inc 8701 S. Orange Blossom Trail, FDEP Facility ID No. 9102647, PENDING petroleum cleanup
2. Cash Auto Sales 8400 S. Orange Blossom Trail, FDEP Facility ID No. 9045668, ACTIVE petroleum cleanup



Document Path: F:\CIVIL\PROJECTS\2014\2014-28\CCU Cont. Eng. Services\14-28-02 Pkg. 10 Pump Stations\3.0 Preliminary Design - Reports\3.3 Drawings, Maps, & Exhibits (pdf)\GIS\1-1 PS General Location Map.mxd



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



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Pump Station R&R Package 10 Improvements
PUMP STATIONS GENERAL LOCATION MAP

FIGURE
1



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Pump Station R&R Package 10 Improvements
**PS #3216, PADGETT CIRCLE
SAMPLE LOCATION MAP**

**FIGURE
2**



N
SCALE: NTS

S Rio Grande Avenue

PS 3116

Sample Location
Depth: 8.1 ft.

Doss Avenue

Lake Ellenor Drive



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Pump Station R&R Package 10 Improvements

**PS #3116, MARTIN CO.
SAMPLE LOCATION MAP**

**FIGURE
3**



PS 3117

Sample Location
Depth: 6.3 ft.

Millay Drive

Lear Street

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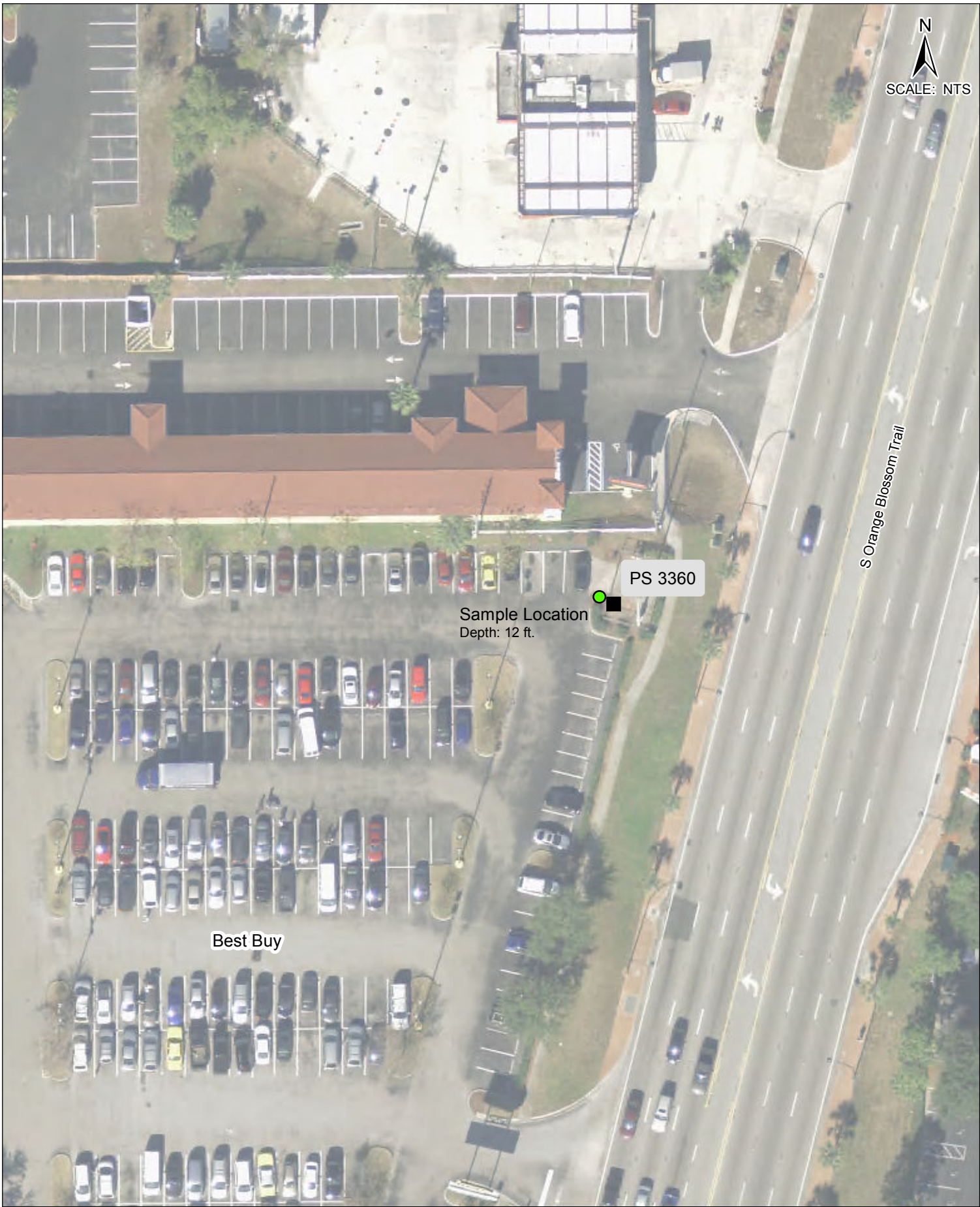
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Pump Station R&R Package 10 Improvements

**PS #3117, MILLAY DRIVE
SAMPLE LOCATION MAP**

**FIGURE
4**



N
SCALE: NTS

PS 3360

Sample Location
Depth: 12 ft.

Best Buy

S Orange Blossom Trail



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Pump Station R&R Package 10 Improvements

**PS #3360, WAL-MART
SAMPLE LOCATION MAP**

**FIGURE
5**

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL PROTECTION

GENERIC PERMIT

FOR THE

DISCHARGE OF PRODUCED GROUND WATER

FROM ANY NON-CONTAMINATED SITE ACTIVITY

Generic Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity

(1) The facility is authorized to discharge produced ground water from any non-contaminated site activity which discharges by a point source to surface waters of the State, as defined in Chapter 62-620, F.A.C., only if the reported values for the parameters listed in Table 1 do not exceed any of the listed screening values. Before discharge of produced ground water can occur from such sites, analytical tests on samples of the proposed untreated discharge water shall be performed to determine if contamination exists.

(2) Minimum reporting requirements for all produced ground water dischargers. The effluent shall be sampled before the commencement of discharge, again within thirty (30) days after commencement of discharge, and then once every six (6) months for the life of the project to maintain continued coverage under this generic permit. Samples taken in compliance with the provisions of this permit shall be taken prior to actual discharge or mixing with the receiving waters. The effluent shall be sampled for the parameters listed in Table 1.

Table 1

Parameter	Screening Values for Discharges into:	
	Fresh Waters	Coastal Waters
Total Organic Carbon (TOC)	10.0 mg/l	10.0 mg/l
pH, standard units	6.0-8.5	6.5-8.5
Total Recoverable Mercury	0.012 µg/l	0.025 µg/l
Total Recoverable Cadmium	9.3 µg/l	9.3 µg/l
Total Recoverable Copper	2.9 µg/l	2.9 µg/l
Total Recoverable Lead	0.03 mg/l	5.6 µg/l
Total Recoverable Zinc	86.0 µg/l	86.0 µg/l
Total Recoverable Chromium (Hex.)	11.0 µg/l	50.0 µg/l
Benzene	1.0 µg/l	1.0 µg/l
Naphthalene	100.0 µg/l	100.0 µg/l

(3) If any of the analytical test results exceed the screening values listed in Table 1, except TOC, the discharge is not authorized by this permit.

(a) For initial TOC values that exceed the screening values listed in Table 1, which may be caused by naturally-occurring, high molecular weight organic compounds, the permittee may request to be exempted from the TOC requirement. To request this exemption, the permittee shall submit additional information with a Notice of Intent (NOI),

described below, which describes the method used to determine that these compounds are naturally occurring. The Department shall grant the exemption if the permittee affirmatively demonstrates that the TOC values are caused by naturally-occurring, high molecular weight organic compounds.

(b) The NOI shall be submitted to the appropriate Department district office thirty (30) days prior to discharge, and contain the following information:

1. the name and address of the person that the permit coverage will be issued to;
2. the name and address of the facility, including county location;
3. any applicable individual wastewater permit number(s);
4. a map showing the facility and discharge location (including latitude and longitude);
5. the name of the receiving water; and
6. the additional information required by paragraph (3)(a) of this permit.

(c) Discharge shall not commence until notification of coverage is received from the Department.

(4) For fresh waters and coastal waters, the pH of the effluent shall not be lowered to less than 6.0 units for fresh waters, or less than 6.5 units for coastal waters, or raised above 8.5 units, unless the permittee submits natural background data confirming a natural background pH outside of this range. If natural background of the receiving water is determined to be less than 6.0 units for fresh waters, or less than 6.5 units in coastal waters, the pH shall not vary below natural background or vary more than one (1) unit above natural background for fresh and coastal waters. If natural background of the receiving water is determined to be higher than 8.5 units, the pH shall not vary above natural background or vary more than one (1) unit below natural background of fresh and coastal waters. The permittee shall include the natural background pH of the receiving waters with the results of the analyses required under paragraph (2) of this permit. For purposes of this section only, fresh waters are those having a chloride concentration of less than 1500 mg/l, and coastal waters are those having a chloride concentration equal to or greater than 1500 mg/l.

(5) In accordance with Rule 62-302.500(1)(a-c), F.A.C., the discharge shall at all times be free from floating solids, visible foam, turbidity, or visible oil in such amounts as to form nuisances on surface waters.

(6) If contamination exists, as indicated by the results of the analytical tests required by paragraph (2), the discharge cannot be covered by this generic permit. The facility shall apply for an individual wastewater permit at least ninety (90) days prior to the date discharge to surface waters of the State is expected, or, if applicable, the facility may seek coverage under any other applicable Department generic permit. No discharge is permissible without an effective permit.

(7) If the analytical tests required by paragraph (2) reveal that no contamination exists from any source, the facility can begin discharge immediately and is covered by this permit without having to submit an NOI request for coverage to the Department. A short summary of the proposed activity and copy of the analytical tests shall be sent to the applicable Department district office within one (1) week after discharge begins. These analytical tests shall be kept on site during discharge and made available to the Department if requested. Additionally, no Discharge Monitoring Report forms are required to be submitted to the Department.

(8) All of the general conditions listed in Rule 62-621.250, F.A.C., are applicable to this generic permit.

(9) There are no annual fees associated with the use of this generic permit.

**Groundwater Analytical Detection Screening Results for
Package 10 Pump Stations R/R Sampled on July 17, 2015**

Site/Sample ID	Analyte Tested	Total Organic Carbon (TOC)	pH (field)	Mercury	Cadmium	Copper	Lead	Zinc	Chromium	Benzene	Napthalene	Total Hardness as CaCO3
	LAB ID	mg/L	SU	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	mg/L
	SCV	10	6.0 - 8.5	0.012	9.3	2.9	0.03	86	11	1	100	---
PS 3216 TH-1	FA26129-1	51.5	6.34	.0093	.20 U	1.0 I	.0046 I	17.8 I	8 U	.20 U	1.0 U	235
PS 3116 TH-2	FA26129-2	11.6	7	.0054	.20 U	1.0 U	.0011 U	8.3 I	10	.20 U	1.0 U	381
PS 3117 TH-3	FA26129-3	4.8	6.06	0078	.20 U	1.0 U	.0011 U	7.5 I	10	.20 U	1.0 U	63.3

NOTES:

µg/L - micrograms per liter;

mg/L - milligrams per liter

SU - Standard Units

U - indicates result less than method detection limit

I - indicates result greater than or equal to method detection limit but less than practical quantitation limit

SCV - FDEP groundwater screening exceedance value (62-621.300(2))

Technical Report for

BFA Environmental Consultants

Orange County Dewatering; FL

Accutest Job Number: FA26129

Sampling Date: 07/17/15

Report to:

**BFA Environmental Consultants
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ATTN: John Watson

Total number of pages in report: 41



Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Program and/or state specific certification programs as applicable.



**Norm Farmer
Technical Director**

Client Service contact: Jean Dent-Smith 407-425-6700

Certifications: FL (E83510), LA (03051), KS (E-10327), IA (366), IL (200063), NC (573), NJ (FL002), SC (96038001)
DoD ELAP (L-A-B L2229), CA (2937), TX (T104704404), PA (68-03573), VA (460177),
AK, AR, GA, KY, MA, NV, OK, UT, WA

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Test results relate only to samples analyzed.

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Sample Summary

BFA Environmental Consultants

Job No: FA26129

Orange County Dewatering; FL

Sample Number	Collected		Received	Matrix		Client Sample ID
	Date	Time By		Code	Type	
FA26129-1	07/17/15	11:35 KB	07/17/15	AQ	Ground Water	TH-1
FA26129-2	07/17/15	12:14 KB	07/17/15	AQ	Ground Water	TH-2
FA26129-3	07/17/15	13:01 KB	07/17/15	AQ	Ground Water	TH-3

Summary of Hits

Job Number: FA26129
Account: BFA Environmental Consultants
Project: Orange County Dewatering; FL
Collected: 07/17/15

Lab Sample ID	Client Sample ID	Result/ Analyte	PQL	MDL	Units	Method
FA26129-1	TH-1					
		Calcium	83400	1000	50	ug/l SW846 6010C
		Copper	1.0 I	25	1.0	ug/l SW846 6010C
		Lead	4.6 I	5.0	1.1	ug/l SW846 6010C
		Magnesium	6490	5000	35	ug/l SW846 6010C
		Mercury ^a	9.3	0.50	0.24	ng/l EPA 1631 REV E
		Zinc	17.8 I	20	4.4	ug/l SW846 6010C
		Hardness, Total as CaCO ₃ ^b	235	23	0.27	mg/l SM19 2340B
		Total Organic Carbon	51.5	1.0	0.23	mg/l SM5310 B-11/SW9060A
		pH ^c	6.34			su SM4500H B-11/SW9040C
FA26129-2	TH-2					
		Calcium	132000	1000	50	ug/l SW846 6010C
		Magnesium	12500	5000	35	ug/l SW846 6010C
		Mercury ^a	5.4	0.50	0.24	ng/l EPA 1631 REV E
		Zinc	8.3 I	20	4.4	ug/l SW846 6010C
		Chromium, Hexavalent	0.010	0.010	0.0080	mg/l SW846 7196A
		Hardness, Total as CaCO ₃ ^b	381	23	0.27	mg/l SM19 2340B
		Total Organic Carbon	11.6	1.0	0.23	mg/l SM5310 B-11/SW9060A
		pH ^c	7.00			su SM4500H B-11/SW9040C
FA26129-3	TH-3					
		Calcium	22500	1000	50	ug/l SW846 6010C
		Magnesium	1740 I	5000	35	ug/l SW846 6010C
		Mercury ^a	7.8	0.50	0.24	ng/l EPA 1631 REV E
		Zinc	7.5 I	20	4.4	ug/l SW846 6010C
		Chromium, Hexavalent	0.010	0.010	0.0080	mg/l SW846 7196A
		Hardness, Total as CaCO ₃ ^b	63.3	23	0.27	mg/l SM19 2340B
		Total Organic Carbon	4.8	1.0	0.23	mg/l SM5310 B-11/SW9060A
		pH ^c	6.06			su SM4500H B-11/SW9040C

(a) No field blank provided for low level mercury, as required by the method. Data may not be valid for regulatory use. Analysis performed at Accutest Laboratories, Dayton, NJ.

(b) Calculated as: (Calcium * 2.497) + (Magnesium * 4.118)

(c) Field analysis required. Received out of hold time and analyzed by request.

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID: TH-1		
Lab Sample ID: FA26129-1		Date Sampled: 07/17/15
Matrix: AQ - Ground Water		Date Received: 07/17/15
Method: SW846 8260B		Percent Solids: n/a
Project: Orange County Dewatering; FL		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 ^a	C0109125.D	1	07/23/15	EP	n/a	n/a	VC4358
Run #2							

Run #	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	PQL	MDL	Units	Q
71-43-2	Benzene	0.20 U	1.0	0.20	ug/l	
91-20-3	Naphthalene	1.0 U	5.0	1.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	119% ^b		83-118%
17060-07-0	1,2-Dichloroethane-D4	109%		79-125%
2037-26-5	Toluene-D8	102%		85-112%
460-00-4	4-Bromofluorobenzene	96%		83-118%

- (a) Sample was treated with an anti-foaming agent.
- (b) Outside control limits; however, sample is ND.

U = Not detected MDL = Method Detection Limit I = Result > = MDL but < PQL J = Estimated value
 PQL = Practical Quantitation Limit V = Indicates analyte found in associated method blank
 L = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: TH-1	Date Sampled: 07/17/15
Lab Sample ID: FA26129-1	Date Received: 07/17/15
Matrix: AQ - Ground Water	Percent Solids: n/a
Project: Orange County Dewatering; FL	

Total Metals Analysis

Analyte	Result	PQL	MDL	Units	DF	Prep	Analyzed By	Method	Prep Method
Cadmium	0.20 U	5.0	0.20	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Calcium	83400	1000	50	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Copper	1.0 I	25	1.0	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Lead	4.6 I	5.0	1.1	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Magnesium	6490	5000	35	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Mercury ^a	9.3	0.50	0.24	ng/l	1	07/21/15	07/24/15 ANJ	EPA 1631 REV E ²	EPA 1631 ⁴
Zinc	17.8 I	20	4.4	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³

- (1) Instrument QC Batch: MA12541
- (2) Instrument QC Batch: N:MA37174
- (3) Prep QC Batch: MP29192
- (4) Prep QC Batch: N:MP87899

(a) No field blank provided for low level mercury, as required by the method. Data may not be valid for regulatory use. Analysis performed at Accutest Laboratories, Dayton, NJ.

PQL = Practical Quantitation Limit
 MDL = Method Detection Limit

U = Indicates a result < MDL
 I = Indicates a result > = MDL but < PQL

Report of Analysis

Client Sample ID: TH-1	Date Sampled: 07/17/15
Lab Sample ID: FA26129-1	Date Received: 07/17/15
Matrix: AQ - Ground Water	Percent Solids: n/a
Project: Orange County Dewatering; FL	

General Chemistry

Analyte	Result	PQL	MDL	Units	DF	Analyzed	By	Method
Chromium, Hexavalent	0.0080 U	0.010	0.0080	mg/l	1	07/17/15 17:00	FN	SW846 7196A
Hardness, Total as CaCO ₃ ^a	235	23	0.27	mg/l	1	07/22/15 15:32	LM	SM19 2340B
Total Organic Carbon	51.5	1.0	0.23	mg/l	1	07/28/15 02:31	FN	SM5310 B-11/SW9060A
pH ^b	6.34			su	1	07/17/15 16:00	JC	SM4500H B-11/SW9040C

(a) Calculated as: (Calcium * 2.497) + (Magnesium * 4.118)

(b) Field analysis required. Received out of hold time and analyzed by request.

PQL = Practical Quantitation Limit
 MDL = Method Detection Limit

U = Indicates a result < MDL
 I = Indicates a result > = MDL but < PQL

Report of Analysis

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Client Sample ID: TH-2	Date Sampled: 07/17/15
Lab Sample ID: FA26129-2	Date Received: 07/17/15
Matrix: AQ - Ground Water	Percent Solids: n/a
Method: SW846 8260B	
Project: Orange County Dewatering; FL	

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	C0109112.D	1	07/23/15	EP	n/a	n/a	VC4358
Run #2							

Run #	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	PQL	MDL	Units	Q
71-43-2	Benzene	0.20 U	1.0	0.20	ug/l	
91-20-3	Naphthalene	1.0 U	5.0	1.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	119% ^a		83-118%
17060-07-0	1,2-Dichloroethane-D4	113%		79-125%
2037-26-5	Toluene-D8	104%		85-112%
460-00-4	4-Bromofluorobenzene	97%		83-118%

(a) Outside control limits due to matrix interference.

U = Not detected MDL = Method Detection Limit I = Result > = MDL but < PQL J = Estimated value
 PQL = Practical Quantitation Limit V = Indicates analyte found in associated method blank
 L = Indicates value exceeds calibration range N = Indicates presumptive evidence of a compound

Report of Analysis

32
3

Client Sample ID: TH-2	Date Sampled: 07/17/15
Lab Sample ID: FA26129-2	Date Received: 07/17/15
Matrix: AQ - Ground Water	Percent Solids: n/a
Project: Orange County Dewatering; FL	

Total Metals Analysis

Analyte	Result	PQL	MDL	Units	DF	Prep	Analyzed By	Method	Prep Method
Cadmium	0.20 U	5.0	0.20	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Calcium	132000	1000	50	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Copper	1.0 U	25	1.0	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Lead	1.1 U	5.0	1.1	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Magnesium	12500	5000	35	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Mercury ^a	5.4	0.50	0.24	ng/l	1	07/21/15	07/24/15 ANJ	EPA 1631 REV E ²	EPA 1631 ⁴
Zinc	8.3 I	20	4.4	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³

- (1) Instrument QC Batch: MA12541
- (2) Instrument QC Batch: N:MA37174
- (3) Prep QC Batch: MP29192
- (4) Prep QC Batch: N:MP87899

(a) No field blank provided for low level mercury, as required by the method. Data may not be valid for regulatory use. Analysis performed at Accutest Laboratories, Dayton, NJ.

PQL = Practical Quantitation Limit
MDL = Method Detection Limit

U = Indicates a result < MDL
I = Indicates a result > = MDL but < PQL

Report of Analysis

Client Sample ID: TH-2 Lab Sample ID: FA26129-2 Matrix: AQ - Ground Water Project: Orange County Dewatering; FL	Date Sampled: 07/17/15 Date Received: 07/17/15 Percent Solids: n/a
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General Chemistry

Analyte	Result	PQL	MDL	Units	DF	Analyzed	By	Method
Chromium, Hexavalent	0.010	0.010	0.0080	mg/l	1	07/17/15 17:00 FN	SW846	7196A
Hardness, Total as CaCO ₃ ^a	381	23	0.27	mg/l	1	07/22/15 15:36 LM	SM19	2340B
Total Organic Carbon	11.6	1.0	0.23	mg/l	1	07/28/15 02:48 FN	SM5310 B-11/SW9060A	
pH ^b	7.00			su	1	07/17/15 16:00 JC	SM4500H B-11/SW9040C	

(a) Calculated as: (Calcium * 2.497) + (Magnesium * 4.118)

(b) Field analysis required. Received out of hold time and analyzed by request.

PQL = Practical Quantitation Limit
 MDL = Method Detection Limit

U = Indicates a result < MDL
 I = Indicates a result > = MDL but < PQL

Report of Analysis

Client Sample ID: TH-3		Date Sampled: 07/17/15
Lab Sample ID: FA26129-3		Date Received: 07/17/15
Matrix: AQ - Ground Water		Percent Solids: n/a
Method: SW846 8260B		
Project: Orange County Dewatering; FL		

Run #	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	C0109113.D	1	07/23/15	EP	n/a	n/a	VC4358
Run #2							

Run #	Purge Volume
Run #1	5.0 ml
Run #2	

CAS No.	Compound	Result	PQL	MDL	Units	Q
71-43-2	Benzene	0.20 U	1.0	0.20	ug/l	
91-20-3	Naphthalene	1.0 U	5.0	1.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	124% ^a		83-118%
17060-07-0	1,2-Dichloroethane-D4	117%		79-125%
2037-26-5	Toluene-D8	100%		85-112%
460-00-4	4-Bromofluorobenzene	100%		83-118%

(a) Outside control limits; however, sample is ND.

U = Not detected MDL = Method Detection Limit
 PQL = Practical Quantitation Limit
 L = Indicates value exceeds calibration range

I = Result > = MDL but < PQL J = Estimated value
 V = Indicates analyte found in associated method blank
 N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID: TH-3	Date Sampled: 07/17/15
Lab Sample ID: FA26129-3	Date Received: 07/17/15
Matrix: AQ - Ground Water	Percent Solids: n/a
Project: Orange County Dewatering; FL	

Total Metals Analysis

Analyte	Result	PQL	MDL	Units	DF	Prep	Analyzed By	Method	Prep Method
Cadmium	0.20 U	5.0	0.20	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Calcium	22500	1000	50	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Copper	1.0 U	25	1.0	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Lead	1.1 U	5.0	1.1	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Magnesium	1740 I	5000	35	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³
Mercury ^a	7.8	0.50	0.24	ng/l	1	07/21/15	07/24/15 ANJ	EPA 1631 REV E ²	EPA 1631 ⁴
Zinc	7.5 I	20	4.4	ug/l	1	07/22/15	07/22/15 LM	SW846 6010C ¹	SW846 3010A ³

- (1) Instrument QC Batch: MA12541
- (2) Instrument QC Batch: N:MA37174
- (3) Prep QC Batch: MP29192
- (4) Prep QC Batch: N:MP87899

(a) No field blank provided for low level mercury, as required by the method. Data may not be valid for regulatory use. Analysis performed at Accutest Laboratories, Dayton, NJ.

PQL = Practical Quantitation Limit
 MDL = Method Detection Limit

U = Indicates a result < MDL
 I = Indicates a result > = MDL but < PQL

Report of Analysis

Client Sample ID: TH-3 Lab Sample ID: FA26129-3 Matrix: AQ - Ground Water Project: Orange County Dewatering; FL	Date Sampled: 07/17/15 Date Received: 07/17/15 Percent Solids: n/a
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General Chemistry

Analyte	Result	PQL	MDL	Units	DF	Analyzed	By	Method
Chromium, Hexavalent	0.010	0.010	0.0080	mg/l	1	07/17/15 17:00 FN		SW846 7196A
Hardness, Total as CaCO ₃ ^a	63.3	23	0.27	mg/l	1	07/22/15 15:41 LM		SM19 2340B
Total Organic Carbon	4.8	1.0	0.23	mg/l	1	07/28/15 03:37 FN		SM5310 B-11/SW9060A
pH ^b	6.06			su	1	07/17/15 16:00 JC		SM4500H B-11/SW9040C

(a) Calculated as: (Calcium * 2.497) + (Magnesium * 4.118)

(b) Field analysis required. Received out of hold time and analyzed by request.

PQL = Practical Quantitation Limit
 MDL = Method Detection Limit

U = Indicates a result < MDL
 I = Indicates a result > = MDL but < PQL

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

ACCUTEST LABORATORIES SAMPLE RECEIPT CONFIRMATION

ACCUTEST'S JOB NUMBER: FA26129 CLIENT: BFA PROJECT: OC Pkg 10 Pump Station
 DATE/TIME RECEIVED: 07-17-15 1330 (MM/DD/YY 24:00) NUMBER OF COOLERS RECEIVED: 1
 METHOD OF DELIVERY: FEDEX UPS ACCUTEST COURIER DELIVERY OTHER: _____
 AIRBILL NUMBERS: _____

COOLER INFORMATION

- CUSTODY SEAL NOT PRESENT OR NOT INTACT
- CHAIN OF CUSTODY NOT RECEIVED (COC)
- ANALYSIS REQUESTED IS UNCLEAR OR MISSING
- SAMPLE DATES OR TIMES UNCLEAR OR MISSING
- TEMPERATURE CRITERIA NOT MET

TRIP BLANK INFORMATION

- TRIP BLANK PROVIDED
- TRIP BLANK NOT PROVIDED
- TRIP BLANK NOT ON COC
- TRIP BLANK INTACT
- TRIP BLANK NOT INTACT
- RECEIVED WATER TRIP BLANK
- RECEIVED SOIL TRIP BLANK

MISC. INFORMATION

NUMBER OF ENCORES ? 25-GRAM _____ 5-GRAM _____
 NUMBER OF 5035 FIELD KITS ? _____
 NUMBER OF LAB FILTERED METALS ? _____

pH PAPER LOT#s WIDE RANGE A036122 NARROW RANGE HC421754 OTHER (specify) 405-230010

SUMMARY OF COMMENTS: _____

TEMPERATURE INFORMATION

IR THERM ID 1 CORR. FACTOR -0.2
 OBSERVED TEMPS: 3.8
 CORRECTED TEMPS: 3.6

SAMPLE INFORMATION

- INCORRECT NUMBER OF CONTAINERS USED
- SAMPLE RECEIVED IMPROPERLY PRESERVED
- INSUFFICIENT VOLUME FOR ANALYSIS
- DATES/TIMES ON COC DO NOT MATCH SAMPLE LABEL
- ID'S ON COC DO NOT MATCH LABEL
- VOC VIALS HAVE HEADSPACE (MACRO BUBBLES)
- BOTTLES RECEIVED BUT ANALYSIS NOT REQUESTED
- NO BOTTLES RECEIVED FOR ANALYSIS REQUESTED
- UNCLEAR FILTERING OR COMPOSITING INSTRUCTIONS
- SAMPLE CONTAINER(S) RECEIVED BROKEN
- 5035 FIELD KITS NOT RECEIVED WITHIN 48 HOURS
- BULK VOA SOIL JARS NOT RECEIVED WITHIN 48 HOURS
- % SOLIDS JAR NOT RECEIVED
- RESIDUAL CHLORINE PRESENT LOT# _____

(APPLICABLE TO EPA 600 SERIES OR NORTH CAROLINA ORGANICS)

TECHNICIAN SIGNATURE/DATE RWW 07-17-15 REVIEWER SIGNATURE/DATE Jc 7-17-15

NF 10/14

receipt confirmation 102914.xls

FA26129: Chain of Custody

Page 2 of 2

GC/MS Volatiles

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QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: FA26129
Account: BFACFLO BFA Environmental Consultants
Project: Orange County Dewatering; FL

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
VC4358-MB	C0109104.D	1	07/23/15	EP	n/a	n/a	VC4358

The QC reported here applies to the following samples:

Method: SW846 8260B

FA26129-1, FA26129-2, FA26129-3

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	1.0	0.20	ug/l	
91-20-3	Naphthalene	ND	5.0	1.0	ug/l	

CAS No.	Surrogate Recoveries	Limits	
1868-53-7	Dibromofluoromethane	103%	83-118%
17060-07-0	1,2-Dichloroethane-D4	106%	79-125%
2037-26-5	Toluene-D8	101%	85-112%
460-00-4	4-Bromofluorobenzene	101%	83-118%

5.1.1
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Blank Spike Summary

Job Number: FA26129
Account: BFACFLO BFA Environmental Consultants
Project: Orange County Dewatering; FL

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
VC4358-BS	C0109102.D	1	07/23/15	EP	n/a	n/a	VC4358

The QC reported here applies to the following samples:

Method: SW846 8260B

FA26129-1, FA26129-2, FA26129-3

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
71-43-2	Benzene	25	24.0	96	81-122
91-20-3	Naphthalene	25	27.4	110	63-132

CAS No.	Surrogate Recoveries	BSP	Limits
1868-53-7	Dibromofluoromethane	94%	83-118%
17060-07-0	1,2-Dichloroethane-D4	98%	79-125%
2037-26-5	Toluene-D8	101%	85-112%
460-00-4	4-Bromofluorobenzene	100%	83-118%

* = Outside of Control Limits.

5.2.1
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Matrix Spike/Matrix Spike Duplicate Summary

Job Number: FA26129
Account: BFACFLO BFA Environmental Consultants
Project: Orange County Dewatering; FL

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
FA26219-1MS	C0109127.D	5	07/23/15	EP	n/a	n/a	VC4358
FA26219-1MSD	C0109128.D	5	07/23/15	EP	n/a	n/a	VC4358
FA26219-1	C0109126.D	5	07/23/15	EP	n/a	n/a	VC4358

The QC reported here applies to the following samples:

Method: SW846 8260B

FA26129-1, FA26129-2, FA26129-3

CAS No.	Compound	FA26219-1 ug/l	Spike Q ug/l	MS ug/l	MS %	Spike ug/l	MSD ug/l	MSD %	RPD	Limits Rec/RPD
71-43-2	Benzene	5.0 U	125	128	102	125	128	102	0	81-122/14
91-20-3	Naphthalene	125	125	269	115	125	266	113	1	63-132/25

CAS No.	Surrogate Recoveries	MS	MSD	FA26219-1	Limits
1868-53-7	Dibromofluoromethane	101%	101%	113%	83-118%
17060-07-0	1,2-Dichloroethane-D4	94%	90%	110%	79-125%
2037-26-5	Toluene-D8	100%	101%	101%	85-112%
460-00-4	4-Bromofluorobenzene	99%	97%	98%	83-118%

* = Outside of Control Limits.

5.3.1
 5

Metals Analysis

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: FA26129
Account: BFACFLO - BFA Environmental Consultants
Project: Orange County Dewatering; FL

QC Batch ID: MP29192
Matrix Type: AQUEOUS

Methods: SW846 6010C
Units: ug/l

Prep Date: 07/22/15

Metal	RL	IDL	MDL	MB raw	final
Aluminum	200	14	14		
Antimony	6.0	1	1		
Arsenic	10	1.3	1.3		
Barium	200	1	1		
Beryllium	4.0	.2	.2		
Cadmium	5.0	.2	.2	-0.10	<5.0
Calcium	1000	50	50	168	<1000
Chromium	10	1	1		
Cobalt	50	.2	.2		
Copper	25	1	1	0.10	<25
Iron	300	17	17		
Lead	5.0	1	1.1	0.60	<5.0
Magnesium	5000	35	35	30.1	<5000
Manganese	15	.5	1		
Molybdenum	50	.3	.3		
Nickel	40	.4	.4		
Potassium	10000	200	200		
Selenium	10	2.4	2.9		
Silver	10	.7	.7		
Sodium	10000	500	500		
Strontium	10	.5	.5		
Thallium	10	1.1	1.4		
Tin	50	.9	1		
Titanium	10	.5	1		
Vanadium	50	.5	.6		
Zinc	20	3	4.4	1.0	<20

Associated samples MP29192: FA26129-1, FA26129-2, FA26129-3

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

6.1.1
6

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: FA26129
 Account: BFACFLO - BFA Environmental Consultants
 Project: Orange County Dewatering; FL

QC Batch ID: MP29192
 Matrix Type: AQUEOUS

Methods: SW846 6010C
 Units: ug/l

Prep Date: 07/22/15 07/22/15

Metal	FA26158-4 Original	DUP	RPD	QC Limits	FA26158-4 Original MS	Spikelot MPFLICP2	% Rec	QC Limits	
Aluminum									
Antimony									
Arsenic	anr								
Barium									
Beryllium									
Cadmium	0.0	0.0	NC	0-20	0.0	49.4	50	98.8	80-120
Calcium	27600	26900	2.6	0-20	27600	52900	25000	101.2	80-120
Chromium	anr								
Cobalt									
Copper	0.0	0.0	NC	0-20	0.0	262	250	104.8	80-120
Iron									
Lead	1.3	2.0	42.4 (a)	0-20	1.3	489	500	97.5	80-120
Magnesium	2290	2230	2.7	0-20	2290	27500	25000	100.8	80-120
Manganese									
Molybdenum									
Nickel									
Potassium									
Selenium									
Silver									
Sodium									
Strontium									
Thallium									
Tin									
Titanium									
Vanadium									
Zinc	8.9	8.6	3.4	0-20	8.9	505	500	99.2	80-120

Associated samples MP29192: FA26129-1, FA26129-2, FA26129-3

Results < IDL are shown as zero for calculation purposes

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

(anr) Analyte not requested

(a) RPD acceptable due to low duplicate and sample concentrations.

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: FA26129
 Account: BFACFLO - BFA Environmental Consultants
 Project: Orange County Dewatering; FL

QC Batch ID: MP29192
 Matrix Type: AQUEOUS

Methods: SW846 6010C
 Units: ug/l

Prep Date: 07/22/15

Metal	FA26158-4 Original MSD	SpikeLot MPFLICP2 % Rec	MSD RPD	QC Limit
Aluminum				
Antimony				
Arsenic	anr			
Barium				
Beryllium				
Cadmium	0.0 50.8	50	101.6	2.8 20
Calcium	27600 53600	25000	104.0	1.3 20
Chromium	anr			
Cobalt				
Copper	0.0 271	250	108.4	3.4 20
Iron				
Lead	1.3 507	500	101.1	3.6 20
Magnesium	2290 27800	25000	102.0	1.1 20
Manganese				
Molybdenum				
Nickel				
Potassium				
Selenium				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Vanadium				
Zinc	8.9 520	500	102.2	2.9 20

Associated samples MP29192: FA26129-1, FA26129-2, FA26129-3

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

6.1.2
 6

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: FA26129
 Account: BFACFLO - BFA Environmental Consultants
 Project: Orange County Dewatering; FL

QC Batch ID: MP29192
 Matrix Type: AQUEOUS

Methods: SW846 6010C
 Units: ug/l

Prep Date: 07/22/15

Metal	BSP Result	Spikelot MPFLICP2	% Rec	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium				
Beryllium				
Cadmium	51.8	50	103.6	80-120
Calcium	22400	25000	89.6	80-120
Chromium	anr			
Cobalt				
Copper	273	250	109.2	80-120
Iron				
Lead	499	500	99.8	80-120
Magnesium	22200	25000	88.8	80-120
Manganese				
Molybdenum				
Nickel				
Potassium				
Selenium				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Vanadium				
Zinc	523	500	104.6	80-120

Associated samples MP29192: FA26129-1, FA26129-2, FA26129-3

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (anr) Analyte not requested

6.1.3
 6

SERIAL DILUTION RESULTS SUMMARY

Login Number: FA26129
 Account: BFACFLO - BFA Environmental Consultants
 Project: Orange County Dewatering; FL

QC Batch ID: MP29192
 Matrix Type: AQUEOUS

Methods: SW846 6010C
 Units: ug/l

Prep Date: 07/22/15

Metal	FA26158-4 Original	SDL 1:5	%DIF	QC Limits
Aluminum				
Antimony				
Arsenic	anr			
Barium				
Beryllium				
Cadmium	0.00	0.00	NC	0-10
Calcium	27600	28300	2.3	0-10
Chromium	anr			
Cobalt				
Copper	0.00	0.00	NC	0-10
Iron				
Lead	1.30	0.00	100.0(a)	0-10
Magnesium	2290	2350	2.8	0-10
Manganese				
Molybdenum				
Nickel				
Potassium				
Selenium				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Vanadium				
Zinc	8.90	0.00	100.0(a)	0-10

Associated samples MP29192: FA26129-1, FA26129-2, FA26129-3

Results < IDL are shown as zero for calculation purposes

(*) Outside of QC limits

(anr) Analyte not requested

(a) Percent difference acceptable due to low initial sample concentration (< 50 times IDL).

6.1.4

6

POST DIGESTATE SPIKE SUMMARY

Login Number: FA26129
 Account: BFACFLO - BFA Environmental Consultants
 Project: Orange County Dewatering; FL

QC Batch ID: MP29192
 Matrix Type: AQUEOUS

Methods: SW846 6010C
 Units: ug/l

Prep Date:

07/22/15

Metal	Sample ml	Final ml	FA26158-4 Raw	PS Corr.**	PS ug/l	Spike ml	Spike ug/ml	Spike ug/l	% Rec	QC Limits
Aluminum										
Antimony										
Arsenic										
Barium										
Beryllium										
Cadmium	9.8	10			55.1	0.2	2.5	50	110.2	80-120
Calcium	9.8	10	27630	27077.4	32510	0.2	250	5000	108.7	80-120
Chromium										
Cobalt										
Copper	9.8	10			113.7	0.2	5	100	113.7	80-120
Iron										
Lead	9.8	10	1.3	1.274	52	0.2	2.5	50	101.5	80-120
Magnesium	9.8	10	2288	2242.24	7373	0.2	250	5000	102.6	80-120
Manganese										
Molybdenum										
Nickel										
Potassium										
Selenium										
Silver										
Sodium										
Strontium										
Thallium										
Tin										
Titanium										
Vanadium										
Zinc	9.8	10	8.9	8.722	283.5	0.2	12.5	250	109.9	80-120

Associated samples MP29192: FA26129-1, FA26129-2, FA26129-3

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (**) Corr. sample result = Raw * (sample volume / final volume)
 (anr) Analyte not requested

General Chemistry

QC Data Summaries

Includes the following where applicable:

- Method Blank and Blank Spike Summaries
- Duplicate Summaries
- Matrix Spike Summaries

METHOD BLANK AND SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: FA26129
Account: BFACFLO - BFA Environmental Consultants
Project: Orange County Dewatering; FL

Analyte	Batch ID	RL	MB Result	Units	Spike Amount	BSP Result	BSP %Recov	QC Limits
Chromium, Hexavalent	GN67171	0.010	0.0	mg/l	0.100	0.10	98.5	85-115%
Total Organic Carbon	GP26387/GN67287	1.0	0.0	mg/l	15	14.6	97.3	90-110%

Associated Samples:

Batch GN67171: FA26129-1, FA26129-2, FA26129-3

Batch GP26387: FA26129-1, FA26129-2, FA26129-3

(*) Outside of QC limits

7.1
7

DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: FA26129
Account: BFACFLO - BFA Environmental Consultants
Project: Orange County Dewatering; FL

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
pH	GN67170	FA26129-1	su	6.34	6.32	0.3	0-10%

Associated Samples:

Batch GN67170: FA26129-1, FA26129-2, FA26129-3

(*) Outside of QC limits

MATRIX SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: FA26129
Account: BFACFLO - BFA Environmental Consultants
Project: Orange County Dewatering; FL

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MS Result	%Rec	QC Limits
Chromium, Hexavalent	GN67171	FA26129-3	mg/l	0.010	0.100	0.096	90.1	85-115%
Total Organic Carbon	GP26387/GN67287	FA26232-1	mg/l	14.0	15	29.9	106.0	90-110%

Associated Samples:

Batch GN67171: FA26129-1, FA26129-2, FA26129-3

Batch GP26387: FA26129-1, FA26129-2, FA26129-3

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

7.3
7

MATRIX SPIKE DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: FA26129
Account: BFACFLO - BFA Environmental Consultants
Project: Orange County Dewatering; FL

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MSD Result	RPD	QC Limit
Chromium, Hexavalent	GN67171	FA26129-3	mg/l	0.010	0.100	0.10	3.3	20%
Total Organic Carbon	GP26387/GN67287	FA26232-1	mg/l	14.0	15	30.0	0.3	20%

Associated Samples:

Batch GN67171: FA26129-1, FA26129-2, FA26129-3

Batch GP26387: FA26129-1, FA26129-2, FA26129-3

(*) Outside of QC limits

(N) Matrix Spike Rec. outside of QC limits

Misc. Forms

Custody Documents and Other Forms

(Accutest New Jersey)

Includes the following where applicable:

- Chain of Custody

Accutest Laboratories Sample Receipt Summary

Accutest Job Number: FA26129 **Client:** _____ **Project:** _____
Date / Time Received: 7/21/2015 9:55:00 AM **Delivery Method:** _____ **Airbill #s:** _____

Cooler Temps (Raw Measured) °C: Cooler 1: (4.5);
 Cooler Temps (Corrected) °C: Cooler 1: (4.2);

Cooler Security Y or N Y or N
 1. Custody Seals Present: 3. COC Present:
 2. Custody Seals Intact: 4. Smpl Dates/Time OK

Cooler Temperature Y or N
 1. Temp criteria achieved:
 2. Cooler temp verification: _____ IR Gun
 3. Cooler media: _____ Ice (Bag)
 4. No. Coolers: _____ 1

Quality Control Preservation Y or N N/A
 1. Trip Blank present / cooler:
 2. Trip Blank listed on COC:
 3. Samples preserved properly:
 4. VOCs headspace free:

Sample Integrity - Documentation Y or N
 1. Sample labels present on bottles:
 2. Container labeling complete:
 3. Sample container label / COC agree:

Sample Integrity - Condition Y or N
 1. Sample recvd within HT:
 2. All containers accounted for:
 3. Condition of sample: _____ Intact

Sample Integrity - Instructions Y or N N/A
 1. Analysis requested is clear:
 2. Bottles received for unspecified tests:
 3. Sufficient volume recvd for analysis:
 4. Compositing instructions clear:
 5. Filtering instructions clear:

Comments

Metals Analysis

QC Data Summaries

(Accutest New Jersey)

Includes the following where applicable:

- Method Blank Summaries
- Matrix Spike and Duplicate Summaries
- Blank Spike and Lab Control Sample Summaries
- Serial Dilution Summaries

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: FA26129
Account: ALSE - Accutest Laboratories Southeast, Inc.
Project: BFACFLO: Orange County Dewatering; FL

QC Batch ID: MP87899
Matrix Type: AQUEOUS

Methods: EPA 1631 REV E
Units: ng/l

Prep Date: 07/21/15

Metal	RL	IDL	MDL	MB raw	final
Mercury	0.50	.086	.24	0.11	<0.50

Associated samples MP87899: FA26129-1, FA26129-2, FA26129-3

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: FA26129
 Account: ALSE - Accutest Laboratories Southeast, Inc.
 Project: BFACFLO: Orange County Dewatering; FL

QC Batch ID: MP87899
 Matrix Type: AQUEOUS

Methods: EPA 1631 REV E
 Units: ng/l

Prep Date: 07/23/15

Metal	FA26129-1 Original MS	Spikelot HGLL1	% Rec	QC Limits
Mercury	9.3	14.6	5	106.0 71-125

Associated samples MP87899: FA26129-1, FA26129-2, FA26129-3

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: FA26129
 Account: ALSE - Accutest Laboratories Southeast, Inc.
 Project: BFACFLO: Orange County Dewatering; FL

QC Batch ID: MP87899
 Matrix Type: AQUEOUS

Methods: EPA 1631 REV E
 Units: ng/l

Prep Date: 07/23/15

Metal	FA26129-1 Original MSD	Spikelot HGLL1	% Rec	MSD RPD	QC Limit
Mercury	9.3	14.5	5	104.0	0.7 24

Associated samples MP87899: FA26129-1, FA26129-2, FA26129-3

Results < IDL are shown as zero for calculation purposes
 (*) Outside of QC limits
 (N) Matrix Spike Rec. outside of QC limits
 (anr) Analyte not requested

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: FA26129
Account: ALSE - Accutest Laboratories Southeast, Inc.
Project: BFACFLO: Orange County Dewatering; FL

QC Batch ID: MP87899
Matrix Type: AQUEOUS

Methods: EPA 1631 REV E
Units: ng/l

Prep Date: 07/23/15

Metal	LCS Result	Spikelot HGLL1	% Rec	QC Limits
Mercury	5.1	5	102.0	77-123

Associated samples MP87899: FA26129-1, FA26129-2, FA26129-3

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

APPENDIX B

ORANGE COUNTY UTILITIES

FORMS

Pressure Test
Pump Station Start-up

APPENDIX B

FORMS

Pressure Test

February 11, 2011

Project Name: _____						<input type="checkbox"/> Force Main <input type="checkbox"/> Reclaimed Main <input type="checkbox"/> Water Main		Allowable Loss – 2 Hours $L = \frac{SD(P)}{1/2}$ 148,000 <i>See Note Below</i>										
Constructed by: _____																		
DATE	LINE SEGMENT	STATION		LENGTH	N	D	START		END		LOSS (gal)		Pass /Fail STATUS					
		From	To				Time	PSI	Time	PSI	Allow	Actual						
COUNTY Inspector's Name:						Signature:						Date:						
Tester's Name:						Signature:						Date:						
Comments:																		

Note: L - Allowable leakage in gallons per hour.
 S - Length of pipe tested, in feet.
 D - Nominal diameter of the pipe in inches.
 P - Average test pressure during leakage test in pounds per square inch gauge.

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

Prior to the pump station start-up, the CONTRACTOR shall submit this completed form to the COUNTY and the following shall have been successfully met.

- A walk through letter of acceptance; and
- All wire checks, video inspections and valve locates
- Video inspections completed;
- FDEP Water Clearance received;
- FDEP placard for fuel tank if applicable; and
- Completed "Pump Station Start-Up" form (Appendix B).

Transfer of utility bills after final acceptance shall be requested by submitting the final utility power billing statement to Utilities Water Reclamation Operations Processing Center located at 8100 Presidents Drive, Suite A, or fax to 407-836-6819.

GENERAL INFORMATION

Inspection Date: _____ Final Acceptance Date: _____
Station Name: _____ PS # _____ FILE # _____
Address: _____ Subdivision: _____
Power Company: _____ Meter Number: _____
Water Company: _____ Meter Number: _____

PRESENT AT START-UP

Contractor Name: _____ Phone Number: _____
Consulting Engineer: _____ Phone Number: _____
Pump Manufacturer Rep: _____ Phone Number: _____
Orange County
Utilities Inspector: _____ Phone Number: _____
Orange County Utilities
Transmission Reps: _____

ELECTRICAL EQUIPMENT

Control Panel Enclosure Mfg. _____ Control Panel Built By _____
Control Panel SN: _____ Date of Manufacture: _____
Main Service Voltage: _____ Amperage: _____
Main Disconnect Breaker Model #: _____ Amperage: _____
Control Panel Main Breaker Model #: _____ Amperage: _____
Emergency Circuit Breaker Model: _____ Amperage: _____
Pump Breaker Model #: _____ Amperage: _____

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

ELECTRICAL EQUIPMENT *(Continued)*

Control Breaker Model # _____ Amperage: _____
SPD Type: _____ Model: _____ Receipt Received Yes No
Transformer Model: _____ Primary: _____ Secondary: _____ KVA: _____
Transformer Model: _____ Primary: _____ Secondary: _____ KVA: _____
Alternator Name: _____ Model: _____
Phase Monitor Name: _____ Model: _____
Alarm Horn Manufacturer: _____ Model: _____
Hour Meter Manufacturer: _____ Model: _____
Starter Name: _____ Starter Size: _____ Heater Size: _____
Starter Coil Part Number: _____
Pump Voltage: _____ Phase: _____ Pump F.L.A.: _____ Pump HP.: _____
Pressure Transducer Manufacturer: _____ Model: _____

PUMP EQUIPMENT

Pump Manufacturer: _____ Model #: _____
Impeller Size: _____ Number: _____
Pump #1 Serial #: _____ Pump #2 Serial #: _____
Pump #3 Serial #: _____ Pump #4 Serial #: _____
Pump #5 Serial #: _____ Pump #6 Serial #: _____

FLOAT BALLS

Float Ball Manufacturer: _____ Float Ball Type: _____
Off Level Depth: _____ Lead Start Depth: _____
Lag 1 Start Depth: _____ Lag 2 Start Depth: _____
Lag 3 Start Depth: _____ High Level Depth: _____

MECHANICAL

Valve Vault Cover Mfg: _____ Valve Vault Cover Size _____
Wet Well Cover Manufacturer: _____ Wet Well Cover Size: _____
Wet Well Diameter: _____ Wet Well Depth: _____ Guide Rail Size: _____
Base Elbow Size: _____ Riser Pipe Material _____ Riser Pipe Size: _____
Plug Valve Manufacturer: _____

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

MECHANICAL (Continued)

Plug Valve Size: _____ Plug Valve Lay Length _____
Check Valve Manufacturer: _____
Check Valve Size: _____ Check Valve Type: _____
Check Valve Lay Length: _____ Pipe Size Entering Wet-Well: _____
Oil Filled Gauges: Yes No Gauge Manufacturer: _____
Emergency Pump Out Size: _____ Female Cam-Lock Yes No

GENERATOR

Generator Receptacle Mfg. _____ Model: _____
Transfer Switch Mfg. : _____ Model: _____
Fuel Tank Manufacturer: _____ Fuel Tank Capacity: _____
Fuel Tank Model: _____ Fuel Tank SN: _____
Generator Manufacturer: _____ KVA _____ KW _____
Generator Model Number: _____
Generator Serial Number: _____
Engine Manufacturer: _____ Year of Manufacture: _____
Engine Model Number: _____
Engine Serial #: _____

BACKFLOW

Backflow Manufacturer: _____ Size: _____ Model #: _____

FLOW METER

Flow Meter Manufacturer: _____ Flow Meter Model #: _____

BIOFILTER

Biofilter Manufacturer: _____ Biofilter Model: _____
Biofilter Media: _____
Name of Approved Nutrient: _____
Blower Motor Manufacturer: _____
Blower Motor Model: _____ Blower Motor SN: _____
Blower Motor Belt Size: _____ Number of Belts: _____
Blower Horsepower: _____ Blower Voltage: _____

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

For COUNTY Use Only

DESIGN CRITERIA

Point 1 GPM: _____ At TDH: _____
 Point 2 GPM: _____ At TDH: _____
 Point 3 GPM: _____ At TDH: _____

PUMPING CAPACITY AT STARTUP						
	Pump # 1	Pump # 2	Pump # 3	Pump # 4	Pump # 5	Pump # 6
GPM at Startup:						
TDH at Startup:						
PSI at Startup:						

ELECTRICAL DATA AT STARTUP						
	PHASE A:		PHASE B:		PHASE C:	
Pump # 1 Amps at Startup						
Pump # 2 Amps at Startup						
Pump # 3 Amps at Startup						
Pump # 4 Amps at Startup						
Pump # 5 Amps at Startup						
Pump # 6 Amps at Startup						
Pump Megs Phase to Ground	Pump # 1:		Pump # 2:		Pump # 3:	
	Pump # 4:		Pump # 5:		Pump # 6:	
Incoming Service Voltage	A to GND:		B to GND:		C to GND:	
	A to B:		A to C:		B to C:	

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

CONTROL PANEL SPARE PARTS TRANSMITTAL

Project Name: _____

Project Number: _____

Quantity	Spec. Section	Manufacturer	Part Number	Part Description
1 set				Indicator pilot lamps of each type and voltage
1 ea				One-hundred percent replacement on lens caps, all colors
1 ea				Phase Monitor
1 ea				Alternator
1 ea				Time delay per starter
1 set				24-volt 8-pin relay
1 set				Fuses (as applicable)
1 set				Overload heaters per starter
1 ea				Elapsed Time Meter per pump
2 ea				Float Balls

Comments:

Delivered by: _____ Date: _____
Contractor

Witnessed by: _____ Date: _____
Construction Observation

Received by: _____ Date: _____
Water Reclamation Division

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

GENERATOR SPARE PARTS TRANSMITTAL

Project Name: _____

Project Number: _____

Quantity	Spec. Section	Manufacturer	Part Number	Part Description
2 ea				Air filter elements
2 ea				Fuel filter elements
3 ea				Complete replacement sets of fuses of each different size and type
1 set				Indicator pilot lamps of each type and voltage
1 ea				Jacket Water Heater
1 ea				One spill kit containing proper quantities and sizes of spill booms, pads, pillows, etc to control spills

Comments:

Delivered by: _____ Date: _____
Contractor

Witnessed by: _____ Date: _____
Construction Observation

Received by: _____ Date: _____
Water Reclamation Division

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

PUMP SPARE PARTS TRANSMITTAL

Project Name: _____

Project Number: _____

Quantity	Spec. Section	Manufacturer	Part Number	Part Description
1 ea				Upper bearing
1 ea				Lower bearing
1 set				Upper and lower shaft seals
1 set				O-Rings or gaskets required for replacement of bearings and seals
1 set				Impeller wear ring or bottom wear plate
1 ea				Shaft sleeve (if applicable)
1 ea				Cable cap for each pump (if applicable)
1 set				Allen sockets
1 ea				Impeller pullers

Comments:

Delivered by: _____ Date: _____

Contractor

Witnessed by: _____ Date: _____

Construction Observation

Received by: _____ Date: _____

Water Reclamation Division

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

BIOFILTER SPARE PARTS TRANSMITTAL

Project Name: _____

Project Number: _____

Quantity	Spec. Section	Manufacturer	Part Number	Part Description
				Belts (One set of each type)
				Pillar block bearings if applicable.
				Spare PLC as applicable with location software preinstalled.
				Fuses (Three sets of each type)
				Couplings (One set if applicable)
				Pilot Lights (One set of each type)
				Lens Caps (Complete replacement for all types)
				Spare Hydrogen Sulfide Sensing Element
				Any specialty tools for normal operation and maintenance
				Sufficient amount of required supplemental nutrients for continued operations to last through monitoring and service period.

Comments: _____

Delivered by: _____ Date: _____
 Contractor

Witnessed by: _____ Date: _____
 Construction Observation

Received by: _____ Date: _____
 Water Reclamation Division

APPENDIX B

FORMS

Pump Station Start-Up

February 11, 2011

APPENDIX D

ORANGE COUNTY UTILITIES Standards and Construction Specification Manual

LIST OF APPROVED PRODUCTS

APPENDIX D

LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	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	Blue 36" Tall	AVG2036 Encl	Pantone 36" Tall	AVG2036 Encl	Green 36" Tall
			GP3232 Base		GP3232 Base		GP3232 Base	
			AVG2041 Encl	Blue 41" Tall	AVG2041 Encl	Pantone 41" Tall	AVG2041 Encl	Green 41" Tall
		GP3232 Base		GP3232 Base		GP3232 Base		
	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	

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	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		

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Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	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 Meter	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	
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	

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Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	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
			Sure Stop 350 Gasket	Gasket	Sure Stop 350 Gasket	Gasket	NA	NA
		McWane Inc. DI Pipe Group	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
			Field Lok 350 Gasket	Gasket	Field Lok 350 Gasket	Gasket	NA	NA
		US Pipe	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		

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Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	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.						
		Certaiteed 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.						
		Certaiteed 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	
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	

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Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	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
	Services	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
Services	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

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	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
Line Stops	Line Stops							
	JCM							
	Romac							
	Smith Blair							
Tapping Sleeves and Valves	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	

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Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	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	
	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	

APPENDIX D

LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater			
			Model #	Comments	Model #	Comments	Model #	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 minimum 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		
			NA	NA	NA	NA	5600 or 5800 (FLG)	4" & up		
Val-Matic	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 (H2O 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	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	Blue Water Locking Lid	MVB050CR thru MVB130CR with Extension Stem	Purple Square Locking Reclaim Lid	MVB050C thru MVB130C with Extension Stem	Green Sewer locking Lid
				MVB875 Guide Plate		MVB875 Guide Plate		MVB875 Guide Plate		

APPENDIX D

LIST OF APPROVED PRODUCTS - GRAVITY SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	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-Graffiti (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		

APPENDIX D

LIST OF APPROVED PRODUCTS - GRAVITY SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	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	

APPENDIX D

LIST OF APPROVED PRODUCTS - GRAVITY SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater		
			Model #	Comments	Model #	Comments	Model #	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		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	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 shall have Diaphragm Seals. Oil filled.						
Ashcroft		NA	NA	NA	NA	10 1008SL 02L 60#	Gauge Diaphragm Seal	
		25 200SS 02T XYTSE						
Terice		NA	NA	NA	NA	D83LFSS4002LA100 - Gauge		
						M51001SSSS - Diaphragm Seal		
Winter Gauges	NA	NA	NA	NA	D99100 Fill and Mount Charge			
Pumps	Submersible Pumps							
	ABS	NA	NA	NA	NA			
	Flygt	NA	NA	NA	NA	PFQ770 0-60 PSI D70950 top D70954 Bottom		

APPENDIX D

LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	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 Srvce Disconnect	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 IEEE C62, 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	
		Joslyn 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		Reclaimed Water		Wastewater		
			Model #	Comments	Model #	Comments	Model #	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				

APPENDIX D

LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	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		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Pump Station Control Pane	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 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	Variable Frequency Drives							
	Square D	NA	NA	NA	NA			

APPENDIX E

ORANGE COUNTY UTILITIES

BOUNDARY SURVEY(S)

SCHEDULE "A"

PARCEL: 801

ESTATE: PERMANENT EASEMENT

PURPOSE: UTILITY

LEGAL DESCRIPTION

ALL THAT TRACT OR PARCEL OF LAND LYING IN SECTION 22, TOWNSHIP 23 SOUTH, RANGE 29 EAST, ORANGE COUNTY, FLORIDA, BEING A PORTION OF TRACT 1, AS RECORDED IN THE OFFICIAL RECORDS BOOK 7505, PAGE 3985 OF THE PUBLIC RECORDS OF ORANGE COUNTY, FLORIDA, BEING A PORTION OF LOT 88, PLAN OF BLOCK "ONE" PROSPER COLONY, AS RECORDED IN PLAT BOOK D, PAGE 109 OF THE PUBLIC RECORDS OF ORANGE COUNTY, FLORIDA, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCE AT THE NORTHWEST CORNER OF TRACT 1, AS RECORDED IN THE OFFICIAL RECORDS BOOK 7505, PAGE 3985 OF THE PUBLIC RECORDS OF ORANGE COUNTY, FLORIDA, SAID POINT BEING A FOUND 5/8" IRON ROD AND CAP STAMPED "SSMC LB 2108"; THENCE SOUTH 00°12'06" EAST ALONG THE WEST LINE OF SAID TRACT 1, A DISTANCE OF 251.24 FEET TO THE SOUTHWEST CORNER OF SAID TRACT 1; THENCE NORTH 89°16'27" EAST ALONG THE SOUTH LINE OF SAID TRACT 1, A DISTANCE OF 223.48 FEET TO THE POINT OF BEGINNING, SAID POINT BEING A SET 5/8" IRON ROD AND CAP STAMPED "GEODATA LB 6556"; THENCE NORTH 25°08'48" EAST, A DISTANCE OF 45.57 FEET TO A POINT, SAID POINT BEING A SET 5/8" IRON ROD AND CAP STAMPED "GEODATA LB 6556"; THENCE NORTH 89°16'27" EAST, A DISTANCE OF 12.00 FEET TO A POINT ON THE WEST LINE OF AN EXISTING UTILITY EASEMENT, AS RECORDED IN OFFICIAL RECORDS BOOK 1786, PAGE 986 OF THE PUBLIC RECORDS OF ORANGE COUNTY, FLORIDA, SAID POINT BEING A SET 5/8" IRON ROD AND CAP STAMPED "GEODATA LB 6556"; THENCE SOUTH 00°13'24" EAST ALONG SAID WEST LINE, A DISTANCE OF 41.00 FEET TO A POINT ON SAID SOUTH LINE OF TRACT 1, SAID POINT BEING A SET 5/8" IRON ROD AND CAP STAMPED "GEODATA LB 6556"; THENCE SOUTH 89°16'27" WEST ALONG SAID SOUTH LINE, A DISTANCE OF 31.53 FEET TO THE POINT OF BEGINNING.

CONTAINING 892 SQUARE FEET, MORE OR LESS.

GENERAL NOTES

1. THE PURPOSE OF THIS SKETCH IS TO DELINEATE THE DESCRIPTION ATTACHED HERETO, THIS DOES NOT REPRESENT A BOUNDARY SURVEY.
2. THE BEARINGS SHOWN HEREON ARE RELATIVE TO THE FLORIDA STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983/2011 ADJUSTMENT (NAD83/11), ZONE 901, FLORIDA EAST, WITH THE NORTH RIGHT OF WAY LINE OF DOSS AVENUE HAVING A BEARING OF NORTH 89°16'27" EAST.
3. UNLESS IT BEARS THE SIGNATURE AND ORIGINAL RAISED SEAL OF A FLORIDA LICENSED SURVEYOR AND MAPPER, THIS SKETCH IS FOR INFORMATIONAL PURPOSES ONLY.
4. THIS SKETCH MAY HAVE BEEN REDUCED IN SIZE BY REPRODUCTION. THIS MUST BE CONSIDERED WHEN OBTAINING SCALED DATA.
5. LANDS SHOWN HEREON WERE ABSTRACTED FOR DEDICATED RIGHT OF WAY, EASEMENTS AND OR OWNERSHIP BY FIRST AMERICAN TITLE INSURANCE COMPANY, HAVING AN EFFECTIVE DATE OF DECEMBER 05, 2014 – FUND FILE NUMBER 2037-3277036, PUMP STATION NO. 3116 (MARTIN CO).
6. ALL RECORDING REFERENCES SHOWN ON THIS SKETCH REFER TO THE PUBLIC RECORDS OF ORANGE COUNTY, FLORIDA, UNLESS OTHERWISE NOTED.
7. THIS SKETCH IS NOT A SURVEY.

SEE SHEET 2 FOR SKETCH OF DESCRIPTION

SHEET 1 OF 2

Date: MARCH 16, 2016

Project No.: B18-16

Drawn: DPW Chkd.: JMS/RJH

**PUMP STATION 3116
PARCEL 801**



GEODATA CONSULTANTS, INC.

SURVEYING & MAPPING

1349 SOUTH INTERNATIONAL PARKWAY

SUITE 2401

LAKE MARY, FLORIDA 32746

VOICE: (407) 732-6965 FAX: (407) 878-0841

Land Surveyor Business License No. 6556

SKETCH OF DESCRIPTION

PARCEL: 801
 ESTATE: PERMANENT EASEMENT
 PURPOSE: UTILITY

**SECTION 22,
 TOWNSHIP 23 SOUTH,
 RANGE 29 EAST**

POINT OF COMMENCEMENT
 NORTHWEST CORNER OF TRACT 1
 FOUND 5/8" IRON ROD & CAP
 "SSMC LB 2108"

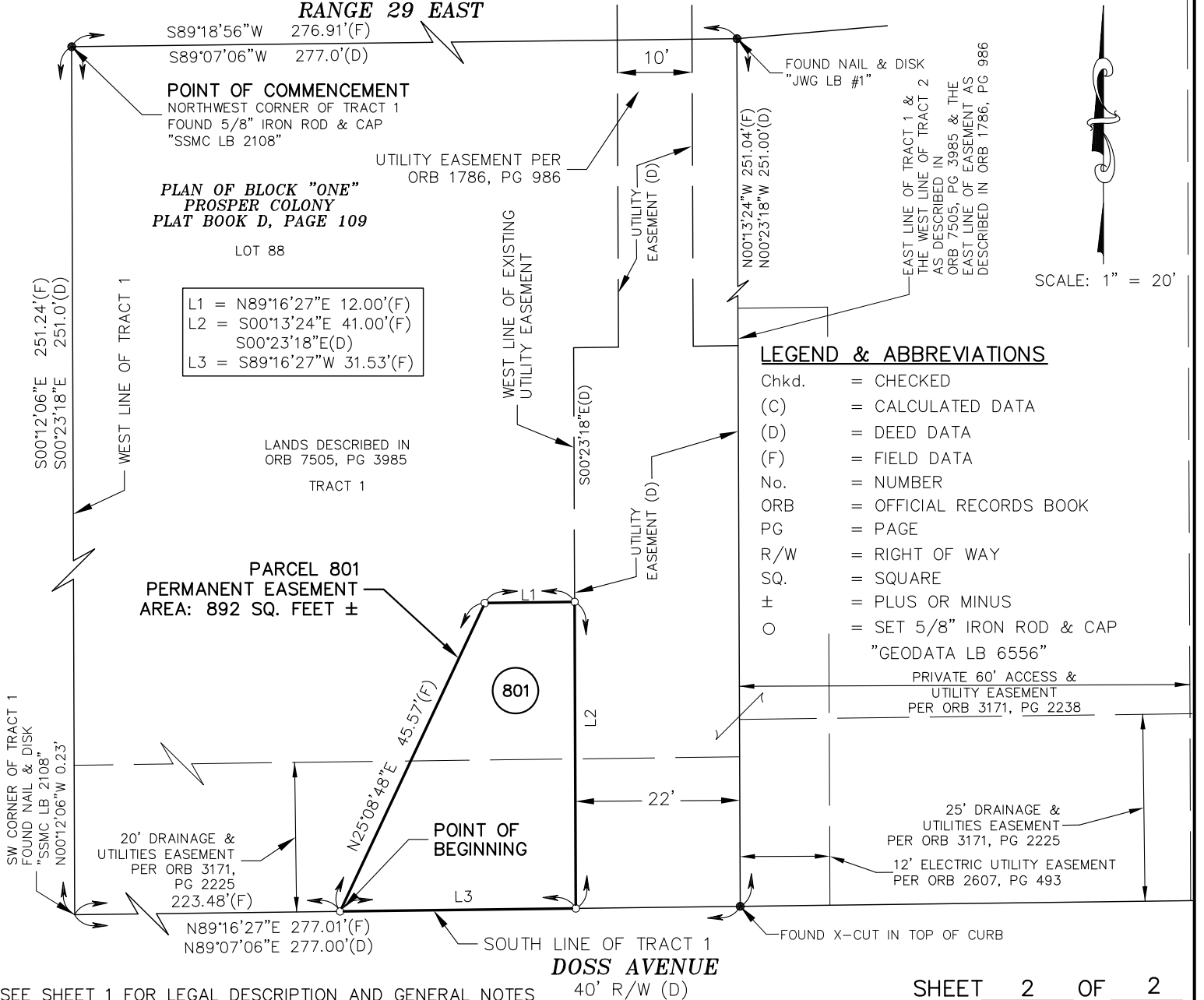
**PLAN OF BLOCK "ONE"
 PROSPER COLONY
 PLAT BOOK D, PAGE 109**

LOT 88

- L1 = N89°16'27"E 12.00'(F)
- L2 = S00°13'24"E 41.00'(F)
- S00°23'18"E(D)
- L3 = S89°16'27"W 31.53'(F)

LANDS DESCRIBED IN
 ORB 7505, PG 3985
 TRACT 1

**PARCEL 801
 PERMANENT EASEMENT
 AREA: 892 SQ. FEET ±**



LEGEND & ABBREVIATIONS

- Chkd. = CHECKED
 - (C) = CALCULATED DATA
 - (D) = DEED DATA
 - (F) = FIELD DATA
 - No. = NUMBER
 - ORB = OFFICIAL RECORDS BOOK
 - PG = PAGE
 - R/W = RIGHT OF WAY
 - SQ. = SQUARE
 - ± = PLUS OR MINUS
 - O = SET 5/8" IRON ROD & CAP
- "GEODATA LB 6556"

PRIVATE 60' ACCESS &
 UTILITY EASEMENT
 PER ORB 3171, PG 2238

25' DRAINAGE &
 UTILITIES EASEMENT
 PER ORB 3171, PG 2225

12' ELECTRIC UTILITY EASEMENT
 PER ORB 2607, PG 493

SCALE: 1" = 20'

SEE SHEET 1 FOR LEGAL DESCRIPTION AND GENERAL NOTES

SHEET 2 OF 2

REVISED PARCEL CONFIGURATION	DPW	06/29/2016
REVISED PER ORANGE COUNTY COMMENTS	DPW	05/16/2016
REVISION	BY	DATE

I HEREBY CERTIFY THAT THIS LEGAL DESCRIPTION AND SKETCH IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. I FURTHER CERTIFY THAT THIS LEGAL DESCRIPTION AND SKETCH MEETS THE STANDARDS OF PRACTICE AS SET FORTH BY THE FLORIDA BOARD OF PROFESSIONAL SURVEYORS AND MAPPERS IN CHAPTER 5J-17, FLORIDA ADMINISTRATIVE CODE, PURSUANT TO CHAPTER 472 OF THE FLORIDA STATUTES. SUBJECT TO NOTES AND NOTATIONS SHOWN HEREON.

H. Paul deVivero, Professional Land Surveyor No. 4990 DATE

Date: MARCH 16, 2016
 Project No.: B18-16
 Drawn: DPW Chkd.: JMS/RJH

**PUMP STATION 3116
 PARCEL 801**

GEODATA CONSULTANTS, INC.
 SURVEYING & MAPPING
 1349 SOUTH INTERNATIONAL PARKWAY
 SUITE 2401
 LAKE MARY, FLORIDA 32746
 VOICE: (407) 732-6965 FAX: (407) 878-0841
 Land Surveyor Business License No. 6556

SCHEDULE "A"

PARCEL: 101

ESTATE: FEE SIMPLE

PURPOSE: PUMP STATION SITE

LEGAL DESCRIPTION

ALL THAT TRACT OR PARCEL OF LAND LYING IN SECTION 34, TOWNSHIP 23 SOUTH, RANGE 29 EAST, ORANGE COUNTY, FLORIDA, BEING A PORTION OF LOT 58 AND 59, PLAN OF BLOCK E PROSPER COLONY, AS RECORDED IN PLAT BOOK D, PAGE 108 OF THE PUBLIC RECORDS OF ORANGE COUNTY, FLORIDA, ALSO BEING A PORTION OF LANDS DESCRIBED IN OFFICIAL RECORDS BOOK 10676, PAGE 2079 OF THE PUBLIC RECORDS OF ORANGE COUNTY, FLORIDA, AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCE AT THE NORTHWEST CORNER OF THE NORTH 100.00 FEET OF THE SOUTH 510.00 FEET OF THE EAST 155.00 FEET OF LOT 60, PLAN OF BLOCK E PROSPER COLONY, AS RECORDED IN PLAT BOOK D, PAGE 108 OF THE PUBLIC RECORDS OF ORANGE COUNTY, FLORIDA, SAID POINT BEING A FOUND 1/2" IRON ROD AND CAP, ILLEGIBLE; THENCE NORTH 89°26'55" EAST ALONG THE NORTH LINE OF THE SOUTH 510.00 FEET OF LOT 59 AND 60 OF SAID PLAT AND THE NORTH LINE OF LANDS DESCRIBED IN OFFICIAL RECORDS BOOK 10676, PAGE 2079 OF THE PUBLIC RECORDS OF ORANGE COUNTY, FLORIDA, A DISTANCE OF 481.43 FEET TO A POINT; THENCE SOUTH 00°33'05" EAST, A DISTANCE OF 5.00 FEET TO THE POINT OF BEGINNING; THENCE NORTH 89°26'55" EAST ALONG A LINE 5 FEET SOUTH OF AND PARALLEL TO THE NORTH LINE OF THE SOUTH 510.00 FEET OF LOT 58 AND 59 OF SAID PLAT AND THE NORTH LINE OF SAID LANDS, A DISTANCE OF 35.83 FEET TO A POINT; THENCE SOUTH 14°11'40" WEST ALONG A LINE 19.2 FEET WEST OF AND PARALLEL TO THE WESTERLY RIGHT OF WAY LINE OF SOUTH ORANGE BLOSSOM TRAIL (STATE ROAD 500) AND THE EASTERLY LINE OF SAID LANDS, A DISTANCE OF 39.78 FEET TO A POINT; THENCE NORTH 75°48'20" WEST, A DISTANCE OF 26.58 FEET TO A POINT; THENCE NORTH 00°33'05" WEST, A DISTANCE OF 31.70 FEET TO THE POINT OF BEGINNING.

CONTAINING 1,097 SQUARE FEET, MORE OR LESS.

GENERAL NOTES

1. THE PURPOSE OF THIS SKETCH IS TO DELINEATE THE DESCRIPTION ATTACHED HERETO, THIS DOES NOT REPRESENT A BOUNDARY SURVEY.
2. THE BEARINGS SHOWN HEREON ARE RELATIVE TO THE FLORIDA STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983/2011 ADJUSTMENT (NAD83/11), ZONE 901, FLORIDA EAST, WITH THE WESTERLY RIGHT OF WAY LINE OF SOUTH ORANGE BLOSSOM TRAIL HAVING A BEARING OF NORTH 14°11'40" EAST.
3. UNLESS IT BEARS THE SIGNATURE AND ORIGINAL RAISED SEAL OF A FLORIDA LICENSED SURVEYOR AND MAPPER, THIS SKETCH IS FOR INFORMATIONAL PURPOSES ONLY.
4. THIS SKETCH MAY HAVE BEEN REDUCED IN SIZE BY REPRODUCTION. THIS MUST BE CONSIDERED WHEN OBTAINING SCALED DATA.
5. LANDS SHOWN HEREON WERE ABSTRACTED FOR DEDICATED RIGHT OF WAY, EASEMENTS AND OR OWNERSHIP BY FIRST AMERICAN TITLE INSURANCE COMPANY, HAVING AN EFFECTIVE DATE OF MARCH 19, 2015 - FUND FILE NUMBER 2037-3330043/15.00032, PUMP STATION NO. 3360 (WALMART).
6. ALL RECORDING REFERENCES SHOWN ON THIS SKETCH REFER TO THE PUBLIC RECORDS OF ORANGE COUNTY, FLORIDA, UNLESS OTHERWISE NOTED.
7. THIS SKETCH IS NOT A SURVEY.

SEE SHEET 2 FOR SKETCH OF DESCRIPTION

SHEET 1 OF 2

Date: AUGUST 11, 2016

Project No.: B18-16

Drawn: PMM Chkd.: JMS/RJH

PUMP STATION 3360 PARCEL 101



GEODATA CONSULTANTS, INC.

SURVEYING & MAPPING

1349 SOUTH INTERNATIONAL PARKWAY

SUITE 2401

LAKE MARY, FLORIDA 32746

VOICE: (407) 732-6965 FAX: (407) 878-0841

Land Surveyor Business License No. 6556

SKETCH OF DESCRIPTION

PARCEL: 101

ESTATE: FEE SIMPLE

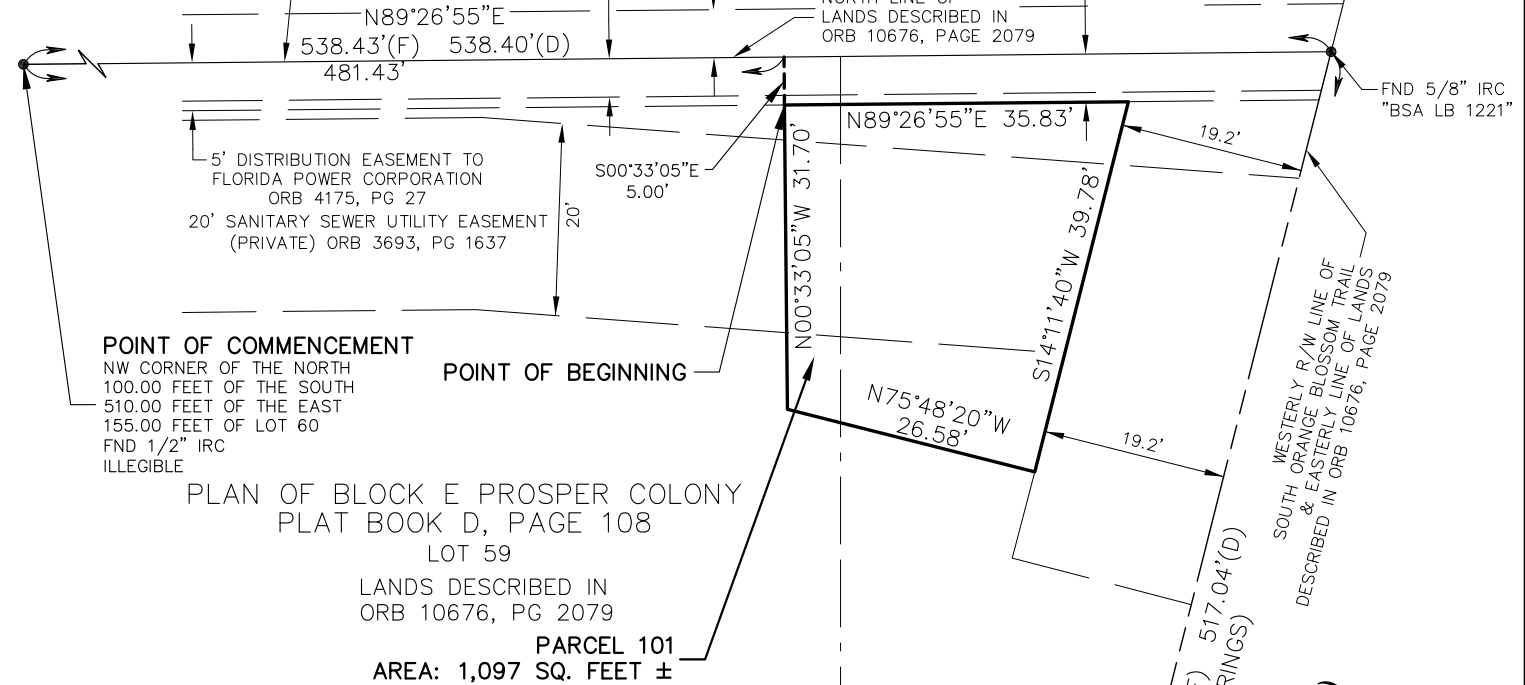
PURPOSE: PUMP STATION SITE

5' DISTRIBUTION EASEMENT TO
FLORIDA POWER CORPORATION
ORB 4182, PG 4277

4' EASEMENT TO
FLORIDA POWER CORPORATION
ORB 1859, PG 985

NORTH LINE OF THE
SOUTH 510' OF LOTS 58-60

NORTH LINE OF
LANDS DESCRIBED IN
ORB 10676, PAGE 2079



POINT OF COMMENCEMENT
NW CORNER OF THE NORTH
100.00 FEET OF THE SOUTH
510.00 FEET OF THE EAST
155.00 FEET OF LOT 60
FND 1/2" IRC
ILLEGIBLE

POINT OF BEGINNING

PLAN OF BLOCK E PROSPER COLONY
PLAT BOOK D, PAGE 108
LOT 59

LANDS DESCRIBED IN
ORB 10676, PG 2079

PARCEL 101
AREA: 1,097 SQ. FEET ±

LEGEND & ABBREVIATION

- Chkd. = CHECKED
- (D) = DEED DATA
- FND = FOUND
- (F) = FIELD DATA
- IRC = IRON ROD & CAP
- No. = NUMBER
- ORB = OFFICIAL RECORDS
BOOK
- PG = PAGE
- R/W = RIGHT OF WAY
- SQ. = SQUARE
- ± = PLUS OR MINUS

LOT 58

ORIGINAL LOT LINE

**SOUTH ORANGE
BLOSSOM TRAIL
(STATE ROAD 500)**
R/W WIDTH VARIES

SCALE: 1" = 20'

SECTION 34, TOWNSHIP 23 SOUTH, RANGE 29 EAST

SHEET 2 OF 2

SEE SHEET 1 FOR LEGAL DESCRIPTION AND GENERAL NOTES

REVISION	BY	DATE

I HEREBY CERTIFY THAT THIS LEGAL DESCRIPTION AND SKETCH IS CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF. I FURTHER CERTIFY THAT THIS LEGAL DESCRIPTION AND SKETCH MEETS THE STANDARDS OF PRACTICE AS SET FORTH BY THE FLORIDA BOARD OF PROFESSIONAL SURVEYORS AND MAPPERS IN CHAPTER 5J-17, FLORIDA ADMINISTRATIVE CODE, PURSUANT TO CHAPTER 472 OF THE FLORIDA STATUTES. SUBJECT TO NOTES AND NOTATIONS SHOWN HEREON.

H. Paul deVivero, Professional Land Surveyor No. 4990 DATE

Date: AUGUST 11, 2016
Project No.: B18-16
Drawn: PMM Chkd.: JMS/RJH

**PUMP STATION 3360
PARCEL 101**

GEODATA CONSULTANTS, INC.
SURVEYING & MAPPING
1349 SOUTH INTERNATIONAL PARKWAY
SUITE 2401
LAKE MARY, FLORIDA 32746
VOICE: (407) 732-6965 FAX: (407) 878-0841
Land Surveyor Business License No. 6556

APPENDIX G

ORANGE COUNTY UTILITIES

DEWATERING DISCHARGE OFF-SITE

- **FDEP Notice of New Method for Mercury Testing**
- **Generic Permit for the Discharge of Produced Ground Water From any Non-Contaminated Site Activity**
- **Memo – EPA - Analytical Methods for Mercury in NPDES Permits**
- **Orange County Environmental Protection Division Work Instruction**

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Department of Environmental Protection

Notice of New Method for Mercury Testing

New Method for Mercury Testing Has Been Approved

In accordance with Rule 62-620.610, Florida Administrative Code (F.A.C.), all sampling and monitoring data, required to be reported to the Department, shall be collected and analyzed in accordance with Rule 62-4.246, Chapters 62-160 and 62-601, F.A.C., and 40 CFR 136, as appropriate. Effective August 25, 2003, Chapter 62-620, F.A.C., was revised to adopt, and incorporate by reference, various sections of Title 40 of the Code of Federal Regulations revised as of July 1, 2003, including the revised 40 CFR 136. The revised 40 CFR 136 includes a new method for low-level mercury analysis, EPA Method 1631(Revision E), Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry (Method 1631E).

Who is Required to Use Method 1631E?

Applicants for a wastewater facility permit and wastewater facility permittees are now required to use the low-level mercury Method 1631E when reporting results associated with water quality standards (WQSs) below 0.2 micrograms per liter (ug/L). The following facilities are now required to use Method 1631E for all **effluent samples**:

- Facilities discharging to Class I and Class II surface waters, including wetlands.
- Facilities discharging to Class III Marine or Fresh surface waters, including wetlands.
- Facilities with Water Quality Based Effluent Limits (WQBELs), or any other limit for mercury specified in a permit, below 0.2 ug/L.

This includes effluent samples collected for any of the following requirements:

- Monitoring specified in Section I, *Reclaimed Water and Effluent Limitations and Monitoring*, section of permits.
- Monitoring performed under Section 3.A. of *Wastewater Permit Application Form 2A For Domestic Wastewater Facilities*; Part VII.C. of *Application to Discharge Process Wastewater from New or Existing Industrial Wastewater Facilities to Surface Water - Form 2CS*; or Part V.C. of *Application to Discharge Process Wastewater from New or Existing Industrial Wastewater Facilities to Ground Water - Form 2CG*.
- Priority pollutant scans performed in accordance with pretreatment program annual report requirements.
- Monitoring performed for the development or re-evaluation of local discharge limitations.
- Monitoring required in Table 4 of the Generic Permit for Discharges from Petroleum Contaminated Sites and Table 1 of the Generic Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity.

The low-level mercury method provides, for the first time, the ability to assess compliance with mercury water quality standards (WQSs) below 0.2 ug/L. Your permit requires that surface water discharges shall be analyzed using a sufficiently sensitive method in accordance with 40 CFR 136. *Wastewater Permit Application Forms 2A, 2CS, and 2CG* require effluent testing be conducted using methods that are able to detect pollutants at levels adequate to meet WQSs and to provide reasonable assurance that the WQSs will not be violated in the future.

Additionally, in order to develop technically and legally defensible local discharge limitations for domestic wastewater facilities that have pretreatment programs, Method 1631E must be used to provide data that clearly establishes the basis for any calculated mercury limitations. Note, regarding local discharge limitations, the requirement to use Method 1631E may be expanded to other locations in the collection and treatment system on a case-by-case basis depending on the initial results from effluent analysis using Method 1631E.

Mercury Laboratory Analysis

Method 1631E has a minimum level of quantitation of 0.0005 ug/L, or 0.5 nanograms per liter (ng/L), which is 400-times more sensitive than Method 245.1 ("Manual Cold Vapor Technique"). Due to the sensitivity of Method 1631E, the results are typically measured in parts per trillion (ng/L) rather than in parts per billion (µg/L). The Department is currently evaluating Method 1631E to determine target method detection limits (MDLs) and target practical quantification limits (PQLs). Until target MDLs and PQLs are incorporated into Rule 62-4.246(4), the laboratory analysis is expected to achieve MDLs close to, or below, 1 ng/L. All laboratory analysis must be done by a NELAP accredited laboratory with current certification by Florida Department of Health for Method 1631E.

Mercury Clean Sampling Techniques

Clean sample handling techniques should be used when collecting samples for low-level mercury analysis to preclude false positives arising from sample collection, handling, or analysis. Sample collection methods should be consistent with *DEP-SOP-001/01: FS 8200 Clean Sampling For Ultratrace Metals in Surface Waters* and *EPA Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels* (EPA-821-R-96-011). Because FS 8200 and Method 1669 are performance-based procedures, sample collection personnel may modify these procedures or eliminate steps if the modification does not lead to unacceptable contamination of samples or blanks. Any modifications should be thoroughly evaluated and demonstrated to be effective before field samples are collected. This may be accomplished through documentation of uncontaminated samples, equipment blanks and/or other quality control samples.

Note, discrete and composite samplers have been found to contaminate samples with mercury at the ng/L level. Therefore, grab samples are permissible when using Method 1631E. However, grab samples must be representative of the wastewater discharge and a field blank should be collected along with the sample.

In order for a permittee to justify a claim that any reported mercury is due to outside contamination, a blank must have been collected. For this reason, permittees should consider collecting at least one blank at each site for each day a sample is collected. If more than one sample is collected in a day, at least one blank for each 10 samples collected on that day should also be collected. The blank may either be an equipment blank or a field blank. Once a permittee demonstrates the ability to collect samples from a given site using an established procedure that prevents contamination, the permittee may choose to decrease the number of blanks being taken. Specific definitions and procedures for collecting blanks are found in DEP SOP FQ 1000.

Field blanks should be collected only if no equipment other than the sample container is used to collect samples. If the sampling procedure involves the use of additional equipment, such as a peristaltic pump and pump tubing, equipment blanks should be collected. All blanks are subject to the same preservation, digestion, and analysis protocols as regular samples and should have a concentration at least five times lower than the sample concentration. The permittee may not subtract field blank concentrations when reporting sample results.

Sample-collection, preservation, and shipping requirements should be discussed with contract laboratories to ensure the requirements of Method 1631E are met.

Additional Assistance and Information

For additional information on Method 1631:
www.epa.gov/waterscience/methods/1631.html

Please refer questions concerning sample collection to:
Silky Labic: 850-245-8066
Silky.Labic@dep.state.fl.us

Additional information concerning NELAP certified laboratories can be obtained from:
Department of Health Bureau of Laboratories
P.O. Box 210 Jacksonville, FL 32231
(904) 791-1599 (voice)(904) 791-1591 (fax)
[ftp.dep.state.fl.us/pub/labs/assessment/doh/accredited.pdf](ftp://ftp.dep.state.fl.us/pub/labs/assessment/doh/accredited.pdf)

STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL PROTECTION

GENERIC PERMIT

FOR THE

DISCHARGE OF PRODUCED GROUND WATER

FROM ANY NON-CONTAMINATED SITE ACTIVITY

Generic Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity

(1) The facility is authorized to discharge produced ground water from any non-contaminated site activity which discharges by a point source to surface waters of the State, as defined in Chapter 62-620, F.A.C., only if the reported values for the parameters listed in Table 1 do not exceed any of the listed screening values. Before discharge of produced ground water can occur from such sites, analytical tests on samples of the proposed untreated discharge water shall be performed to determine if contamination exists.

(2) Minimum reporting requirements for all produced ground water dischargers. The effluent shall be sampled before the commencement of discharge, again within thirty (30) days after commencement of discharge, and then once every six (6) months for the life of the project to maintain continued coverage under this generic permit. Samples taken in compliance with the provisions of this permit shall be taken prior to actual discharge or mixing with the receiving waters. The effluent shall be sampled for the parameters listed in Table 1.

Table 1

Parameter	Screening Values for Discharges into:	
	Fresh Waters	Coastal Waters
Total Organic Carbon (TOC)	10.0 mg/l	10.0 mg/l
pH, standard units	6.0-8.5	6.5-8.5
Total Recoverable Mercury	0.012 µg/l	0.025 µg/l
Total Recoverable Cadmium	9.3 µg/l	9.3 µg/l
Total Recoverable Copper	2.9 µg/l	2.9 µg/l
Total Recoverable Lead	0.03 mg/l	5.6 µg/l
Total Recoverable Zinc	86.0 µg/l	86.0 µg/l
Total Recoverable Chromium (Hex.)	11.0 µg/l	50.0 µg/l
Benzene	1.0 µg/l	1.0 µg/l
Naphthalene	100.0 µg/l	100.0 µg/l

(3) If any of the analytical test results exceed the screening values listed in Table 1, except TOC, the discharge is not authorized by this permit.

(a) For initial TOC values that exceed the screening values listed in Table 1, which may be caused by naturally-occurring, high molecular weight organic compounds, the permittee may request to be exempted from the TOC requirement. To request this exemption, the permittee shall submit additional information with a Notice of Intent (NOI),

described below, which describes the method used to determine that these compounds are naturally occurring. The Department shall grant the exemption if the permittee affirmatively demonstrates that the TOC values are caused by naturally-occurring, high molecular weight organic compounds.

(b) The NOI shall be submitted to the appropriate Department district office thirty (30) days prior to discharge, and contain the following information:

1. the name and address of the person that the permit coverage will be issued to;
2. the name and address of the facility, including county location;
3. any applicable individual wastewater permit number(s);
4. a map showing the facility and discharge location (including latitude and longitude);
5. the name of the receiving water; and
6. the additional information required by paragraph (3)(a) of this permit.

(c) Discharge shall not commence until notification of coverage is received from the Department.

(4) For fresh waters and coastal waters, the pH of the effluent shall not be lowered to less than 6.0 units for fresh waters, or less than 6.5 units for coastal waters, or raised above 8.5 units, unless the permittee submits natural background data confirming a natural background pH outside of this range. If natural background of the receiving water is determined to be less than 6.0 units for fresh waters, or less than 6.5 units in coastal waters, the pH shall not vary below natural background or vary more than one (1) unit above natural background for fresh and coastal waters. If natural background of the receiving water is determined to be higher than 8.5 units, the pH shall not vary above natural background or vary more than one (1) unit below natural background of fresh and coastal waters. The permittee shall include the natural background pH of the receiving waters with the results of the analyses required under paragraph (2) of this permit. For purposes of this section only, fresh waters are those having a chloride concentration of less than 1500 mg/l, and coastal waters are those having a chloride concentration equal to or greater than 1500 mg/l.

(5) In accordance with Rule 62-302.500(1)(a-c), F.A.C., the discharge shall at all times be free from floating solids, visible foam, turbidity, or visible oil in such amounts as to form nuisances on surface waters.

(6) If contamination exists, as indicated by the results of the analytical tests required by paragraph (2), the discharge cannot be covered by this generic permit. The facility shall apply for an individual wastewater permit at least ninety (90) days prior to the date discharge to surface waters of the State is expected, or, if applicable, the facility may seek coverage under any other applicable Department generic permit. No discharge is permissible without an effective permit.

(7) If the analytical tests required by paragraph (2) reveal that no contamination exists from any source, the facility can begin discharge immediately and is covered by this permit without having to submit an NOI request for coverage to the Department. A short summary of the proposed activity and copy of the analytical tests shall be sent to the applicable Department district office within one (1) week after discharge begins. These analytical tests shall be kept on site during discharge and made available to the Department if requested. Additionally, no Discharge Monitoring Report forms are required to be submitted to the Department.

(8) All of the general conditions listed in Rule 62-621.250, F.A.C., are applicable to this generic permit.

(9) There are no annual fees associated with the use of this generic permit.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
WATER

signed: August 23, 2007

MEMORANDUM

SUBJECT: Analytical Methods for Mercury in National Pollutant Discharge Elimination System (NPDES) Permits

FROM: James A. Hanlon, Director
Office of Wastewater Management

TO: Water Division Directors, Regions 1 - 10

The purpose of this memorandum is to inform you of EPA's March 12, 2007, approval of Method 245.7 for measurement of mercury and modified versions of approved analytical methods for mercury as well as the impact of their approval on the NPDES permitting process. While several different methods are currently approved under 40 CFR Part 136 for the analysis of mercury, some of these methods have much greater sensitivities and lower quantitation levels than others. This memorandum clarifies and explains that, in light of existing regulatory requirements for NPDES permitting,¹ only the most sensitive methods such as Methods 1631E and 245.7 are appropriate in most instances for use in deciding whether to set a permit limitation for mercury and for sampling and analysis of mercury pursuant to the monitoring requirements within a permit.

BACKGROUND

Section 301 of the Clean Water Act (CWA) requires NPDES permits to include effluent limitations that are as stringent as necessary to meet water quality standards. Thus, under the Act and EPA regulations, each permit must include, as necessary, requirements in addition to or more stringent than technology-based effluent limitations established under section 301 of the CWA in order to achieve water quality standards. 40 C.F.R. § 122.44(d)(1). The regulations require limitations to control all pollutants that the NPDES program director determines are or may be discharged at a level that "will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard," including both narrative and

¹ This memorandum is based on existing legal requirements and authorities. It does not impose any new, legally binding requirements on EPA, states, or the regulated community.

numeric criteria, 40 C.F.R. § 122.44(d)(1)(i). If the program director determines that a discharge has the reasonable potential to cause or contribute to such an excursion, the permit must contain water quality-based effluent limitations for the pollutant, 40 C.F.R. § 122.44(d)(1)(iii). Thus, a prospective permittee may need to measure various pollutants in its effluent at two stages: first, at the permit application stage so that the program director can determine whether “reasonable potential” exists and establish appropriate permit limits; and second, where a permit limit has been established, to meet the monitoring requirements within the permit. The following discussion explains which analytical methods permit applicants and permittees should use to make these measurements when mercury is the pollutant at issue.

Approved Analytical Methods

Measurements included on NPDES permit applications and on reports required to be submitted under the permit must generally be made using analytical methods approved by EPA under 40 CFR Part 136. See 40 CFR 136.1, 136.4, 136.5, 122.21(g)(7), and 122.41(j). For mercury, there are three methods commonly used in the NPDES program that EPA has approved under Part 136: Method 245.1, Method 245.2, and Method 1631E. Methods 245.1 and 245.2 were approved by EPA in 1974 and can achieve measurement of mercury down to 200 parts per trillion (ppt). Additionally, EPA approved Method 1631 Revision E in 2002. Method 1631E has a quantitation level of 0.5 ppt, making it 400 times more sensitive than Methods 245.1 and 245.2. In fact, the sensitivity of Methods 245.1 and 245.2 are well above the water quality criteria now adopted in most states (as well as the criteria included by EPA in the Final Water Quality Guidance for the Great Lakes System) for the protection of aquatic life and human health, which generally fall in the range of 1 to 50 ppt.² In contrast, Method 1631E, with a quantitation level of 0.5 ppt, does support the measurement of mercury at these low levels.

In addition to Methods 245.1, 245.2, and 1631E listed above, EPA approved Method 245.7 as well as modified versions of other EPA-approved methods on March 12, 2007. See 72 FR 11200. Method 245.7 has a quantitation level of 5.0 ppt, making it 40 times more sensitive than Methods 245.1 and 245.2. Additionally, modified versions of EPA-approved methods may also be used for the measurement of mercury. Methods approved under Part 136, such as 245.1 and 245.2, may be modified to achieve lower quantitation levels than can be achieved by the method as written.³ Modifications to an EPA-approved method for mercury that meet the method

² Many states have adopted mercury water quality criteria of 12 ppt for protection of aquatic life and 50 ppt for the protection of human health, and for discharges to the Great Lakes Basin, the applicable water quality criteria for mercury are 1.3 ppt for the protection of wildlife and 1.8 ppt for the protection of human health. In 2001, EPA issued new recommended water quality criteria guidance for the protection of human health. This new guidance recommends adoption of a methylmercury water quality criterion of 0.3 milligrams of methylmercury per kilogram (mg/kg) in fish tissue. EPA is currently developing implementation guidance to assist states in implementing the criterion, and *Draft Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion* (EPA-823-B-04-001) was released for public comment in August 2006.

³ Examples of such modification may include changes in the sample preparation digestion procedures such as the use of reagents similar in properties to ones used in the approved method, changes in the equipment operating parameters such as the use of an alternate more sensitive wavelength, adjusting the sample volume to optimize method performance, and changes in the calibration ranges (provided that the modified range covers any relevant regulatory limit).

performance requirements of Part 136.6 are considered to be approved methods and require no further EPA approval. See 72 FR 11239-40 (March 12, 2007). For analytical method modifications that do not fall within the flexibility of Part 136.6, the modified methods may be approved under the alternate test procedure program as defined by Parts 136.4 and 136.5.

ACTIONS RESULTING FROM THE MARCH 12, 2007, RULEMAKING

To implement the March 12, 2007, rule, the Office of Wastewater Management (OWM) provides the following guidance:

Monitoring Data Submitted as Part of NPDES Permit Applications

As noted, most states have adopted water quality criteria for the protection of aquatic life and human health that fall in the range of 1 to 50 ppt, and Methods 245.1 and 245.2, as written, do not detect or quantify mercury in this range. A "did not detect" result using Method 245.1 or Method 245.2 would show only that mercury levels are below 200 ppt but would not establish that they are at or below the applicable water quality criterion. Therefore, when a permit writer receives a permit application reporting mercury data analyzed with Method 245.1 or Method 245.2 as "did not detect" results, the permit writer in reality may lack the information needed to make a "reasonable potential" determination. In contrast, Method 1631E is able to detect and quantify mercury concentrations at these low levels.

EPA therefore expects, in general, that all facilities with the potential to discharge mercury will provide with their NPDES permit applications monitoring data for mercury using Method 1631E or another sufficiently sensitive EPA-approved method. For purposes of permit applications, a method for mercury is "sufficiently sensitive" when (1) its method quantitation level is at or below the level of the applicable water quality criterion for mercury or (2) its method quantitation level is above the applicable water quality criterion, but the amount of mercury in a facility's discharge is high enough that the method detects and quantifies the level of mercury in the discharge.⁴ Accordingly, EPA strongly recommends that the permitting authority determine that a permit application that lacks effluent data analyzed with a sufficiently sensitive EPA-approved method such as Method 1631E is incomplete unless and until the facility supplements the original application with data analyzed with such a method. See 40 CFR 122.21(e) (a permit application is determined to be complete at the discretion of the permitting authority) and 40 CFR 122.21(g)(13) (the applicant shall provide to the Director, upon request, such other information as the Director may reasonably require to assess the discharge). Such data would allow the permitting authority to characterize the effluent to determine whether the discharge causes, has the reasonable potential to cause, or contributes to an excursion of state water quality standards for mercury and would consequently allow the permitting authority to determine whether a water quality-based effluent limit for mercury is necessary in the permit.

⁴ To illustrate the latter, if the water quality criterion for mercury in a particular state is 2.0 ppt, Method 245.7 (with a quantitation level of 5.0 ppt) would be sufficiently sensitive where it reveals that the level of mercury in a facility's discharge is 5.0 ppt or greater. In contrast, Method 245.7 would not be sufficiently sensitive if it resulted in a level of non-detect for that discharge because it could not be known whether mercury existed in the discharge at a level between 2.0 and 5.0 (less than the quantitation level but exceeding the water quality criterion).

Monitoring Requirements in Permits

Where a permit authority establishes a permit limit for mercury, it also needs to consider specifying an analytical method that the permittee must use to monitor for mercury during the term of the permit. Methods 245.1 and 245.2, as written, are not likely to be sensitive enough to detect or quantify the concentration of mercury in the discharge at a level that matches the limitation for mercury in the permit. EPA therefore expects the permitting authority to require the use of a sufficiently sensitive EPA-approved method for monitoring under the permit in order to ensure that the sampling and measurements required are "representative of the monitored activity" (as required by 40 CFR 122.41(j)(1)). For purposes of monitoring under a permit, a method for mercury is "sufficiently sensitive" when (1) its method quantitation level is at or below the level of the mercury limit established in the permit or (2) its method quantitation level is above the mercury limit in the permit, but the amount of mercury in a facility's discharge is high enough that the method detects and quantifies the level of mercury in the discharge.⁵

EPA Permit Review and Objection to State Issued Permits

For NPDES-authorized states, EPA regions are expected to review state permits and should strongly consider objecting to permits that are issued based on analytical data collected and analyzed using an EPA-approved method that is not sufficiently sensitive or that do not require use of a sufficiently sensitive EPA-approved method for monitoring when the permit includes a limit for mercury. OWM is expecting to undertake a permit quality review of a small representative number of permits with respect to mercury limitations and other conditions.

If you have questions concerning the content of this memorandum, please contact Linda Boornazian, Director of the Water Permits Division, at 202-564-0221 or have your staff contact Marcus Zobrist of the State and Regional Branch at 202-564-8311 or zobrist.marcus@epa.gov.

cc: NPDES Branch Chiefs Regions 1 - 10

⁵ See footnote 4.

**ORANGE COUNTY ENVIRONMENTAL PROTECTION DIVISION
WORK INSTRUCTION**

Title: Dewatering Permitting and Approvals Work Instruction
Number: EPD-WI-2000-04

Effective Date: 10/04/2011 Revision: 1
Renewal Date: 10/04/2014 Revision Date: 10/04/2011
Approved By: Elizabeth R. Johnson, Environmental Programs Administrator

Purpose: The purpose of this work instruction is to provide guidance regarding the approvals required to initiate construction related dewatering in unincorporated Orange County

I. Procedure

County Offices:

Orange County Public Works

For proposed dewatering discharges to the Orange County Municipal Separate Storm Sewer System (MS4), contact Orange County Development Engineering prior to commencement of dewatering. OC Public Works Contact: Miguel Tamayo, 407-836-7914.

Orange County Utilities (OCU)

If the groundwater discharge testing indicates groundwater quality parameter exceedences, the discharge may be allowed to enter into the Orange County sanitary system. Coordinate with OCU. If OCU can accept the discharge, a County Industrial Wastewater Discharge Permit (IWD) will be required. Per Florida Department of Environmental Protection (FDEP), no FDEP dewatering permitting is required if an IWD is received.

Contact: Susanna Littell, OCU/Water Reclamation, 407-254-7710 (Industrial Wastewater Discharge Permits)

Contact: Laura Woodbury, P.E., OCU/Development Engineering, 407-254-9928.

Rules/Permits:

- Chapter 37 Article XX. Addresses industrial waste pretreatment and permitting.
- Industrial Wastewater Discharge (IWD) Permit. Required prior to discharge to the wastewater system.
- OCU Development Engineering Connection Requirements. OCU Development Engineering reviews and approves plans for groundwater dewatering and remediation projects when discharge will be to the OCU sanitary sewer system.

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**ORANGE COUNTY ENVIRONMENTAL PROTECTION DIVISION
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State Agencies:

Florida Department of Environmental Protection (FDEP)

For dewatering that is discharged offsite, sampling/analytical work is required prior to dewatering to determine if the proposed activity can be permitted under one of the generic dewatering permits.

FDEP Contacts: Ali Kazi, 407-897-4149; Randall Cunningham, 407-897-4152.

Rules/Permits:

- Generic Permit for Discharges from Petroleum Contaminated Sites (62-621.300(1)).
- Generic Permit for the Discharge of Produced Groundwater from any Non-Contaminated Site Activity (62-621.300(2)).
- Permit for all Other Contaminated Sites (62-04; 62-302; 62-620 & 62-660).

Water Management Districts:

St. Johns River Water Management District

Contact: Richard Kimmel, 407-659-4849.

Rules/Permits:

- No permit ("No Notice").
- Noticed General Permit for Short-term Construction Dewatering.
- Individual and Standard General Consumptive Use Permit.

South Florida Water Management District

Contact: Mario Cabana, 407-858-6100, ext. 3816.

Rules/Permits:

- "No-Notice" Short-Term Dewatering Permits.
- Dewatering General Water Use Permits.
- Long-term Dewatering Individual Permits.

For dewatering activities located in the City of Orlando contact Lisa Lotti at 407-246-2037.

II. Scope

This procedure applies to construction sites within unincorporated Orange County.

Definitions:

Off-site: For the purposes of this Work Instruction, off-site means property not under control of the owner/applicant or (discharging to) the municipal separate storm sewer system or waters of the County.

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**ORANGE COUNTY ENVIRONMENTAL PROTECTION DIVISION
WORK INSTRUCTION**

Related Documents:

Florida Department of Environmental Protection's Construction Generic Permit

History of Revisions:

Revision No.	Revision Date	Summary of Revisions
0	06/06/2011	Original
1	10/04/2011	Update contact information

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