CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

NWRF EXPANSION PHASE 1

Prepared for
BOARD OF COUNTY COMMISSIONERS
COUNTY OF MANATEE, FLORIDA

COUNTY PROJECT NO.

ISSUE FOR BID

July 2011

Prepared by

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GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE AND INTENT

A. Description

The work to be done consists of the furnishing of all labor, materials and equipment, and the performance of all work included in this Contract.

B. Work Included

The Contractor shall furnish all labor, superintendence, materials, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, shop drawings, working drawings and other means of construction necessary or proper for performing and completing the work. He shall obtain and pay for all required permits necessary for the work, other than those permits such as the DEP permit and railroad permit which may have already been obtained. He shall perform and complete the work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Engineer, and in strict accordance with the Contract Documents. The Contractor shall clean up the work and maintain it during and after construction, until accepted, and shall do all work and pay all costs incidental thereto. He shall repair or restore all structures and property that may be damaged or disturbed during performance of the work.

The cost of incidental work described in these General Requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the work and shall be included in the prices for the various Contract Items. No additional payment will be made therefore.

The Contractor shall provide and maintain such modern plant, tools, and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy of his workmanship, materials and equipment, prior approval of the Engineer notwithstanding.

C. Public Utility Installations and Structures

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

The Contractor shall protect all public utility installations and structures from damage during the work. Access across any buried public utility installation or structure shall be made only in such locations and by means approved by the Engineer. The Contractor shall so arrange his operations as to avoid any damage to these facilities. All required protective devices and construction shall be provided by the Contractor at his expense. All existing public utilities damaged by the Contractor which are shown on the Plans or have been located in the field by the utility shall be repaired by the Contractor, at his expense, as approved by the Engineer. No separate payment shall be made for such protection or repairs to public utility installations or structures.

Public utility installations or structures owned or controlled by the Owner or other governmental body, which are required by this contract to be removed, relocated, replaced or rebuilt by the Contractor not identified in any separate bid item shall be considered as a part of the general cost of doing the work and shall be included in the prices bid for the various contract items. No separate payment shall be made therefore.

Where public utility installations or structures owned or controlled by the Owner or other governmental body are encountered during the course of the work, and are not indicated on the Plans or in the Specifications, and when, in the opinion of the Engineer, removal, relocation, replacement or rebuilding is necessary to complete the work under this Contract, such work shall be accomplished by the utility having jurisdiction, or such work may be ordered, in writing by the Engineer, for the contractor to accomplish. If such work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required. If such work is

accomplished by the Contractor, it will be in accordance with the General and Supplemental General Conditions.

The Contractor shall give written notice to Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight hours in advance of breaking ground in any area or on any unit of the work. This can be accomplished by making the appropriate contact with the "Sunshine State One-Call of Florida, Inc. Call Center ("Call Sunshine") and per all requirements provided for in the Florida Underground Facilities Damage Prevention and Safety Act (Florida Statutes, Title XXXIII, Chapter 556).

The maintenance, repair, removal, relocation or rebuilding of public utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the Engineer.

1.02 PLANS AND SPECIFICATIONS

A. Plans

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

B. Copies Furnished to Contractor

The Contractor shall furnish each of the subcontractors, manufacturers, and material men such copies of the Contract Documents as may be required for their work. Additional copies of the Plans and Specifications, when requested, may be furnished to the Contractor at cost of reproduction.

C. Supplementary Drawings

When, in the opinion of the Engineer, it becomes necessary to explain more fully the work to be done or to illustrate the work further or to show any changes which may be required, drawings known as Supplementary Drawings, with specifications pertaining thereto, will be prepared by the Engineer and five paper prints thereof will be given to the Contractor.

D. Contractor to Check Plans and Data

The Contractor shall verify all dimensions, quantities and details shown on the Plans, Supplementary Drawings, Schedules, Specifications or other data received from the Engineer, and shall notify him of all errors, omissions,

conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction or improper operation resulting there from nor from rectifying such conditions at his own expense. He will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the Engineer, should such errors or omissions be discovered. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in work to be done under the Contract.

E. Specifications

The Technical Specifications consist of three parts: General, Products and Execution. The General Section contains General Requirements which govern the work. Products and Execution modify and supplement these by detailed requirements for the work and shall always govern whenever there appears to be a conflict.

F. Intent

All work called for in the Specifications applicable to this Contract, but not shown on the Plans in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Plans or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the work, is required and shall be performed by the Contractor as though it were specifically delineated or described.

The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.

The inclusion of the Related Requirements (or work specified elsewhere) in the General part of the specifications is only for the convenience of the Contractor, and shall not be interpreted as a complete list of related Specification Sections.

1.03 MATERIALS AND EQUIPMENT

A. Manufacturer

The names of proposed manufacturers, material men, suppliers and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings shall be submitted to the Engineer for approval. Such approval must be obtained before shop drawings will be checked. No manufacturer will be approved for any materials to be furnished under this Contract unless he shall be of good reputation and have a plant of ample capacity. He shall, upon the request of the Engineer, be required to submit evidence that he has manufactured a similar product to the one specified and that it has been previously used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.

All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the Engineer, that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.

Any two or more pieces or material or equipment of the same kind, type or classification, and being used for identical types of services, shall be made by the same manufacturer.

B. Delivery

The Contractor shall deliver materials in ample quantities to insure the most speedy and uninterrupted progress of the work so as to complete the work within the allotted time. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the work of any related Contractor.

C. Tools and Accessories

The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind or size of equipment, one complete set of suitably marked high grade special tools and appliances which may be needed to adjust, operate, maintain or repair the equipment. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.

Spare parts shall be furnished as specified.

Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place and

clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight and principal rating data.

D. Installation of Equipment.

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

Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Plans, unless directed otherwise by the Engineer during installation. All equipment shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.

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

The Contractor shall, at his own expense, furnish all materials and labor for, and shall properly bed in non-shrink grout, each piece of equipment on its supporting base that rests on masonry foundations.

Grout shall completely fill the space between the equipment base and the foundation. All metal surfaces coming in contact with concrete or grout shall receive a coat of coal tar epoxy equal to Koppers 300M.

E. Service of Manufacturer's Engineer

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

designated by the Owner in the proper operation and maintenance of such equipment.

1.04 INSPECTION AND TESTING

A. General

Inspection and testing of materials will be performed by the Owner unless otherwise specified.

For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Three (3) copies of the reports shall be submitted and authoritative certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.

If, in the making of any test of any material or equipment, it is ascertained by the Engineer that the material or equipment does not comply with the Contract, the Contractor will be notified thereof and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the work and replace it with acceptable material, without cost to the Owner.

Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.

The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

B. Costs

All inspection and testing of materials furnished under this Contract will be performed by the Owner or duly authorized inspection engineers or inspections bureaus without cost to the Contractor, unless otherwise expressly specified.

The cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents shall be borne by the Contractor and such costs shall be deemed to be included in the Contract price.

Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the Owner for compliance. The Contractor shall reimburse the Owner for the expenditures incurred in making such tests on materials and equipment which are rejected for non-compliance.

C. Inspections of Materials

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

D. Certificate of Manufacture

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

E. Shop Tests of Operating Equipment

Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function or special requirements are specified shall be tested in the shop of the maker in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. No such equipment shall be shipped to the work until the Engineer notifies the Contractor, in writing, that the results of such tests are acceptable.

Five copies of the manufacturer's actual test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company, shall be forwarded to the Engineer for approval. The cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

F. Preliminary Field Tests

As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make preliminary field tests of equipment. If the preliminary field tests disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, the Contractor shall, prior to the acceptance tests, make all changes, adjustments and replacements required. The furnishing Contractor shall assist in the preliminary field tests as applicable.

G. Final Field Tests

Upon completion of the work and prior to final payment, all equipment and piping installed under this Contract shall be subjected to acceptance tests as specified or required to prove compliance with the Contract Documents.

The Contractor shall furnish labor, fuel, energy, water and all other materials, equipment and instruments necessary for all acceptance tests, at no additional cost to the Owner. The Supplier shall assist in the final field tests as applicable.

H. Failure of Tests

Any defects in the materials and equipment or their failure to meet the tests, guarantees or requirements of the Contract Documents shall be promptly corrected by the Contractor. The decision of the Engineer as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails to make these corrections or if the improved materials and equipment, when tested, shall again fail to meet the guarantees of specified requirements, the Owner, notwithstanding its partial payment for work, and materials and equipment, may reject the materials and equipment and may order the Contractor to remove them from the site at his own expense.

In case the Owner rejects any materials and equipment, then the Contractor shall replace the rejected materials and equipment within a reasonable time. If he fails to do so,

the Owner may, after the expiration of a period of thirty (30) calendar days after giving him notice in writing, proceed to replace such rejected materials and equipment, and the cost thereof shall be deducted from any compensation due or which may become due the Contractor under his Contract.

I. Final Inspection

During such final inspections, the work shall be clean and free from water. In no case will the final pay application be prepared until the Contractor has complied with all requirements set forth and the Engineer has made his final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Document.

1.05 TEMPORARY STRUCTURES

A. Temporary Fences

If, during the course of the work, it is necessary to remove or disturb any fence or part thereof, the Contractor shall, at his own expense, if so ordered by the Engineer, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced. The Engineer shall be solely responsible for the determination of the necessity for providing a temporary fence and the type of temporary fence to be used.

1.06 TEMPORARY SERVICES

A. First Aid

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

1.07 LINES AND GRADES

A. Grade

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

B. Safeguarding Marks

The Contractor shall safeguard all points, stakes, grade marks, monuments and bench marks made or established on the work, bear the cost of reestablishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or to removing without authorization such established points, stakes and marks.

The Contractor shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the work and, if required, shall bear the cost of reestablishing them if disturbed or destroyed.

C. Datum Plane

All elevations indicated or specified refer to the Mean Sea Level Datum of the NGVD 1929 Datum and/or NAVD 1988.

1.08 ADJACENT STRUCTURES AND LANDSCAPING

A. Responsibility

The Contractor shall also be entirely responsible and liable for all damage or injury as a result of his operations to all other adjacent public and private property, structures of any kind and appurtenances thereto met with during the progress of the work. The cost of protection, replacement in their original locations and conditions or payment of damages for injuries to such adjacent public and private property and structures affected by the work, whether or not shown on the Plans, and the removal, relocation and reconstruction of such items called for on the Plans or specified shall be included in the various Contract Items and no separate payments will be made therefore. Where such public and private property, structures of any kind and appurtenances thereto are not shown on the Plans and when, in the opinion of the Engineer, additional work is deemed necessary to avoid interference with the work, payment therefore will be made as provided for in the General Conditions.

Contractor is expressly advised that the protection of buildings, structures, tunnels, tanks, pipelines, etc. and related work adjacent and in the vicinity of his operations, wherever they may be, is solely his responsibility. Conditional inspection of buildings or structures in the immediate vicinity of the project which may reasonably be expected to be affected by the Work shall be performed by and be the responsibility of the Contractor.

Contractor shall, before starting operations, make an examination of the interior and exterior of the adjacent structures, buildings, facilities, etc., and record by notes, measurements, photographs, etc., conditions which might be aggravated by open excavation and construction. Repairs or replacement of all conditions disturbed by the construction shall be made to the satisfaction of the Owner and to the satisfaction of the Engineer. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be given to the Engineer.

Prior to the beginning of any excavations, the Contractor shall advise the Engineer of all buildings or structures on which he intends to perform work or which performance of the project work will affect.

B. Protection of Trees

1. All trees and shrubs shall be adequately protected by the Contractor with boxes and otherwise and in accordance with ordinances governing the protection of trees. No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by him with new stock of similar size and age, at the proper season and at the sole expense of the Contractor.

2. Beneath trees or other surface structures, where possible, pipelines may be built in short tunnels, backfilled with excavated materials, except as otherwise specified, or the trees or structures carefully supported and protected from damage.

3. The Owner may order the Contractor, for the convenience of the Owner, to remove trees along the line or trench excavation. If so ordered, the Owner will obtain any permits required for removal of trees. Such tree removal ordered shall be paid for under the appropriate Contract Items.

C. Lawn Areas

Lawn areas shall be left in as good condition as before the starting of the work. Where sod is to be removed, it shall be carefully removed, and later replaced, or the area where sod has been removed shall be restored with new sod in the manner described in the Workmanship and Materials Paragraph in Section 02900, Seeding and Sodding.

D. Restoration of Fences

Any fence, or part thereof, that is damaged or removed during the course of the work shall be replaced or repaired by the Contractor and shall be left in as good a condition as before the starting of the work. The manner in which the fence is repaired or replaced and the materials used in such work shall be subject to the approval of the Engineer. The cost of all labor, materials, equipment, and work for the replacement or repair of any fence shall be deemed included in the appropriate Contract Item or items, or if no specific Item is provided therefore, as part of the overhead cost of the work, and no additional payment will be made therefore.

1.09 PROTECTION OF WORK AND PUBLIC

A. Barriers and Lights

During the prosecution of the work, the Contractor shall put up and maintain at all times such barriers and lights as will effectually prevent accidents. The Contractor shall provide suitable barricades, red lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the work causes obstructions to the normal traffic or constitutes in any way a hazard to the public, in accordance with state and local requirements.

B. Smoke Prevention

A strict compliance with ordinances regulating the production and emission of smoke will be required. No open fires will be permitted.

C. Noise

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

Except in the event of an emergency, no work shall be done between the hours of 7:00 P.M. and 7:00 A.M., or on weekends. If the proper and efficient prosecution of the work requires operations during the night or weekends, the written permission of the Owner shall be obtained before starting such items of the work.

D. Access to Public Services

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

E. Dust prevention

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

1.10 CUTTING AND PATCHING

The Contractor shall do all cutting, fitting or patching of his portion of the work that may be required to make the several parts thereof join and coordinate in a manner satisfactory to the Engineer and in accordance with the Plans and Specifications. The work must be done by competent workmen skilled in the trade required by the restoration.

1.11 CLEANING

A. During Construction

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

The Contractor shall remove from the site all of his surplus materials and temporary structures when no further need therefore develops.

B. Final Cleaning

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

The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver such materials and equipment undamaged in a bright, clean, polished and new operating condition.

1.12 MISCELLANEOUS

A. Protection Against Siltation and Bank Erosion

1. The Contractor shall arrange his operations to minimize siltation and bank erosion on construction sites and on existing or proposed water courses and drainage ditches.

2. The Contractor, at his own expense, shall remove any siltation deposits and correct any erosion problems as directed by the Engineer which results from his construction operations.

B. Protection of Wetland Areas

The Contractor shall properly dispose of all surplus material, including soil, in accordance with Local, State and Federal regulations. Under no circumstances shall surplus material be disposed of in wetland areas as defined by the Florida Department of Environmental Protection or Southwest Florida Water Management District.

C. Existing Facilities

The work shall be so conducted to maintain existing facilities in operation insofar as is possible. Requirements and schedules of operations for maintaining existing facilities in service during construction shall be as described in the Special Provisions.

D. Use of Chemicals

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. The work may consist of, but may not be limited to the following improvements for the NWRF Expansion:

1. Replace four (4) mixed liquor internal recirculation pumps in the two (2) existing anoxic/aeration basins with 50 HP pumps and motors. Replace four (4) existing 30-inch plug valves and replace with 30-inch knife gate valves. The basins shall be drained, and acculumated grit removed, dewatered and disposed of. The basins shall then be pressure washed to allow the Engineer to inspection the basins for needed repair. Remove and replace two wier gates and two sluice gates within the basins.

2. Rehabilitate existing plant drain pump station with new piping, valves, guide rails, coatings, control panel, flow meter, and ancillary components. The existing 20 HP submersible pumps will be reused.

3. Install three (3) new gravity disk filters including associated backwash lift staton, valves, metering, electrical, instrumentation, and yarding piping modifications required to utilize the existing 18” and 20” mains for lake storage return and for sending water from the Manatee County Agricultural Reuse System (MARS) to storage. Replace the three (3) lake storage intake structures with new intake screens and concrete structures.Install new chemical feed system consisting of simplex and duplex chemical skids, residual analyzer and piping.

B. The Contractor shall furnish all labor, equipment, and incidentals, which are necessary for the full completion of the work whether specifically indicated in the Contract Documents or not. This includes, but is not limited to, miscellaneous concrete, dewatering, workplace safety, cleanup, etc.

1.02 PLANS AND SPECIFICATIONS

A. The Plans and the Specifications indicate the extent and nature of the work to be performed.

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

C. Copies Furnished to Contractor: The Contractor shall furnish each of the subcontractors, manufacturers, and material men such copies of the Contract Documents as may be required for their work. Additional copies of the Plans and Specifications, when requested, may be furnished to the Contractor at cost of reproduction.

D. Supplementary Drawings: When, in the opinion of the County or Engineer, it becomes necessary to explain more fully the work to be done or to illustrate the work further or to show any changes which may be required, drawings known as Supplementary Drawings, with specifications pertaining thereto, will be prepared and five paper prints thereof will be given to the Contractor.

E. Contractor to Check Plans and Data: The Contractor shall verify all dimensions, quantities and details shown on the Plans, Supplementary Drawings, Schedules, Specifications or other data received from the Owner, and shall notify him Owner of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction or improper operation resulting there from nor from rectifying such conditions at his own expense. Contractor He will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the Engineer, should such errors or omissions be discovered. All schedules are given for the convenience of the Owner and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in work to be done under the Contract.

F. Specifications: The Technical Specifications consist of three parts: General, Products and Execution. The General Section contains General Requirements which govern the work. Products and Execution modify and supplement these by detailed requirements for the work and shall always govern whenever there appears to be a conflict.

G. Intent:

1. All work called for in the Specifications applicable to this Contract, but not shown on the Plans in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Plans or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the work, is required and shall be performed by the Contractor as though it were specifically delineated or described.

2. The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.

3. The inclusion of the Related Requirements (or work specified elsewhere) in the General part of the specifications is only for the convenience of the Contractor, and shall not be interpreted as a complete list of related Specification Sections.

1.03 MATERIALS AND EQUIPMENT

A. Manufacturer

1. The names of proposed manufacturers, materials, suppliers and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings shall be submitted to the Engineer and Manatee County Project Management for approval. Such approval must be obtained before shop drawings will be checked. No manufacturer will be approved for any materials to be furnished under this Contract unless he shall be of good reputation and have a plant of ample capacity. He shall, upon the request of the Engineer, be required to submit evidence that he has manufactured a similar product to the one specified and that it has been previously used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.

2. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the Engineer, that the manufacturer or subcontractor deal directly with the Engineer. Any

such transactions shall not in any way release the Contractor from his full responsibility under this Contract.

3. Any two or more pieces or material or equipment of the same kind, type or classification, and being used for identical types of services, shall be made by the same manufacturer.

4. Delivery: The Contractor shall deliver materials in ample quantities to insure the most speedy and uninterrupted progress of the work so as to complete the work within the allotted time. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the work of any related Contractor.

B. Tools and Accessories:

1. The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind or size of equipment, one complete set of suitably marked high grade special tools and appliances which may be needed to adjust, operate, maintain or repair the equipment. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.

2. Spare parts shall be furnished as specified.

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

C. Installation of Equipment.

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

2. Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Plans, unless directed otherwise by the Engineer during installation. All equipment shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.

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

4. The Contractor shall, at his own expense, furnish all materials and labor for, and shall properly bed in non-shrink grout, each piece of equipment on its supporting base that rests on masonry foundations.

5. Grout shall completely fill the space between the equipment base and the foundation. All metal surfaces coming in contact with concrete or grout shall receive a coat of coal tar epoxy equal to Koppers 300M.

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

1.04 SUBMITTALS

A. The Contractor shall submit to the Engineer, within ten days after receipt of Notice to Proceed, a schedule of Shop Drawing Submittals which shall include:

1. The names of proposed manufacturers, suppliers, and dealers,
2. A list of materials and equipment for shop drawing submittals, and
3. Proposed shop drawing submittal dates.

B. The Contractor shall coordinate all submittals with the related Vendor in a manner not to impede construction on the individual project(s).

1.05 CONTRACTS

A. Furnish all the labor and needed materials as ordered on a project basis under the Contract (Agreement).

1.06 CONSTRUCTION AREAS

The Contractor shall:

A. Limit his use of the construction areas for work and for storage, to allow for:

1. Work by other contractors.
2. Owner Use.

B. Coordinate use of work site under direction of Owner's Representative.

C. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.

D. Move any stored-products, under Contractor’s control, which interfere with operations of the Owner or separate contractor.

E. Obtain and pay for the use of additional storage of work areas needed for operations.

1.07 OWNER OCCUPANCY

A. It is assumed that portions of the work will be completed prior to completion of the entire work. Upon completion of construction in each individual facility, including testing, if the Owner, at his sole discretion, desires to accept the individual facility, the Contractor will be issued a dated certificate of completion and acceptance for each individual facility. The Owner will assume ownership and begin operation of the individual facility on that date and the one-year guaranty period shall commence on that date. The Owner has the option of not accepting any individual completed facility, but accepting the entire work as a whole when it is completed and tested.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01015

CONTROL OF WORK

PART 1 GENERAL

1.01 WORK PROGRESS

A. The Contractor shall furnish personnel and equipment which will be efficient, appropriate and adequately sized to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the time stipulated in the Contract. If at any time such personnel appears to the Engineer to be inefficient, inappropriate, or insufficient for securing the quality of work required for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the personnel and equipment and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.02 PRIVATE LAND

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

1.03 WORK LOCATIONS

A. Work shall be located substantially as indicated on the drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons.

1.04 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require

special construction procedures such as limiting the length of open trench, prohibiting stacking excavated material in the street and requiring that the trench shall not remain open overnight.

B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be barricaded and well lighted at all times when construction is not in progress.

1.05 DISTRIBUTION SYSTEMS AND SERVICES

A. The Contractor shall avoid interruptions to water, telephone, cable TV, sewer, gas, or other related utility services. He shall notify the Engineer and the appropriate agency well in advance of any requirement for dewatering, isolating, or relocating a section of a utility, so that necessary arrangements may be made.

B. If it appears that utility service will be interrupted for an extended period, the Engineer may order the Contractor to provide temporary service lines at the Contractor's expense. Inconvenience of the users shall be kept to the minimum, consistent with existing conditions. The safety and integrity of the systems are of prime importance in scheduling work.

1.06 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

A. The Contractor shall assume full responsibility for the protection of all buildings, structures and utilities, public or private, including poles, signs, services to building utilities, gas pipes, water pipes, hydrants, sewers, drains and electric and telephone cables and other similar facilities, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operation shall be repaired by the Contractor at his expense.

B. The Contractor shall bear full responsibility for obtaining locations of all underground structures and utilities (including existing water services, drain lines and sewers). Services to buildings shall be maintained and all costs or charges resulting from damage thereto shall be paid by the Contractor.

C. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract and all costs in connection therewith shall be included in the unit prices established in the Bid.

D. If, in the opinion of the Engineer, permanent relocation of a utility owned by the Owner is required, he may direct the Contractor, in writing, to perform the work. Work so ordered will be paid for at the Contract unit prices, if applicable, or as extra work as classified in the General Conditions. If relocation of a privately owned utility is required, the Owner will notify the utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the Owner and utility and shall have no claim for delay due to such relocation. The Contractor shall notify public utility companies in writing at least 48 hours (excluding Saturdays, Sundays and legal holidays) before excavating near their utilities.

1.07 TEST PITS

A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor immediately after the utility location and the surface shall be restored in a manner equal or better than the original condition. No separate payment will be made.

1.08 CARE AND PROTECTION OF PROPERTY

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

B. All sidewalks which are disturbed by the Contractor's operations shall be restored to their original or better condition by the use of similar or comparable materials. All curbing shall be restored in a condition equal to the original construction and in accordance with the best

modern practice.

C. Along the location of this work, all fences, walks, bushes, trees, shrubbery and other physical features shall be protected and restored in a thoroughly workmanlike manner unless otherwise shown on the drawings. Fences and other features removed by the Contractor shall be replaced in the location indicated by the Engineer as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be regraded and sodded to equal or exceed original conditions.

D. Trees close to the work which drawings do not specify to be removed shall be boxed or otherwise protected against injury. The Contractor shall trim all branches that are liable to damage because of his operations, but in no case shall any tree be cut or removed without prior notification to the Engineer. All injuries to bark, trunk, limbs and roots of trees shall be repaired by dressing, cutting and painting according to approved methods, using only approved tools and materials.

E. The protection, removal and replacement of existing physical features along the line of work shall be a part of the work under the Contract and all costs in connection therewith shall be included in the unit and/or lump sum prices established under the items in the Bid.

1.09 MAINTENANCE OF TRAFFIC

A. Open pits, trenches, unpaved streets, debris, or other obstructions due to construction that will prevent the normal flow of traffic during an extended construction stoppage, for any reason, shall be minimized. In the event an extended construction stoppage is found to be necessary, Contractor shall, at his own expense, provide normal traffic flow during extended construction stoppage. Extended stoppage will be defined by the Engineer.

B. All excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he shall repair the road surface, provide temporary roadways, erect wheel guards or fences, or take other safety measures which are satisfactory to the Engineer and Owner.

C. Detours around construction areas will be subject to the approval of the Owner and the Engineer. Where detours

are permitted, the contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured, the Contractor shall expedite construction operations and periods when traffic is being detoured, will be strictly controlled by the Owner.

1.10 WATER FOR CONSTRUCTION PURPOSES

A. In locations where public water supply is available, the Contractor may purchase water for all construction purposes.

B. The Contractor shall be responsible for paying for all water tap fees incurred for the purpose of obtaining a potable water service or temporary use meter.

1.11 MAINTENANCE OF FLOW

A. The Contractor shall at his own cost, provide for the flow of sewers, drains and water courses interrupted during the progress of the work and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the Engineer and Owner well in advance of the interruption of any flow.

1.12 CLEANUP

A. During the course of the work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. He shall dispose of all residue resulting from the construction work and at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and shall leave the entire site of the work in a neat and orderly condition.

1.13 COOPERATION WITHIN THIS CONTRACT

A. All firms or person authorized to perform any work under this Contract shall cooperate with the General Contractor and his subcontractors or trades and shall assist in incorporating the work of other trades where necessary or required.

B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or

directed by the Engineer.

1.14 PROTECTION OF CONSTRUCTION AND EQUIPMENT

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

B. All structures shall be protected in a manner approved by the Engineer. Should any of the floors or other parts of the structures become heaved, cracked, or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor, at his own expense and to the satisfaction of the Engineer. If, in the final inspection of the work, any defects, faults, or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the warranty period described in the Contract.

C. Further, the Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the Owner.

1.15 CONSTRUCTION WITHIN RIGHT-OF-WAY

A. Where pipe lines are installed within FDOT right-of-way, all excavation backfill and compaction for the purpose of reconstructing roadways and/or adjacent slopes contiguous thereto shall be in accordance with FDOT or Manatee County Standards and Specifications, whichever is applicable. Contractor shall satisfy the authorized representative of the FDOT with respect to proper safety procedures, construction methods, required permitting, etc., within the FDOT right-of-way.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01030

SPECIAL PROJECT PROCEDURES

PART 1 GENERAL

1.01 PERMITS

A. Upon notice of award, the Contractor shall immediately apply for and/or obtain all applicable permits not previously obtained by the Owner to do the work from the appropriate governmental agency or agencies. No work shall commence until all applicable permits have been obtained and copies delivered to the Owner's Representative. The costs for obtaining all permits shall be borne by the Contractor.

1.02 CONNECTIONS TO EXISTING SYSTEM

A. The Contractor shall perform all work necessary to locate, excavate and prepare for connections to the terminus of the existing systems all as shown on the Drawings or where directed by the Owner's Representative. The cost for this work and for the actual connection to the existing systems shall be included in the price bid for the project and shall not result in any additional cost to the Owner.

1.03 RELOCATIONS

A. The Contractor shall be responsible for the coordination of the relocation of structures, including but not limited to light poles, power poles, signs, sign poles, fences, piping, conduits, drains and irrigation components that interfere with the positioning of the work as set out on the Drawings. No relocation of the items under this Contract shall be done without approval from the Engineer.

1.04 EXISTING UNDERGROUND PIPING, STRUCTURES AND UTILITIES

A. The attention of the Contractor is drawn to the fact that during excavation, the possibility exists of the Contractor encountering various water, sewer, telephone, electrical, or other utility lines not shown on the Drawings. The Contractor shall exercise extreme care before and during excavation to locate and flag these lines as to avoid damage to the

existing lines. Cost for relocation of all existing lines shall be included in the price bid for the project. Should damage occur to an existing line, the Contractor shall bear the cost of all repairs to said line.

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

C. The existing utility locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping to be encountered. The Contractor shall be responsible for notifying the various utility companies to locate their respective utilities in advance of construction in conformance with all requirements provided for in the Florida Underground Facilities Damage Prevention and Safety Act (Florida Statutes, Title XXXIII, Chapter 556).

D. The existing piping and utilities that interfere with new construction shall be rerouted as shown, specified, or required. Before any piping and utilities not shown on the Drawings are disturbed, the Contractor shall notify the Engineer of the location of the pipeline or utility and shall reroute or relocate the pipeline or utility as directed. Cost for relocation of existing pipelines or utilities shall be included in the price bid for the project.

E. The Contractor shall exercise care in any excavation to locate all existing piping and utilities. All utilities which do not interfere with complete work shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the Owner’s Representative and/or the owner of the utility.

F. It is intended that wherever existing utilities such as water, sewer, telephone, electrical, or other

service lines must be crossed, deflection of the pipe within recommended limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated in the Drawings. However, when in the opinion of the Owner's Representative this procedure is not feasible, he may direct the use of fittings for a utilities crossing as detailed on the Drawings. No deflections will be allowed in gravity sanitary sewer lines or in existing storm sewer lines.

1.05 SUSPENSION OF WORK DUE TO WEATHER

A. Refer to FDOT Standards and Specifications Book, Section 8.

1.06 HURRICANE PREPAREDNESS PLAN

A. Within 30 days of the date of Notice to Proceed, the Contractor shall submit to the Owner's Representative and Owner a Hurricane Preparedness Plan. The plan should outline the necessary measures which the Contractor proposes to perform at no additional cost to the Owner in case of a hurricane warning.

B. In the event of inclement weather, or whenever Owner's Representative shall direct, Contractor shall insure that he and his Subcontractors shall carefully protect work and materials against damage or injury from the weather. If, in the opinion of the Owner's Representative, any portion of work or materials is damaged due to the failure on the part of the Contractor or Subcontractors to protect the work, such work and materials shall be removed and replaced at the expense of the Contractor.

1.07 POWER SUPPLY

A. Electricity as may be required for construction and permanent power supply shall be secured and purchased by the Contractor.

1.08 SALVAGE

A. Any existing equipment or material, including, but not limited to, valves, pipes, fittings, couplings, building materials, etc., which is removed or replaced as a result of construction under this project may be designated as salvage by the Owner's

Representative or Owner and, if so, shall be protected for a reasonable time until picked up by the Owner. Any equipment or material not worthy of salvaging, as directed by the Owner’s Representative, shall be disposed of by the Contractor at no additional cost.

1.09 DEWATERING

A. The Contractor shall do all groundwater pumping necessary to prevent flotation of any part of the work during construction operations with his own equipment.

B. The Contractor shall pump out water and wastewater which may seep or leak into the excavations for the duration of the Contract and with his own equipment. He shall dispose of this water in an appropriate manner.

1.10 ADDITIONAL PROVISIONS

A. Before commencing work on any of the existing pipelines, structures or equipment, the Contractor shall notify the Owner’s Representative, in writing, at least two weeks in advance of the date he proposes to commence such work.

B. The Contractor shall provide, at his own expense, all necessary temporary facilities for access to and for protection of, all existing facilities. The Owner's personnel must have ready access at all times to the existing facilities. The Contractor is responsible for all damage to existing structures, equipment and facilities caused by his construction operations and must repair all such damage when and as ordered by the Engineer.

C. Contractor shall provide protective matting, fuel containment and all other materials, equipment and labor during construction. Any spill of fuel, hydraulic fluid, or oil shall be contained. Any contaminated soil shall be removed and disposed of according to all applicable federal, state and local regulations, entirely at the Contractor’s expense. Contractor shall, prior to beginning construction, submit a “Fueling Spill Prevention Plan” that shall clearly indicate how fuel spills will be prevented.

1.11 CONSTRUCTION CONDITIONS

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

1.12 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, excessive noise or dust.

B. Sound levels must comply with all applicable state and local codes. Sound levels in excess of those listed in said codes are sufficient cause to have the work halted until equipment can be quieted to these levels. Work stoppage by the Engineer or County for excessive noise shall not relieve the Contractor of the other portions of this specification including, but not limited to contract time and contract price.

C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.13 CHANGES TO GENERAL CONDITIONS

A. The word “completion” shall be replaced with the words “substantial completion” in Specification Section 00700- General Conditions, Article 9.3.2.

1.14 FIELD OFFICES

A. Office space will be made available at the site for the temporary field offices of the Contractor (and his subcontractors) and for storage of construction materials. The Contractor (and his subcontractors) shall provide all necessary temporary fencing and gates to protect materials from pilferage. The location and type of temporary buildings shall be subject to the approval of the OWNER and the Engineer.

B. Record documents required by the General Conditions and other sections of the Contract Documents shall be

kept in the office.

1.15 EXISTING FACILITIES- PLAN OF OPERATION

A. The functions of the existing wastewater treatment facility include screening, grit removal, aeration, secondary clarification, sludge recycle, sludge wasting, filtration, chlorine disinfection prior to discharge to the MARS System, sludge digestion and sludge dewatering facilities. These functions must be maintained and shall be maintained by the contractor throughout the construction period unless otherwise specified herein, such that there is no deterioration in the quality of the treated effluent. At no time will an overflow of wastewater of a quality less than that which meets the County's discharge permit and which is not disinfected as required by State regulations, be allowed as a result of the Contractor's operations. Construction operations shall be scheduled and undertaken so that treatment of the wastewater is continuously maintained, as specified above, throughout the life of the project. The existing limitations for the facility must be met during the construction period.

B. All electrical work shall be scheduled to allow continuous electrical operation of the existing facilities with a minimum of required outages. Any power outage or any work which required interruption of the plant flow shall be scheduled during a normally dry weather period of the year and at those times of the day and/or night when sewage flows are low. In such cases, the Contractor shall submit a written request at least seven days prior to the scheduled work or outage and obtain the written permission of the Owner. Such permission shall give consideration to recent weather conditions and plant flow patterns, as well as projected weather forecasts for the area, and the Contractor's preparedness to perform the work. The Contractor shall coordinate with the electric utility, as required, regarding the scheduling of the power outages.

C. The Contractor shall prepare a detailed construction sequence to maintain continuous treatment to allow the facility to meet the required effluent limitations. Continuous treatment shall be defined, at a minimum, as consisting of the following unit processes:

- Screening
- Grit Removal
- Aeration & Mixing of Existing Oxidation Ditches
- Secondary Clarification
- Sludge Recycle
- Sludge Wasting
- Filtration of Plant Water
- Disinfection
- Effluent Pumping and Flow Measurement
- Plant Water System
- Aerobic Digestion
- Sludge Dewatering

This plan shall require approval by the Engineer before any of the existing facilities are modified. In this plan he shall successfully demonstrate to the Engineer that the continuity and degree (quality) of treatment will not be adversely affected.

1. In development of his detailed construction sequence, the contractor shall give particular consideration to the following:

    a. One anoxic/aerobic basin shall remain on line at all times. The Contractor shall provide two weeks advance notice of taking a basin off line or placing a basin on line. The maximum duration a basin shall be off line is two months.
    b. Connection of the lake gravity disk filter effluent to the effluent pump station wet well and modification to PRV-712 shall occur during the off peak hours and be coordinated with Operational Staff two weeks in advance.
    c. Work within the Golf Course shall be scheduled between May 1st and September 30th.
    d. Two lake return pump stations must be operational at all times.
    e. Contractor shall coordinate with the Wastewater Treatment Plant personnel, two weeks in advance, all power interruptions.
    f. All other work including new construction and demolition not mentioned in the above schedule may be performed concurrently with any stage of the work as long as the

performance of such work will in no way jeopardize the continuity and quality of treatment of wastewater. The Contractor shall coordinate his work closely with the ongoing functions of the existing treatment facility, chemical and other deliveries and with the work of all subcontractors.

D. As part of the construction sequence, the Contractor may find that temporary pumping facilities and temporary piping will be required for wastewater or other process streams. These facilities or other means that the Contractor elects shall be subject to the review and approval of the Engineer and shall be provided by the Contractor to maintain continuous process operations.

E. Any process equipment, utility, etc. necessary to maintain treatment must be maintained. The primary goal is to maintain continuous treatment to the required levels.

F. The Owner's personnel shall be responsible for the day-to-day operations including meter reading, process monitoring, and establishing control system modifications to ensure compliance with the effluent limits. Maintenance of temporary process equipment including routine corrective repairs and maintenance shall be performed by the Contractor as part of the base bid price. Operational changes (valves, etc.) shall be performed by the Owner or the Owner's representative.

G. A minimum 10-ft road must be maintained for traffic within the plant at all times during work that is parallel to the road. Road closures required for utility crossings of the road shall be scheduled two weeks in advanced. Detour signs shall be provided to reroute traffic.

H. Additional Requirements:

1. ANOXIC/AEROBIC BASINS

a. The Contractor shall clean the anoxic/aerobic basins in accordance with Bid Item 6 of Technical Specification 01150- Measurement and Payment.

b. Subsequent to the cleaning of the anoxic/aerobic basins, the Contractor shall allow the Engineer to perform a structural integrity review of the basins. The Contractor shall coordinate this task two weeks in advance with the Engineer.

c. The Contractor shall hire the services of an independent testing company to test the power and control wire from Electrical Building No. 1 to each of the internal recycle pumps. See Specification Section 16960 for information.

2. EFFLUENT PUMP STATION

a. During connection of the lake gravity disc filters to the effluent pump station wet well, it cannot be guaranteed that the northern portion of the effluent pump station wet well can be completely isolated from the southern portion. Contactor shall provide all means to dewater the southern portion of the effluent pump station wet well as required to perform the work. Additionally, the Contractor shall provide by-pass pumping consisting of four pumps (three duty and one redundant) for a firm capacity of 9,000 gpm to discharge plant flow flowing into the southern portion of the effluent pump station complete with metering, float system and controls to discharge from the effluent pump station wet well into the golf course storage lake. The contractor may utilize the existing 18” discharge line to the accomplish this.

3. INTAKE STRUCTURES

a. The Contractor’s bid shall not rely on County efforts to intentionally lower the water level in the East or Golf Course Storage Lakes to assist the Contractor with the removal and replacement of the intake structures. Historically, the lakes have seasonal fluctuations with higher water levels occurring during the summer rainy months and lower levels during the dryer spring months. The Contractor will be required to construct coffer damns as needed to perform this work.

4. PLANT DRAIN PUMP STATION

a. During the rehabilitation of the plant drain pump station, the Contractor shall provide by-pass pumping consisting of three pumps complete with float system and controls. The design capacity of the temporary by-pass pumping shall be 2,400 gpm at 42-ft of total dynamic head with 2 pumps operating and one on standby. The Contractor shall temporarily plug the existing 6-inch pipe that discharges into the plant drain pump station during by-pass operations.

I. The Contractor shall make whatever provisions are necessary to protect and maintain the continued operation of the existing facilities. Such provisions shall include, but not be limited to the following.

1. Protection of the structural integrity of the existing oxidation ditches, plant drain pump station, effluent wet well and structures adjacent to work shall be provided as necessary and required for the successful rehabilitation and modification.

2. Installation of suitable temporary piping to replace those which must be demolished as part of the construction or as otherwise required to maintain continuous treatment.

3. Access to each of the buildings or process structures.

J. In addition to the master schedule, prior to commencing alteration work on any existing facility, The Contractor shall submit to the Engineer, a proposed method and schedule of construction in the immediate area, taking into account the precautions and requirements specified herein. Such work shall not commence until approval is obtained with the Engineer and interruptions of normal plant operations reviewed with the Owner. In general, temporary isolation of existing plant components for construction operations shall be carefully coordinated beforehand with the Owner and Engineer so that treatment of wastewater can continue. All work shall be closely coordinated with

the Owner's operating personnel so that they can adjust their normal operating procedures to any temporary conditions imposed upon them. No temporary isolation of plant components will be permitted until the Contractor has on hand all materials, labor, tools and equipment necessary to accomplish the work in that isolated area. Such work shall begin immediately and be expedited to satisfactory completion as soon as particular area or plant component has been isolated.

K. The Contractor shall assist the Owner in maintaining any process equipment, utility, etc., necessary to maintain continuous treatment. Any such equipment that must be relocated, either temporarily or permanently, or any process equipment, utilities, etc., that must be installed, either temporarily or permanently, to maintain wastewater treatment shall be the responsibility of the General Contractor. The Contractor shall include the cost of all temporary facilities required to maintain treatment, meeting secondary standards, during the construction period in his bid prices. The cost shall include the cost of all labor, tools, equipment and materials necessary.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01045

CUTTING AND PATCHING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for all cutting, fitting and patching, including excavation and backfill, required to complete the work or to:

1. Make its several parts fit together properly.
2. Uncover portions of the work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to requirements of Contract Documents.
5. Provide penetrations of non-structural surfaces for installation of piping and electrical conduit.

PART 2 PRODUCTS

2.01 MATERIALS

A. Comply with specifications and standards for each specific product involved.

PART 3 EXECUTION

3.01 INSPECTION

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

B. After uncovering work, inspect conditions affecting installation of products, or performance of work.

C. Report unsatisfactory or questionable conditions to Engineer. Do not proceed with work until Engineer has provided further instructions.

3.02 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value to integrity of affected portion of work.

B. Provide devices and methods to protect other portions of project from damage.

C. Provide protection from elements for that portion of the project which may be exposed by cutting and patching work and maintain excavations free from water.

3.03 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs.

B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.

C. Fit and adjust products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

D. Restore work which has been cut or removed; install new products to provide completed work in accordance with the requirements of the Contract Documents.

E. Replace surfaces airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

F. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.

END OF SECTION

SECTION 01050

FIELD ENGINEERING AND SURVEYING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall provide and pay for field surveying service required for the project.

B. The Contractor shall furnish and set all necessary stakes to establish the lines and grades as shown on the Contract Drawings and layout each portion of the Work of the Contract.

1. All survey work required in execution of Project.

2. All costs of construction layout shall be included in the unit and lump sum prices contained in the respective divisions of the Contract Bid Form.

3. Civil, structural or other professional engineering services specified or required to execute Contractor's construction methods.

1.02 QUALIFICATION OF SURVEYOR AND ENGINEER

A. All construction staking shall be conducted by or under the supervision of a Florida Registered Professional Surveyor and Mapper approved by the Owner. The Contractor shall be responsible for the layout of all such lines and grades, which will be subject to verification by the Engineer.

1.03 SURVEY REFERENCE POINTS

A. Existing horizontal and vertical control points for the Project are designated on the Contract Drawings.

B. Locate and protect all survey monumentation, property corners and project control points prior to starting work and preserve all permanent reference points during construction. All costs associated with the replacement of all survey monumentation, property corners and project control points shall be borne by the Contractor.

C. Make no changes or relocations without prior written notice to Engineer.

D. Report to Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

E. Require surveyor to replace project control points which may be lost or destroyed.

F. Establish replacements based on original survey control.

1.04 PROJECT SURVEY REQUIREMENTS

A. The Contractor shall establish temporary bench marks as needed, referenced to data established by survey control points.

1.05 RECORD DRAWINGS

A. Maintain a complete, accurate log of all control and survey work as it progresses.

B. The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data and properly prepare and certify Record Drawings per Section 01720 – Project Record Documents.

1.06 SUBMITTALS

A. Submit name and address of Professional Surveyor and Mapper to Engineer for Owner’s approval.

B. Submit certificate signed by the Professional Surveyor and Mapper certifying that elevations and locations of improvements are in conformance, or nonconformance, with Contract Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01090

REFERENCE STANDARDS

PART 1 GENERAL

1.01 REQUIREMENTS

Abbreviations and acronyms used in Contract Documents to identify reference standards.

A. Application: When a standard is specified by reference, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes established stricter standards.

B. Publication Date: The most recent publication in effect on the date of Contract Documents (including addenda), except when a specific publication date is specified.

1.03 ABBREVIATIONS, NAMES AND ADDRESSES OR ORGANIZATIONS

A. Obtain copies of reference standards direct from publication source, when needed for proper performance of work, or when required for submittal by Contract Documents.

AA Aluminum Association
818 Connecticut Avenue, N.W.
Washington, DC 20006

AASHTO American Association of State Highway and Transportation Officials
444 North Capital Street, N.W.
Washington, DC 20001

ACI American Concrete Institute
Box 19150
Reford Station
Detroit, MI 48219

AI Asphalt Institute
Asphalt Institute Building
College Park, MD 20740

AISC American Institute of Steel Construction
1221 Avenue of the Americas
New York, NY 10020

AISI	American Iron and Steel Institute 1000 16th Street NW Washington, DC 20036
ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 179l Tullie Circle, N.E. Atlanta, GA 30329
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
AWS	American Welding Society 2501 N.W. 7th Street Miami, FL 33125
CRSI	Concrete Reinforcing Steel Institute 180 North LaSalle Street, Suite 2110 Chicago, IL 60601
FDEP	Florida Department of Environmental Protection 3900 Commonwealth Blvd. Tallahassee, Florida 32399
FDOT	Florida Department of Transportation Standards Specifications for Road and Bridge Construction Maps & Publication Sales - Mail Station 12 605 Suwannee St. Tallahassee, FL 32399-0450
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407

MCUOD	Manatee County Utility Operations Department 4410 66th St. W. Bradenton, FL 34210
MLSFA	Metal Lath/Steel Framing Association 221 North LaSalle Street Chicago, IL 60601
MMA	Monorail Manufacturer's Association 1326 Freeport Road Pittsburgh, PA 15238
NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601
NEMA	National Electrical Manufacturer's Assoc. 2101 L Street N.W. Washington, DC 20037
OHSA	Occupational Safety and Health Assoc. 5807 Breckenridge Pkwy., Suite A Tampa, FL 33610-4249
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 20076
PCI	Prestressed Concrete Institute 20 North Wacker Drive Chicago, IL 60606
SDI	Steel Door Institute 712 Lakewood Center North Cleveland, OH 44107
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association 8224 Old Court House Road Vienna, VA 22180
SSPC	Steel Structures Painting Council 402 24th Street, Suite 600 Pittsburgh, PA 15213
SWFWMD	Southwest Florida Water Management District 2379 Broad Street Brooksville, FL 34604-6899

UL Underwriter's Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01150

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The scope of this section of the Contract Documents is to further define the items included in each Bid Item in the Bid Proposal section of these specifications. Payment will be made based on the specified items supplied and delivered in the description in this section for each bid item.

1.02 GENERAL

A. All contract lump sum prices included in the Bid Proposal section will be full compensation for all labor, equipment and incidentals to construct the wastewater treatment plant expansion and appurtenances as specified in the Contract Documents under this contract.

1.03 WORK OUTSIDE AUTHORIZED LIMITS

A. No payment will be made for work constructed outside the authorized limits of work.

1.04 PAYMENT

A. Lump Sum Items: Where payment for items is shown to be paid for on a lump sum basis, no separate payment will be made for any item of work required to complete the lump sum item within the limits of work shown or specified.

1.05 COSTS INCLUDED IN PAYMENT ITEMS

A. Separate Payment: No separate payment will be made for the following items and the cost of such work shall be included in the applicable pay items of work.

1. Clearing and grubbing.
2. Trench excavation, including necessary pavement and rock removal, sheeting or shoring except as otherwise specified.
3. Dewatering and disposal of surplus water.
4. Structural fill, backfill, grading, and related transport costs.
5. Replacement of paved or unpaved roadways, grass (sod) and shrubbery plots.
6. Cleanup.

7. Foundation and borrow materials, except as hereinafter specified.
8. Testing and placing system in operation.
9. Any material and equipment required to be installed and utilized for tests.
10. Pipe, structures, pavement replacement, restoration and/or appurtenances included within the limits of lump sum work, unless otherwise shown.
11. Maintaining the existing quality of service during construction, including any required by-pass pumping.
12. Appurtenant work as required for a complete and operable system.
13. Repair of damaged irrigation piping and sprinkler heads.
14. Maintaining access to treatment plant structures with barriers, lights, signage etc.
15. Relocation of utilities as required to perform the work.

B. Cleanup: CONTRACTOR's attention is called to the fact that cleanup is considered a part of the work of construction. No payment will be made until cleanup is essentially complete.

1.06 BID ITEMS

Bid Item No. 1 - Mobilization/Demobilization

A. Mobilization shall be the preparatory work and operations in mobilizing for beginning work on the project, including, but not limited to, those operations necessary for the movement of personnel, equipment, supplies and incidentals to the project site, and for the establishment of temporary offices, storage buildings, safety equipment and first aid supplies, sanitary and other facilities, as required by the Contract Documents and applicable laws and regulations. The costs of bonds, required insurance, permits and any other preconstruction expense necessary for the start of the work, excluding the cost of construction materials, shall also be included in this item. Demobilization shall be the work of removing temporary facilities from the site.

B. Payment for mobilization/demobilization shall not exceed five percent (5%) of the total Bid Price. Partial payments for this item will be made in accordance with the following schedule:

Percent of Original Contract Amount Amount Earned	Allowable Percent of the Lump Sum Price for the Item
5	25
10	35
25	45
50	50
75	75
100	100

C. These payments will be subject to the standard retainage provided in the agreement. Payment of the retainage will be made after completion of the work and demobilization.

D. These payments will be subject to the standard retainage provided in the agreement. Payment of the retainage will be made after completion of the work and demobilization.

Bid Item No. 2 – Anoxic/Aerobic Basin Modifications

A. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary for the modifications to the anoxic/aerobic basins including, but not limited to, removal of plug valves, temporary submersible pump/piping, and sluice gates; abandoned chlorine piping; removal and replacement of suction piping, piping appurtenances, seal water system, and internal recycle pumps (including the power and control wiring to the pumps from Electrical Building No. 1); installation of bonneted knife gates and support; weir gates and sluice gates; testing of power and control wiring to each of the internal recycle pumps; site restoration and all other appurtenant civil, mechanical, electrical and instrumentation work related to this lump sum pay item as presented in the Contract Documents.

B. If the Engineer’s inspection warrants concrete repair, the County may negotiate the repair work with the Contractor which shall be paid for under Bid Item 6.

Bid Item No. 3 – Lake Gravity Disc Filters

A. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary for the construction of the lake gravity disc filters including, but not limited

to, removal and replacement of the lake intake structures; coffer damns; yard piping, valves, meters and associated appurtenances; filtration system equipment; chlorination system equipment; backwash lift station and associated force mains; concrete; asphalt pavement; stormwater system and swale; effluent pump station by-pass pumping and metering; site restoration; and all other appurtenant civil, mechanical, electrical and instrumentation work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 4 – Plant Drain Pump Station

A. Payment of the applicable lump sum price shall be full compensation for furnishing all plant, labor, materials and equipment necessary to rehabilitate the plant drain pump station including, but not limited to, by-pass pumping; dewatering; removal and replacement of concrete, pipe and appurtenances, guide rail, floats, coating system, and control panel; removal and reinstallation of existing pumps; installation of ultrasonic level transmitter, stilling well, and flow meter (at headworks); site restoration and all other appurtenant civil, mechanical, electrical and instrumentation work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 5 –Anoxic/Aerobic Basin Cleaning

A. Contractor shall be responsible to remove, dewater, haul, and dispose of any accumulated grit remaining in the basins after the County has drained the basins at its desired rate to the extent reasonably possible using the existing basin drains. Grit material shall be considered what is remaining in the basins after the basin has been drained and biosolids have been removed to the extent reasonably possible using conventional methods. Contractor shall also be responsible to dispose of the centrate produced from its dewatering efforts. This may be disposed of at the plant at a rate acceptable to the County. It is anticipated that this range would be 150 gpm or less. Following the removal of the sediment, the basin walls, floors and ceilings shall be pressure washed to allow the engineer to perform a visual inspection of the basins' structural integrity. The Contractor shall provide one scissor lift w/ wheels, two ladders of sufficient length, and the required OSHA safety equipment to provide a means for the inspector to enter and exit the basins and to perform his inspection as part of this bid item.

B. Payment for this bid item shall be a) by the cubic yard of accumulated grit removed as measured in the disposal truck by the Engineer to the nearest whole cubic yard and, b) for each basin pressure washed and inspection equipment provided for. The bid items shall constitute full compensation for all labor, equipment, materials and incidental work necessary to allow satisfactory completion of the work under this item.

Bid Item No. 6 - Discretionary Work

A. This payment item is for the Owner's requested changes in the work pertaining to the NWRF Phase 1 Expansion Work that requires authorization of the Owner prior to the work being performed. This item is not to cover work outlined in the plans and/or specifications or for work incidental to the completion of the project as outlined herein, and shall only be used when directed by the Owner.

B. Payment shall be made based on written authorization of the additional work. The authorization shall reflect the actual amounts agreed to by the Contractor and the Owner.

C. Payment of the applicable negotiated lump sum price shall be full compensation for furnishing, but is not limited to, all plant, labor, materials and equipment necessary to perform work not covered under Bid Item Nos. 2-5. **All work performed under Bid Item No. 6 shall be submitted to the Engineer and the Owner for review and approval. However, no work shall be performed without written authorization to proceed.**

Alternate Deduct #1

A. Indicate the unit deduct from base bid for not providing and installing new power and control wiring to the four internal recycle pumps from Electrical Building No.1.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01152

REQUESTS FOR PAYMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Submit Applications for Payment to the Project Manager or as directed at the preconstruction meeting, in accordance with the schedule established by Conditions of the Contract and Agreement between Owner and Contractor.

1.02 FORMAT AND DATA REQUIRED

A. Submit payment requests in the form provided by the Owner with itemized data typed in accordance with the Bid Form.

B. Provide construction photographs in accordance with Contract Documents.

1.03 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. When the Owner or the Engineer requires substantiating data, Contractor shall submit suitable information with a cover letter.

B. Submit one copy of data and cover letter for each copy of application.

1.04 PREPARATION OF APPLICATION FOR FINAL PAYMENT

A. Fill in application form as specified for progress payments.

1.05 SUBMITTAL PROCEDURE

A. Submit applications for payment at the times stipulated in the Agreement.

B. Number: Three (3) copies of each application; all signed and certified by the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01153

CHANGE ORDER PROCEDURES

PART 1 GENERAL

1.01 DEFINITION

A. Change Order: Major change in contract scope or time that must be approved by the Board.

B. Administrative Change Adjustment: Minor change order under 10% of project cost or 20% time, does not have to be Board approved.

C. Field Directive Change: Change to contract quantity that does not require a change of scope or time extension.

1.02 REQUIREMENTS INCLUDED

A. The Contractor shall promptly implement change order procedures:

1. Provide full written data required to evaluate changes.
2. Maintain detailed records of work done on a time-and-material/force account basis.
3. Provide full documentation to Engineer on request.

B. The Contractor shall designate a member of the Contractor's organization who:

1. Is authorized to accept changes to the Work.
2. Is responsible for informing others in the Contractor's employ of the authorized changes into the Work.

C. The Board of County Commissioners executes all Change Orders.

1.03 PRELIMINARY PROCEDURES

A. Project Manager may initiate changes by submitting a Request to Contractor. Request will include:

1. Detailed description of the change, products, costs and location of the change in the Project.
2. Supplementary or revised Drawings and Specifications.
3. The projected time extension for making the change.

4. A specified period of time during which the requested price will be considered valid.
5. Such request is for information only and is not an instruction to execute the changes, nor to stop work in progress.

B. Contractor may initiate changes by submitting a written notice to the Project Manager, containing:

1. Description of the proposed changes.
2. Statement of the reason for making the changes.
3. Statement of the effect on the Contract Sum and the Contract Time.
4. Statement of the effect on the work of separate contractors.
5. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

1.04 FIELD DIRECTIVE CHANGE

A. In lieu of a Change Order, the Project Manager may issue a Field Directive change for the Contractor to proceed with additional work within the original intent of the Project.

B. Field Directive change will describe changes in the work, with attachments of backup information to define details of the change.

C. Contractor must sign and date the Field Directive change to indicate agreement with the terms therein.

1.05 DOCUMENTATION OF PROPOSALS AND CLAIMS

A. Support each quotation for a lump sum proposal and for each unit price which has not previously been established, with sufficient substantiating data to allow the Engineer/Owner to evaluate the quotation.

B. On request, provide additional data to support time and cost computations:

1. Labor required.
2. Equipment required.
3. Products required.
   a. Recommended source of purchase and unit cost.
   b. Quantities required.
4. Taxes, insurance and bonds.
5. Credit for work deleted from Contract, similarly documented.
6. Overhead and profit.

7. Justification for any change in Contract Time.

C. Support each claim for additional costs and for work done on a time-and-material/force account basis, with documentation as required for a lump-sum proposal, plus additional information.

1. Name of the Owner's authorized agent who ordered the work and date of the order.
2. Date and time work was performed and by whom.
3. Time record, summary of hours work and hourly rates paid.
4. Receipts and invoices for:
   a. Equipment used, listing dates and time of use.
   b. Products used, listing of quantities.
   c. Subcontracts.

1.06 PREPARATION OF CHANGE ORDERS

A. Project Manager will prepare each Change Order.

B. Change Order will describe changes in the Work, both additions and deletions, with attachments as necessary to define details of the change.

C. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.

1.07 LUMP SUM/FIXED PRICE CHANGE ORDER

A. Project Manager initiates the form, including a description of the changes involved and attachments based upon documents and proposals submitted by the Contractor, or requests from the Owner, or both.

B. Once the form has been completed, all copies should be sent to Contractor for approval. After approval by Contractor, all copies should be sent to Owner for approval. The Owner will distribute executed copies after approval by the Board of County Commissioners.

1.08 UNIT PRICE CHANGE ORDER

A. Contents of Change Orders will be based on, either:

1. Owner's definition of the scope of the required changes.
2. Contractor's Proposal for a change, as approved by the Owner.

3. Survey of completed work.

B. The amounts of the unit prices to be:

1. Those stated in the Agreement.
2. Those mutually agreed upon between Owner and Contractor.

1.09 TIME AND MATERIAL/FORCE ACCOUNT CHANGE ORDER/CONSTRUCTION CHANGE AUTHORIZATION

A. At completion of the change, Contractor shall submit itemized accounting and supporting data as provided in the Article "Documentation of Proposals and Claims" of this Section.

B. Engineer will determine the allowable cost of such work, as provided in General Conditions and Supplementary Conditions.

C. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.

D. Owner and Contractor will sign and date the Change Order to indicate their agreement therewith.

1.10 CORRELATION WITH CONTRACTOR'S SUBMITTALS

A. Periodically revise Schedule of Values and Application for Payment forms to record each change as a separate item of work, and to record the adjusted Contract Sum.

B. Periodically revise the Construction Schedule to reflect each change in Contract Time. Revise sub schedules to show changes for other items of work affected by the changes.

C. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Owner or Engineer shall schedule the pre-construction meeting, periodic progress meetings and special meetings, if required, throughout progress of work.

B. Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

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

1.02 PRE-CONSTRUCTION MEETING

A. Attendance:

1. Owner's Engineer.
2. Owner's Project Manager
3. Contractor.
4. Resident Project Representative.
5. Related Labor Contractor's Superintendent.
6. Major Subcontractors.
7. Major Suppliers.
8. Others as appropriate.

B. Suggested Agenda:

1. Distribution and discussion of:
   a. List of major subcontractors.
   b. Projected Construction Schedules.
   c. Coordination of Utilities
2. Critical work sequencing.
3. Project Coordination.
   a. Designation of responsible personnel.
   b. Emergency contact persons with phone numbers.
4. Procedures and processing of:
   a. Field decisions.
   b. Submittals.
   c. Change Orders.
   d. Applications for Payment.
5. Procedures for maintaining Record Documents.

6. Use of premises:
   a. Office, work and storage areas.
   b. Owner's REQUIREMENTS.
7. Temporary utilities.
8. Housekeeping procedures.
9. Liquidated damages.
10. Equal Opportunity Requirements.
11. Laboratory testing.
12. Project / Job meetings: Progress meeting, other special topics as needed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01310

CONSTRUCTION SCHEDULE AND PROJECT RESTRAINTS

PART 1 GENERAL

1.01 GENERAL

A. Construction under this contract must be coordinated with the Owner and accomplished in a logical order to maintain utilization and flow through existing facilities and public properties and rights-of-way and to allow construction to be completed within the time allowed by Contract Documents and in the manner set forth in the Contract.

1.02 CONSTRUCTION SCHEDULING GENERAL PROVISIONS

A. No work shall be done between 7:00 p.m. and 7:00 a.m. nor on weekends or legal holidays without written permission of the Owner. However, emergency work may be done without prior permission.

B. Night work may be established by the Contractor as regular procedure with the written permission of the Owner. Such permission, however, may be revoked at any time by the Owner if the Contractor fails to maintain adequate equipment and supervision for the proper execution and control of the work at night.

C. Due to potential health hazards and requirements of the State of Florida and the U.S. Environmental Protection Agency, existing facilities must be maintained in operation.

D. The Contractor shall be fully responsible for providing all temporary piping, plumbing, electrical hook-ups, lighting, temporary structure, or other materials, equipment and systems required to maintain the existing facility's operations. All details of temporary piping and temporary construction are not necessarily shown on the Drawings or covered in the Specifications. However, this does not relieve the Contractor of the responsibility to insure that construction will not interrupt proper facility operations.

E. The Contractor shall designate an authorized representative of his firm who shall be responsible for development and maintenance of the schedule and of progress and payment reports. This representative of the

Contractor shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the commitments of the Contractor's schedule.

1.03 PROGRESS OF THE WORK

The work shall be executed with such progress as may be required to prevent any delay to the general completion of the work. The work shall be executed at such times and in or on such parts of the project and with such forces, materials and equipment to assure completion of the work in the time established by the Contract and in the manner set forth in the Contract.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The Contractor shall submit a critical path schedule as described herein.

B. The planning, scheduling, management and execution of the work is the sole responsibility of the Contractor. The progress schedule requirement is established to allow Engineer to review Contractor's planning, scheduling, management and execution of the work; to assist Engineer in evaluating work progress and make progress payments and to allow other contractors to cooperate and coordinate their activities with those of the Contractor.

2.02 FORM OF SCHEDULES

A. Prepare schedules using the latest version of Microsoft Project, or other Owner approved software, in the form of a horizontal bar chart diagram. The diagram shall be time-scaled and sequenced by work areas. Horizontal time scale shall identify the first work day of each week.

B. Activities shall be at least as detailed as the Schedule of Values. Activity durations shall be in whole working days. In addition, man-days shall be shown for each activity or tabulated in an accompanying report.

C. Diagrams shall be neat and legible and submitted on sheets at least 8-1/2 inches by 11 inches suitable for reproduction. Scale and spacing shall allow space for notations and future revisions.

2.03 CONTENT OF SCHEDULES

A. Each monthly schedule shall be based on data as of the last day of the current pay period.

B. Description for each activity shall be brief, but convey the scope of work described.

C. Activities shall identify all items of work that must be accomplished to achieve substantial completion, such as items pertaining to Contractor's installation and testing activities; items pertaining to the approval of regulatory agencies; contractor's time required for submittals, fabrication and deliveries; the time required by Engineer to review all submittals as set forth in the Contract Documents; items of work required of Owner to support pre-operational, startup and final testing; time required for the relocation of utilities. Activities shall also identify interface milestones with the work of other contractors performing work under separate contracts with Owner.

D. Schedules shall show the complete sequence of construction by activities. Dates for beginning and completion of each activity shall be indicated as well as projected percentage of completion for each activity as of the first day of each month.

E. Submittal schedule for shop drawing review, product data, and samples shall show the date of Contractor submittal and the date approved submittals will be required by the Engineer, consistent with the time frames established in the Specifications.

F. For Contract change orders granting time extensions, the impact on the Contract date(s) shall equal the calendar-day total time extension specified for the applicable work in the Contract change orders.

G. For actual delays, add activities prior to each delayed activity on the appropriate critical path(s). Data on the added activities of this type shall portray all steps leading to the delay and shall further include the following: separate activity identification, activity description indicating cause of the delay, activity duration consistent with whichever set of dates below applies, the actual start and finish dates of the delay or, if the delay is not finished, the actual start date and estimated completion date.

H. For potential delays, add an activity prior to each potentially delayed activity on the appropriate critical path(s). Data for added activities of this type shall include alternatives available to mitigate the delay including acceleration alternatives and further show the following: separate activity identification, activity description indicating cause of the potential delay and activity duration equal to zero work days.

2.04 SUPPORTING NARRATIVE

A. Status and scheduling reports identified below shall contain a narrative to document the project status, to explain the basis of Contractor's determination of durations, describe the Contract conditions and restraints incorporated into the schedule and provide an analysis pertaining to potential problems and practical steps to mitigate them.

B. The narrative shall specifically include:

1. Actual completion dates for activities completed during the monthly report period and actual start dates for activities commenced during the monthly report period.
2. Anticipated start dates for activities scheduled to commence during the following monthly report period.
3. Changes in the duration of any activity and minor logic changes.
4. The progress along the critical path in terms of days ahead or behind the Contract date.
5. If the Monthly Status Report indicates an avoidable delay to the Contract completion date or interim completion dates as specified in the Agreement, Contractor shall identify the problem, cause and the activities affected and provide an explanation of the proposed corrective action to meet the milestone dates involved or to mitigate further delays.
6. If the delay is thought to be unavoidable, the Contractor shall identify the problem, cause, duration, specific activities affected and restraints of each activity.
7. The narrative shall also discuss all change order activities whether included or not in the revised/current schedule of legal status. Newly introduced change order work activities and the CPM path(s) that they affect, must be specifically identified. All change order work activities added to the schedule shall conform with the sequencing

and Contract Time requirements of the applicable Change Order.

8. Original Contract date(s) shall not be changed except by Contract change order. A revision need not be submitted when the foregoing situations arise unless required by Engineer. Review of a report containing added activities will not be construed to be concurrence with the duration or restraints for such added activities; instead the corresponding data as ultimately incorporated into the applicable Contract change order shall govern.
9. Should Engineer require additional data, this information shall be supplied by Contractor within 10 calendar days.

2.05 SUBMITTALS

A. Contractor shall submit estimated and preliminary progress schedules (as identified in the Terms and Conditions of the Contract and the General Conditions), monthly status reports, a start-up schedule and an as-built schedule report all as specified herein.

B. All schedules, including estimated and preliminary schedules, shall be in conformance with the Contract Documents.

C. The finalized progress schedule discussed in the Contract Documents shall be the first monthly status report and as such shall be in conformance with all applicable specifications contained herein.

D. Monthly Status Report submittals shall include three copies of a time-scaled (days after notice to proceed) diagram showing all contract activities and supporting narrative. The initial detailed schedule shall use the notice to proceed as the start date. The finalized schedule, if concurred with by Owner, shall be the work plan to be used by the contractor for planning, scheduling, managing and executing the work.

E. The schedule diagram shall be formatted as above. The diagram shall include (1) all detailed activities included in the preliminary and estimated schedule submittals, (2) calendar days prior to substantial completion, (3) summary activities for the remaining days. The critical path activities shall be identified, including critical paths for interim dates, if possible.

F. The Contractor shall submit monthly progress schedules with each month's application for payment.

G. Contractor shall submit three monthly status reports which will be retained by the Owner and Engineer.

2.06 MONTHLY STATUS REPORTS

A. Contractor shall submit three copies of detailed schedule status reports on a monthly basis with the Application for Payment. The first such status report shall be submitted with the first Application for Payment and include data as of the last day of the pay period. The Monthly Report shall include a "marked-up" copy of the latest detailed schedule of legal status and a supporting narrative including updated information as described above. The Monthly Report will be reviewed by Engineer and Contractor at a monthly schedule meeting and Contractor will address Engineer's comments on the subsequent monthly report. Monthly status reports shall be the basis for evaluating Contractor's progress.

B. The "marked-up" diagram shall show, for the latest detailed schedule of legal status, percentages of completion for all activities, actual start and finish dates and remaining durations, as appropriate. Activities not previously included in the latest detailed schedule of legal status shall be added, except that contractual dates will not be changed except by change order. Review of a marked-up diagram by Engineer will not be construed to constitute concurrence with the time frames, duration, or sequencing for such added activities; instead the corresponding data as ultimately incorporated into an appropriate change order shall govern.

2.07 STARTUP SCHEDULE

A. At least 60 calendar days prior to the date of substantial completion, Contractor shall submit a time-scaled (days after notice to proceed) diagram detailing the work to take place in the period between 60 days prior to substantial completion, together with a supporting narrative. Engineer shall have 10 calendar days after receipt of the submittal to respond. Upon receipt of Engineer's comments, Contractor shall make the necessary revisions and submit the revised schedule within 10 calendar days. The resubmittal, if concurred with by Owner, shall be the Work Plan to be used by Contractor for planning, managing, scheduling and executing the remaining work leading to substantial completion.

B. The time-scaled diagram shall use the latest schedule of legal status for those activities completed ahead of the last 60 calendar days prior to substantial completion and detailed activities for the remaining 60-day period within the time frames outlined in the latest schedule of legal status.

C. Contractor will be required to continue the requirement for monthly reports, as outlined above. In preparing this report, Contractor must assure that the schedule is consistent with the progress noted in the startup schedule.

2.08 REVISIONS

A. All revised Schedule Submittals shall be made in the same form and detail as the initial submittal and shall be accompanied by an explanation of the reasons for such revisions, all of which shall be subject to review by Engineer and concurrence by Owner. The revision shall incorporate all previously made changes to reflect current as-built conditions. Minor changes to the approved submittal may be approved at monthly meetings; a minor change is not considered a revision in the context of this paragraph.

B. A revised schedule submittal shall be submitted for review when required by Engineer.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01340

SHOP DRAWINGS, PROJECT DATA AND SAMPLES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the Engineer for review and approval: working drawings, shop drawings, test reports and data on materials and equipment (hereinafter in this section called data), and material samples (hereinafter in this section called samples) as are required for the proper control of work, including, but not limited to those working drawings, shop drawings, data and samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.

B. Within thirty (30) calendar days after the effective date of the Agreement, the Contractor shall submit to the Engineer, a complete list of preliminary data on items for which Shop Drawings are to be submitted. Included in this list shall be the names of all proposed manufacturers furnishing specified items and the date on which each Shop Drawing shall be submitted. Review of this list by the Engineer shall in no way relieve the Contractor from submitting complete Shop Drawings and providing materials, equipment, etc., fully in accordance with the Specifications. This procedure is required in order to expedite final review of Shop Drawings.

C. The Contractor is to maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the Owner and the Engineer. This log should include the following items:

1. Submittal description and number assigned.
2. Date to Engineer.
3. Date returned to Contractor (from Engineer).
4. Status of Submittal (No exceptions taken, returned for confirmation or resubmittal, rejected).
5. Date of Resubmittal and Return (as applicable).
6. Date material released (for fabrication).

7. Projected date of fabrication.
8. Projected date of delivery to site.
9. Projected date and required lead time so that product installation does not delay contract.
10. Status of O&M manuals submitted.

1.02 CONTRACTOR'S RESPONSIBILITY

A. It is the duty of the Contractor to check all drawings, data and samples prepared by or for him before submitting them to the Engineer for review. Each and every copy of the Drawings and data shall bear Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement. Shop drawings shall indicate any deviations in the submittal from requirements of the contract Documents.

B. Determine and verify:

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with Specifications and indicate all variances from the Specifications.

C. The Contractor shall furnish the Engineer a schedule of Shop Drawing submittals fixing the respective dates for the submission of shop and working drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall indicate those that are critical to the progress schedule.

D. The Contractor shall not begin any of the work covered by a drawing, data, or a sample returned for correction until a revision or correction thereof has been reviewed and returned to him, by the Engineer, with No Exceptions Taken or Approved As Noted.

E. The Contractor shall submit to the Engineer all drawings and schedules sufficiently in advance of construction requirements to provide no less than twenty-one (21) calendar days for checking and

appropriate action from the time the Engineer receives them.

F. The Contractor shall submit five (5) copies of descriptive or product data submittals to complement shop drawings for the Engineer plus the additional copies if the Contractor requires more than one (1) being returned. The Engineer shall retain four (4) sets.

G. The Contractor shall be responsible for and bear all costs of damages which may result from the ordering of any material or from proceeding with any part of work prior to the completion of the review by Engineer of the necessary Shop Drawings.

1.03 ENGINEER'S REVIEW OF SHOP DRAWINGS AND WORKING DRAWINGS

A. The Engineer's review of drawings, data and samples submitted by the Contractor shall cover only general conformity to the Specifications, external connections and dimensions which affect the installation.

B. The review of drawings and schedules shall be general and shall not be construed:

1. As permitting any departure from the Contract requirements.
2. As relieving the Contractor of responsibility for any errors, including details, dimensions and materials.
3. As approving departures from details furnished by the Engineer, except as otherwise provided herein.

C. If the drawings or schedules as submitted describe variations and show a departure from the Contract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting any exception.

D. When reviewed by the Engineer, each of the Shop and Working Drawings shall be identified as having received such review being so stamped and dated. Shop

Drawings stamped "REJECTED" and with required corrections shown shall be returned to the Contractor for correction and resubmittal.

E. Resubmittals will be handled in the same manner as first submittals. On resubmittals, the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by the Engineer on previous submissions. The Contractor shall make any corrections required by the Engineer.

F. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the Engineer.

G. The Engineer shall review a submittal a maximum of three (3) times after which cost of review shall be borne by the Contractor. The cost of engineering shall be equal to the Engineer's actual payroll cost.

H. When the Shop and Working Drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

I. No partial submittals shall be reviewed. Incomplete submittals shall be returned to the Contractor and shall be considered not approved until resubmitted.

1.04 SHOP DRAWINGS

A. When used in the Contract Documents, the term "Shop Drawings" shall be considered to mean Contractor's plans for material and equipment which become an integral part of the Project. These drawings shall be complete and detailed. Shop Drawings shall consist of fabrication, drawings, setting drawings, schedule drawings, manufacturer's scale drawings and wiring and control diagrams. Cuts, catalogs, pamphlets, descriptive literature and performance and test data, shall be considered only as supportive to required Shop Drawings as defined above.

B. Drawings and schedules shall be checked and coordinated with the work of all trades involved, before they are submitted for review by the Engineer and shall bear the Contractor's stamp of approval and original signature as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval and original signature shall be returned to the Contractor for resubmission.

C. Each Shop Drawing shall have a blank area 3-1/2 inches by 3-1/2 inches, located adjacent to the title block. The title block shall display the following:

1. Number and title of the drawing.
2. Date of Drawing or revision.
3. Name of project building or facility.
4. Name of contractor and subcontractor submitting drawing.
5. Clear identification of contents and location of the work.
6. Specification title and number.

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

E. Data on materials and equipment shall include, without limitation, materials and equipment lists, catalog sheets, cuts, performance curves, diagrams, materials of construction and similar descriptive material. Materials and equipment lists shall give, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.

F. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name and address and telephone number of the manufacturer's representative and service company so

that service and/or spare parts can be readily obtained.

G. All manufacturers or equipment suppliers who proposed to furnish equipment or products shall submit an installation list to the Engineer along with the required shop drawings. The installation list shall include at least five installations where identical equipment has been installed and have been in operation for a period of at least one (1) year.

H. Only the Engineer will utilize the color "red" in marking shop drawing submittals.

1.05 WORKING DRAWINGS

A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the Contractor's fabrication and erection drawings for structures such as roof trusses, steelwork, precast concrete elements, bulkheads, support of open cut excavation, support of utilities, groundwater control systems, forming and false work; underpinning; and for such other work as may be required for construction of the project.

B. Copies of working drawings as noted above, shall be submitted to the Engineer where required by the Contract Documents or requested by the Engineer and shall be submitted at least thirty (30) days (unless otherwise specified by the Engineer) in advance of their being required for work.

C. Working drawings shall be signed by a registered Professional Engineer, currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use. Prior to commencing such work, working drawings must have been reviewed without specific exceptions by the Engineer, which review will be for general conformance and will not relieve the Contractor in any way from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the Contractor; the Owner and Engineer shall not have responsibility therefore.

1.06 SAMPLES

A. The Contractor shall furnish, for the review of the Engineer, samples required by the Contract Documents or requested by the Engineer. Samples shall be delivered to the Engineer as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until reviewed by the Engineer.

B. Samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices.
2. Full range of color, texture and pattern.
3. A minimum of two samples of each item shall be submitted.

C. Each sample shall have a label indicating:

1. Name of product.
2. Name of Contractor and Subcontractor.
3. Material or equipment represented.
4. Place of origin.
5. Name of Producer and Brand (if any).
6. Location in project.
   (Samples of finished materials shall have additional markings that will identify them under the finished schedules.)
7. Reference specification paragraph.

D. The Contractor shall prepare a transmittal letter in triplicate for each shipment of samples containing the information required above. He shall enclose a copy of this letter with the shipment and send a copy of this letter to the Engineer. Review of a sample shall be only for the characteristics or use named in such and shall not be construed to change or modify any Contract requirements.

E. Reviewed samples not destroyed in testing shall be sent to the Engineer or stored at the site of the work. Reviewed samples of the hardware in good condition will be marked for identification and may be used in the work. Materials and equipment

incorporated in work shall match the reviewed samples. If requested at the time of submission, samples which failed testing or were rejected shall be returned to the Contractor at his expense.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01370

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the Engineer a Schedule of Values allocated to the various portions of the work, within 10 days from the date of Notice to Proceed.

B. Upon request of the Engineer, the Contractor shall support the values with data which will substantiate their correctness.

C. The Schedule of Values shall be used only as the basis for the Contractor's Applications for Payment.

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Schedule of Values will be considered for approval by Engineer upon Contractor's request. Identify schedule with:

1. Title of Project and location.
2. Project number.
3. Name and address of Contractor.
4. Contract designation.
5. Date of submission.

B. Schedule of Values shall list the installed value of the component parts of the work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. Follow the table of contents for the Contract Document as the format for listing component items for structures:

1. Identify each line item with the number and title of the respective major section of the specification.

2. For each line item, list sub values of major products or operations under item.

D. Follow the bid sheets included in this Contract Documents as the format for listing component items for pipe lines.

E. The sum of all values listed in the schedule shall equal

the total Contract sum.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall employ a competent photographer to take construction record photographs or perform video recording including furnishing all labor, materials, equipment and incidentals necessary to obtain photographs and/or video recordings of all construction areas.

B. Preconstruction record information shall consist of video recordings on digital video disks (DVD).

C. Construction progress information shall consist of photographs and digital photographs on a recordable compact disc (CD-R).

1.02 QUALIFICATIONS

A. All photography shall be done by a competent camera operator who is fully experienced and qualified with the specified equipment.

B. For the video recording, the audio portion should be done by a person qualified and knowledgeable in the specifics of the Contract, who shall speak with clarity and diction so as to be easily understood.

1.03 PROJECT PHOTOGRAPHS

A. Provide two prints of each photograph with each pay application.

B. Provide one recordable compact disc with digital photographs with each pay application.

C. Negatives:

1. All negatives shall remain the property of photographer.

2. The Contractor shall require that photographer maintain negatives or protected digital files for a period of two years from date of substantial completion of the project.

3. Photographer shall agree to furnish additional prints to Owner and Engineer at commercial rates applicable at time of purchase. Photographer shall also agree to participate as required in any litigation requiring the photographer as an expert witness.

D. The Contractor shall pay all costs associated with the required photography and prints. Any parties requiring additional photography or prints shall pay the photographer directly.

E. All project photographs shall be a single weight, color image. All finishes shall be smooth surface and glossy and all prints shall be 8 inches x 10 inches.

F. Each print shall have clearly marked on the back, the name of the project, the orientation of view, the date and time of exposure, name and address of the photographer and the photographers numbered identification of exposure.

G. All project photographs shall be taken from locations to adequately illustrate conditions prior to construction, or conditions of construction and state of progress. The Contractor shall consult with the Engineer at each period of photography for instructions concerning views required.

1.04 VIDEO RECORDINGS

A. Video recording shall be done along all routes that are scheduled for construction. Video, recording shall include full, recording of both sides of all streets and the entire width of easements plus 10 feet on each side on which construction is to be performed. All video recording shall be in full color.

B. A complete view, in sufficient detail with audio description of the exact location shall be provided.

C. The engineering plans shall be used as a reference for stationing in the audio portion of the recordings for easy location identification.

D. Two complete sets of video recordings shall be delivered to the Engineer on digital video disks (DVD) for the permanent and exclusive use of the Engineer prior to the start of any construction on the project.

E. All video recordings shall contain the name of the project, the date and time of the video, recording, the name and address of the photographer and any other identifying information required.

F. Construction shall not start until preconstruction video recordings are completed, submitted and accepted by the Engineer. In addition, no progress payments shall be made until the preconstruction video recordings are accepted by the Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01410

TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Owner shall employ and pay for the services of an independent testing laboratory to perform testing specifically indicated on the Contract Documents or called out in the Specifications. Owner may elect to have materials and equipment tested for conformity with the Contract Documents at any time.

1. Contractor shall cooperate fully with the laboratory to facilitate the execution of its required services.

2. Employment of the laboratory shall in no way relieve the Contractor's obligations to perform the work of the Contract.

1.02 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.

2. Approve or accept any portion of the Work.

3. Perform any duties of the Contractor.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel; provide access to Work and/or to Manufacturer's operations.

B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes which require control by the testing laboratory.

D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard

specifications for quality and workmanship are indicated in the Contract Documents. The Engineer may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor and no extra charge to the Owner shall be allowed on account of such testing and certification.

E. Furnish incidental labor and facilities:

1. To provide access to work to be tested.
2. To obtain and handle samples at the project site or at the source of the product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed due to insufficient notice, Contractor shall reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor's negligence.

G. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor's convenience and as approved by the Engineer.

H. If the test results indicate the material or equipment complies with the Contract Documents, the Owner shall pay for the cost of the testing laboratory. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the contractor shall pay for the laboratory costs directly to the testing firm or the total of such costs shall be deducted from any payments due the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01510

TEMPORARY AND PERMANENT UTILITIES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for furnishing all requisite temporary utilities, i.e., power, water, sanitation, etc. The Contractor shall obtain and pay for all permits required as well as pay for all temporary usages. The Contractor shall remove all temporary facilities upon completion of work.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with National Electric Code.

B. Comply with Federal, State and Local codes and regulations and with utility company requirements.

C. Comply with County Health Department regulations.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Materials for temporary utilities may be "used". Materials for electrical utilities shall be adequate in capacity for the required usage, shall not create unsafe conditions and shall not violate requirements of applicable codes and standards.

2.02 TEMPORARY ELECTRICITY AND LIGHTING

A. Arrange with the applicable utility company for temporary power supply. Provide service required for temporary power and lighting and pay all costs for permits, service and for power used.

2.03 TEMPORARY WATER

A. The Contractor shall arrange with Manatee County Utilities Customer Service office to provide water for construction purposes, i.e., meter, pay all costs for installation, maintenance and removal, and service charges for water used.

B. The Contractor shall protect piping and fitting against freezing.

2.04 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide sanitary facilities in compliance with all laws and regulations.

B. The Contractor shall service, clean and maintain facilities and enclosures.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall maintain and operate systems to assure continuous service.

B. The Contractor shall modify and extend systems as work progress requires.

3.02 REMOVAL

A. The Contractor shall completely remove temporary materials and equipment when their use is no longer required.

B. The Contractor shall clean and repair damage caused by temporary installations or use of temporary facilities.

END OF SECTION

SECTION 01570

TRAFFIC REGULATIONS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for providing safe and expeditious movement of traffic through construction zones. A construction zone is defined as the immediate areas of actual construction and all abutting areas which are used by the Contractor and which interfere with the driving or walking public.

B. The Contractor shall remove temporary equipment and facilities when no longer required, restore grounds to original or to specified conditions.

1.02 TRAFFIC CONTROL

A. The necessary traffic control shall include, but not be limited to, such items as proper construction warning signs, signals, lighting devices, markings, barricades, channelization and hand signaling devices. The Contractor shall be responsible for installation and maintenance of all devices and detour routes and signage for the duration of the construction period. The Contractor shall utilize the appropriate traffic plan from the FDOT Maintenance of Traffic Standards, Series 600 of the FDOT Roadway & Traffic Design Standards, Latest Edition.

B. Should there be the necessity to close any portion of a roadway carrying vehicles or pedestrians the Contractor shall submit a Traffic Control Plan (TCP) at least 5 days before a partial or full day closure, and at least 8 days before a multi-day closure. TCP shall be submitted, along with a copy of their accreditation, by a certified IMSA or ATSA Traffic Control Specialist.

1. At no time will more than one (1) lane of a roadway be closed to vehicles and pedestrians without an approved road closure from the County Transportation Department. With any such closings, adequate provision shall be made for the safe expeditious movement of each.

2. All traffic control signs must be in place and inspected at least 1 day in advance of the closure.

Multi-day closures notification signs shall be in place al least 3 days in advance of the closure. All signs must be covered when no in effect, and checked twice a day by the Worksite Traffic Supervisor when they are in effect.

C. The Contractor shall be responsible for removal, relocation, or replacement of any traffic control device in the construction area which exists as part of the normal preconstruction traffic control scheme. Any such actions shall be performed by the Contractor under the supervision and in accordance with the instructions of the applicable highway department unless otherwise specified.

D. The Engineer will consult with the Owner immediately on any vehicular or pedestrian safety or efficiency problem incurred as a result of construction of the project.

E. The Contractor shall provide ready access to businesses and homes in the project area during construction. The Contractor shall be responsible for coordinating this work with affected homeowners.

F. When conditions require the temporary installation of signs, pavement markings and traffic barriers for the protection or workers and traffic, the entire array of such devices shall be depicted on working drawings for each separate stage of work. These drawings shall be submitted to the Engineer for review and approval prior to commencement of work on the site.

G. Precast concrete traffic barriers shall be placed adjacent to trenches and other excavations deeper than six inches below the adjacent pavement surface.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01580

PROJECT IDENTIFICATION AND SIGNS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Furnish, install and maintain County project identification signs.

B. Remove signs on completion of construction.

C. Allow no other signs to be displayed except for traffic control and safety.

1.02 PROJECT IDENTIFICATION SIGN (COUNTY)

A. One painted sign, of not less than 32 square feet (3 square meters) area, with painted graphic content to include:

1. Title of Project.
2. Name of Owner.
3. Names and titles of authorities as directed by Owner.
4. Prime Contractor.

B. Graphic design, style of lettering and colors: As approved by the Engineer and subject to approval of the Owner.

C. Erect on the site at a lighted location of high public visibility, adjacent to main entrance to site, as approved by the Engineer and the Owner

1.03 INFORMATIONAL SIGNS

A. Painted signs with painted lettering, or standard products.

1. Size of signs and lettering: as required by regulatory agencies, or as appropriate to usage.

2. Colors: as required by regulatory agencies, otherwise of uniform colors throughout project.

B. Erect at appropriate locations to provide required information.

1.04 QUALITY ASSURANCE

A. Sign Painter: Professional experience in type of work required.

B. Finishes, Painting: Adequate to resist weathering and fading for scheduled construction period.

1.05 PUBLIC NOTIFICATION

A. Door Hangers: Manatee County Project Management shall generate and the General Contractor shall distribute door hangers to all residents who will be impacted by project construction.

1.0 Residents impacted include anyone who resides inside, or within 500 feet of project limits of construction.

B. Door Hangers shall be distributed prior to start of construction of the project. Hangers shall be affixed to doors of residents via elastic bands or tape.

EXAMPLE:

PLEASE PARDON THE INCONVENIENCE WHILE THE ROADWAY IS BEING RECONSTRUCTED IN YOUR NEIGHBORHOOD

This project consists of utility improvements and the reconstruction of?? Boulevard from U.S.??? to?? Street West. The project is expected to begin in August, 201X and be completed in July 201X.

Location Map

WE HOPE TO KEEP ANY INCONVENIENCE TO A MINIMUM. HOWEVER, IF YOU HAVE ANY PROBLEMS, PLEASE CONTACT THE FOLLOWING:

A. Contractor
Contractor Address
Contractor Phone (Site Phone)

B. Project Inspector
Inspector Phone Number

C. Project Manager

PM Address
PM Phone No. & Ext.

AFTER HOURS EMERGENCY NUMBER – (941) 747-HELP
THANK YOU FOR YOUR UNDERSTANDING AND PATIENCE
MANATEE COUNTY GOVERNMENT – PROJECT MANAGEMENT DEPT.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: May be new or used, wood or metal, in sound condition structurally adequate to work and suitable for specified finish.

B. Sign Surfaces: Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints.

1. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles.

C. Rough Hardware: Galvanized.

D. Paint: Exterior quality, as specified in the Contract Documents.

PART 3 EXECUTION

3.01 PROJECT IDENTIFICATION SIGN

A. Paint exposed surface or supports, framing and surface material; one coat of primer and one coat of exterior paint.

B. Paint graphics in styles, size and colors selected.

3.02 MAINTENANCE

A. The Contractor shall maintain signs and supports in a neat, clean condition; repair damages to structures, framing or sign.

3.03 REMOVAL

A. The Contractor shall remove signs, framing, supports and foundations at completion of project.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Material and equipment incorporated into the work:

1. Conform to applicable specifications and standards.

2. Comply with size, make, type and quality specified, or as specifically approved in writing by the Engineer.

3. Manufactured and Fabricated Products:

   a. Design, fabricate and assemble in accordance with the best engineering and shop practices.
   b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
   c. Two or more items of the same kind shall be identical and manufactured by the same manufacturer.
   d. Products shall be suitable for service conditions.
   e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

4. Do not use material or equipment for any purpose other than that for which it is specified.

5. All material and equipment incorporated into the project shall be new.

1.02 MANUFACTURER'S INSTRUCTIONS

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Engineer. Maintain one set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accordance with such instructions and in conformity with specified requirements. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer prior to proceeding. Do not proceed with work without clear instructions.

1.03 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accordance with construction schedules, coordinate to avoid conflict with work and conditions at the site.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.04 SUBSTITUTIONS AND PRODUCT OPTIONS

Contractor's Options:

1. For products specified only by reference standard, select any product meeting that standard.
2. For products specified by naming one or more products or manufacturers and "or equal" ,Contractor must submit a request for substitutions of any product or manufacturer not specifically named in a timely manner so as not to adversely affect the construction schedule.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01620

STORAGE AND PROTECTION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Provide secure storage and protection for products to be incorporated into the work and maintenance and protection for products after installation and until completion of Work.

1.02 STORAGE

A. Store products immediately on delivery and protect until installed in the Work, in accord with manufacturer's instructions, with seals and labels intact and legible.

B. Exterior Storage

1. Provide substantial platform, blocking or skids to support fabricated products above ground to prevent soiling or staining.

    a. Cover products, subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
    b. Prevent mixing of refuse or chemically injurious materials or liquids.

C. Arrange storage in manner to provide easy access for inspection.

1.03 MAINTENANCE OF STORAGE

A. Maintain periodic system of inspection of stored products on scheduled basis to assure that:

1. State of storage facilities is adequate to provide required conditions.

2. Required environmental conditions are maintained on continuing basis.

3. Surfaces of products exposed to elements are not adversely affected. Any weathering of products, coatings and finishes is not acceptable under requirements of these Contract Documents.

B. Mechanical and electrical equipment which requires servicing during long term storage shall have complete manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on exterior of package.

1. Equipment shall not be shipped until approved by the Engineer. The intent of this requirement is to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.

2. All equipment having moving parts such as gears, electric motors, etc. and/or instruments shall be stored in a temperature and humidity controlled building approved by the Engineer until such time as the equipment is to be installed.

3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.

4. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.

5. Lubricants shall be changed upon completion of installation and as frequently as required, thereafter during the period between installation and acceptance.

6. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.04 PROTECTION AFTER INSTALLATION

A. Provide protection of installed products to prevent damage from subsequent operations. Remove when no longer needed, prior to completion of work.

B. Control traffic to prevent damage to equipment and surfaces.

C. Provide coverings to protect finished surfaces from damage.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the work.

1.02 SUBSTANTIAL COMPLETION

A. The Contractor shall submit the following items when the Contractor considers the work to be substantially complete:

1. A written notice that the work or designated portion thereof, is substantially complete.

2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the Engineer and Owner shall make an inspection to determine the status of completion.

C. Project record documents and operations and maintenance manuals must be submitted before the project shall be considered substantially complete.

D. If the Engineer determines that the work is not substantially complete:

1. The Engineer shall notify the Contractor in writing, stating the reasons.

2. The Contractor shall remedy the deficiencies in the work and send a second written notice of substantial completion to the Engineer.

3. The Engineer shall reinspect the work.

E. When the Engineer finds that the work is substantially complete:

1. He shall prepare and deliver to the Owner a tentative Certificate of Substantial Completion (Manatee County Project Management Form PMD-8) with a tentative list of the items to be completed or

corrected before final payment.

2. The Engineer shall consider any objections made by the Owner as provided in Conditions of the Contract. When the Engineer considers the work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion (Manatee County Project Management Form PMD-8) with a revised tentative list of items to be completed or corrected.

1.03 FINAL INSPECTION

A. When the Contractor considered the work to be complete, he shall submit written certification stating that:

1. The Contract Documents have been reviewed.

2. The work has been inspected for compliance with Contract Documents.

3. The work has been completed in accordance with Contract Documents.

4. The equipment and systems have been tested in the presence of the Owner’s representative and are operational.

5. The work is completed and ready for final inspection.

B. The Engineer shall make an inspection to verify the status of completion after receipt of such certification.

C. If the Engineer determines that the work is incomplete or defective:

1. The Engineer shall promptly notify the Contractor in writing, listing the incomplete or defective work.

2. The Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to Engineer that the work is complete.

3. The Engineer shall reinspect the work.

D. Upon finding the work to be acceptable under the Contract Documents, the Engineer shall request the Contractor to make closeout submittals.

E. For each additional inspection beyond a total of three (3) inspections for substantial and final completion due to the incompleteness of the work, the Contractor shall reimburse the Owner for the Engineer's fees.

1.04 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER

A. Project Record Documents (prior to substantial completion).

B. Operation and maintenance manuals (prior to substantial completion).

C. Warranties and Bonds.

D. Evidence of Payment and Release of Liens: In accordance with requirements of General and Supplementary Conditions.

E. Certification letter from Florida Department of Transportation and Manatee County Department of Transportation, as applicable.

F. Certificate of Insurance for Products and Completed Operations.

G. Final Reconciliation, Warranty Period Declaration, and Contractor's Affidavit (Manatee County Project Management Form PMD-9).

1.05 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to the Engineer.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.
2. Additions and deductions resulting from:
    a. Previous Change Orders
    b. Unit Prices
    c. Penalties and Bonuses
    d. Deductions for Liquidated Damages
    e. Other Adjustments
3. Total Contract Sum, as adjusted.
4. Previous payments.
5. Sum remaining due.

C. Project Management shall prepare a final Change Order, reflecting approved adjustments to the Contract Sum which

were not previously made by Change Orders.

1.06 FINAL APPLICATION FOR PAYMENT

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01710

CLEANING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Execute cleaning during progress of the work and at completion of the work, as required by the General Conditions.

1.02 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal operations to comply with all Federal, State and Local codes, ordinances, regulations and anti-pollution laws.

PART 2 PRODUCTS

2.01 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

A. Execute periodic cleaning to keep the work, the site and adjacent properties free from accumulation of waste materials, rubbish and wind-blown debris, resulting from construction operations.

B. Provide on-site containers for the collection of waste materials, debris and rubbish.

C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL

A. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

3.03 FINAL CLEANING

A. Employ skilled workmen for final cleaning.

B. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

C. Prior to final completion or Owner occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas to verify that the entire work is clean.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Contractor shall maintain at the site for the Owner one record copy of:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Engineer's field orders or written instructions.
6. Approved shop drawings, working drawings and samples.
7. Field test records.
8. Construction photographs.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Store documents and samples in Contractor's field office apart from documents used for construction.

1. Provide files and racks for storage of documents.
2. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with CSI format.

C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by the Engineer.

1.03 MARKING DEVICES

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

1.04 RECORDING

A. Label each document "PROJECT RECORD" in neat large printed letters.

B. Record information concurrently with construction progress.

C. Do not conceal any work until required information is recorded.

D. Drawings - Legibly mark to record actual construction:

1. All underground piping with elevations and dimensions; Changes to piping location; Horizontal and vertical locations of underground utilities and appurtenances (referenced to permanent surface improvements. Actual installed pipe material, class, etc.). Locations of drainage ditches, swales, water lines and force mains shall be shown every 200 feet (measured along the centerline) or alternate lot lines, whichever is closer. Dimensions at these locations shall indicate distance from centerline of right-of-way to the facility.

2. Field changes of dimension and detail.

3. Changes made by Field Order or by Change Order.

4. Details not on original contract drawings.

5. Equipment and piping relocations.

6. Locations of all valves, fire hydrants, manholes, water and sewer services, water and force main fittings, underdrain cleanouts, catch basins, junction boxes and any other structures located in the right-of-way or easement, shall be located by elevation and by station and offset based on intersection P.I.'s and centerline of right-of-way. For facilities located on private roads, the dimensioning shall be from centerline of paving or another readily visible baseline.

7. Elevations shall be provided for all manhole rim and inverts; junction box rim and inverts; catch basin rim and inverts; and baffle, weir and invert elevations in control structures. Elevations shall also be provided at the PVI's and at every other lot line or 200 feet, whichever is less, of drainage swales and ditches. Bench marks and elevation datum shall be indicated.

8. Slopes for pipes and ditches shall be recalculated, based on actual field measured distances, elevations, pipe sizes, and type shown. Cross section of drainage ditches and swales shall be verified.

9. Centerline of roads shall be tied to right-of-way lines. Elevation of roadway centerline shall be given at PVI's and at all intersections.

10. Record drawings shall show bearings and distances for all right-of-way and easement lines, and property corners.

11. Sidewalks, fences and walls, if installed at the time of initial record drawing submittal, shall be located every 200 feet or alternate lot lines, whichever is closer. Dimensions shall include distance from the right-of-way line and the back of curb and lot line or easement line.

12. Sanitary sewer mainline wyes shall be located from the downstream manhole. These dimensions shall be provided by on-site inspections or televiewing of the sewer following installation.

13. Elevations shall be provided on the top of operating nuts for all water and force main valves.

14. Allowable tolerance shall be ± 6.0 inches for horizontal dimensions. Vertical dimensions such as the difference in elevations between manhole inverts shall have an allowable tolerance of ± 1/8 inch per 50 feet (or part thereof) of horizontal distance up to a maximum tolerance of ± 2 inch.

15. Properly prepared record drawings on mylar, together with two copies, shall be certified by a design professional (Engineer and/or Surveyor registered in the State of Florida), employed by the Contractor, and submitted to the Owner/Engineer.

E. Specifications and Addenda; Legibly mark each Section to record:

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.

2. Changes made by field order or by change order.

F. Shop Drawings (after final review and approval):

1. Five sets of record drawings for each process equipment, piping, electrical system and instrumentation system.

1.05 SUBMITTAL

A. Prior to substantial completion and prior to starting the bacteria testing of water lines, deliver signed and sealed Record Documents and Record Drawings to the Engineer. These will be reviewed and verified by the inspector. If there are any required changes or additions, these shall be completed and the entire signed and sealed set resubmitted prior to final pay application.

B. The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data and properly prepare record drawings. Record drawings shall be certified by the professional(s) (Engineer or Surveyor licensed in Florida), as stipulated by the Land Development Ordinance and submitted on signed and dated mylar drawings together with a recordable compact disk (CD).

C. The CD shall contain media in AutoCAD Version 2005 or later, or in any other CAD program compatible with AutoCAD in DWG or DXF form. All fonts, line types, shape files or other pertinent information used in the drawing and not normally included in AutoCAD shall be included on the media with a text file or attached noted as to its relevance and use.

D. Accompany submittal with transmittal letter, containing:

1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Title and number of each Record Document.
5. Signature of Contractor or his authorized representative.

Note: The data required to properly prepare these record drawings shall be obtained at the site, at no cost to the County by the responsible design professional or his/her duly appointed representative. The appointed representative shall be a qualified employee of the responsible design professional or a qualified inspector retained by the responsible design professional on a project-by-project basis.

PART 2 STANDARDS

2.01 MINIMUM RECORD DRAWING STANDARDS FOR ALL RECORD DRAWINGS SUBMITTED TO MANATEE COUNTY

A. Record drawings shall be submitted to at least the level of detail in the contract documents. It is anticipated that the original contract documents shall serve as at least a background for all record information. Original drawings in CAD format may be requested of the Engineer.

B. Drawings shall meet the criteria of paragraph 1.04 D above.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01730

OPERATING AND MAINTENANCE DATA

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under Contract.

B. Prepare operating and maintenance data as specified in this and as referenced in other pertinent sections of Specifications.

C. Instruct Owner's personnel in maintenance of products and equipment and systems.

D. Provide three (3) sets of operating and maintenance manuals for each piece of equipment provided within this Contract.

1.02 FORM OF SUBMITTALS

A. Prepare data in form of an instructional manual for use by Owner's personnel.

B. Format:

1. Size: 8-1/2 inch x 11 inch
2. Paper: 20 pound minimum, white, for typed pages
3. Text: Manufacturer's printed data or neatly typewritten
4. Drawings:
   a. Provide reinforced punched binder tab, bind in with text.
   b. Fold larger drawings to size of text pages.
5. Provide fly-leaf for each separate product or each piece of operating equipment.
   a. Provide typed description of product and major component parts of equipment.
   b. Provide indexed tabs.
6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
   a. Title of Project.
   b. Identity of separate structures as applicable.
   c. Identity of general subject matter covered in the manual.

C. Binders:

1. Commercial quality three-ring binders with durable and cleanable plastic covers.

2. Maximum ring size: 1 inch.

3. When multiple binders are used, correlate the data into related consistent groupings.

1.03 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit three copies of complete manual in final form.

B. Content for each unit of equipment and system, as appropriate:

1. Description of unit and component parts.

a. Function, normal operating characteristics and limiting conditions.
b. Performance curves, engineering data and tests.
c. Complete nomenclature and commercial number of replaceable parts.

2. Operating Procedures:

a. Start-up, break-in, routine and normal operating instructions.
b. Regulation, control, stopping, shut-down and emergency instructions.
c. Summer and winter operating instructions.
d. Special operating instructions.

3. Maintenance Procedures:

a. Routine operations.
b. Guide to "trouble-shooting".
c. Disassembly, repair and reassembly.
d. Alignment, adjusting and checking.

4. Servicing and lubricating schedule.

a. List of lubricants required.

5. Manufacturer's printed operating and maintenance instructions.

6. Description of sequence of operation by control manufacturer.

7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

    a. List of predicted parts subject to wear.
    b. Items recommended to be stocked as spare parts.

8. As installed control diagrams by controls manufacturer.

9. Each contractor's coordination drawings.

    a. As installed color coded piping diagrams.

10. Charts of valve tag numbers, with location and function of each valve.

11. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.

12. Other data as required under pertinent sections of specifications.

C. Content, for each electric and electronic system, as appropriate:

1. Description of system and component parts.
    a. Function, normal operating characteristics and limiting conditions.
    b. Performance curves, engineering data and tests.
    c. Complete nomenclature and commercial number of replaceable parts.

2. Circuit directories of panelboards.
    a. Electrical service.
    b. Controls.
    c. Communications.

3. As-installed color coded wiring diagrams.

4. Operating procedures:
    a. Routine and normal operating instructions.
    b. Sequences required.
    c. Special operating instructions.

5. Maintenance procedures:
   a. Routine operations.
   b. Guide to "trouble-shooting".
   c. Disassembly, repair and reassembly.
   d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacture's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.

8. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.

D. Prepare and include additional data when the need for such data becomes apparent during instruction on Owner's personnel.

E. Additional requirements for operating and maintenance data: Respective sections of Specifications.

1.04 SUBMITTAL SCHEDULE

A. Submit one copy of completed data in final form fifteen days prior to substantial completion.

1. Copy will be returned after substantial completion, with comments (if any).

B. Submit two copies of approved data in final form. Final acceptance will not be provided until the completed manual is received and approved.

1.05 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

B. Operating and maintenance manual shall constitute the basis of instruction.

1. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Submit to Engineer for review and transmittal to Owner.

1.02 SUBMITTAL REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.

B. Number of original signed copies required: Two each.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product or work item.
2. Firm, with name of principal, address and telephone number.
3. Scope.
4. Date of beginning of warranty, bond or service and maintenance contract.
5. Duration of warranty, bond or service maintenance contract.
6. Provide information for Owner's personnel:
   a. Proper procedure in case of failure.
   b. Instances which might affect the validity of warranty or bond.
7. Contractor, name of responsible principal, address and telephone number.

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 inch x 11 inch punched sheets for standard 3-ring binder. Fold larger sheets to fit into binders.

2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:
   a. Title of Project.
   b. Name of Contractor.

C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.04 TIME OF SUBMITTALS

A. Make submittals within ten days after date of substantial completion and prior to final request for payment.

B. For items of work, where acceptance is delayed materially beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.05 SUBMITTALS REQUIRED

A. Submit warranties, bonds, service and maintenance contracts as specified in respective sections of Specifications.

B. Approval by the Owner of all documents required under this section is a pre-requisite to requesting a final inspection and final payment

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 02050

DEMOLITION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes demolition, debris removal and items to be salvaged as indicated on the Drawings and as specified herein.

B. Demolition items consist of, but are not limited to the following:

1. Removal of: Aeration/Anoxic Basin Internal Recycle Pumps, pipes, valves, concrete caps, lake intake structures, electrical and control panels, concrete, asphalt, sidewalk, various sizes and lengths of yard piping, material and debris in aeration/anoxic basins and other items as shown on the drawings and as specified herein.

C. Items to be salvaged and turned over to the Owner shall be identified by the Owner during the preconstruction meeting.

1.02 QUALITY ASSURANCE

A. Accomplish all demolition work so there is no injury to any persons and no damage to adjacent structures or property. All demolition methods shall be in full compliance with municipal, county, state, and federal ordinances. Demolition work shall comply with the requirements of the Occupational Safety and Health Administration (OSHA).

B. The Contractor shall comply with all municipal, county, state and federal ordinances regarding the disposal of rubble, scrap metal, and refuse.

C. Demolition procedures shall provide for safe conduct of the work, protection of property which is to remain undisturbed, and coordination with other work in progress.

1.03 JOB CONDITIONS

A. It shall be the responsibility of the Contractor to visit the site and inspect the nature and condition of the items to be removed and salvaged before submitting his bid.

B. Dust Control: Control the amount of dust resulting from demolition to prevent the spread of dust to occupied portions of buildings and to avoid creation of a nuisance in the surrounding area. Do not use water when it will result in, or create, hazardous or objectionable conditions such as flooding and pollution.

C. Protection of Existing Work: Protect existing work. Work damaged by the Contractor shall be repaired to match existing work.

D. No interference with plant operations: Demolition work shall be scheduled and conducted so there is no interference with normal plant operations or deliveries.

PART 2 PRODUCTS

2.01 REPAIR AND REPLACEMENT MATERIALS

A. Materials used in the repair or replacement of existing work to remain shall be identical or equal to the materials used in existing work when new.

PART 3 EXECUTION

3.01 STRUCTURES AND BUILDINGS

A. Remove all parts of existing structures to be demolished to a minimum depth of 3-ft below grade unless otherwise shown on the drawings. Structures left below grade shall be punctured to allow water to pass through and prevent flotation.

3.02 EQUIPMENT

A. Completely remove equipment which is designated to be removed.

B. Remove concrete equipment bases if the existing bases are not to be used for new equipment.

C. Completely remove isolated equipment bases.

3.03 PIPING

A. Completely remove piping, conduit, and wiring in structures and buildings which are to be demolished, partially demolished, and where otherwise designated to be removed as shown on the Drawings. When not indicated on the Drawings, the removal of said piping, conduit and wiring shall be a minimum of 5-feet from the outside of the structure or building. The Contractor shall schedule underground pipe removal and new pipe installation in order to minimize disruption of the existing piping system and reduce bypass pumping.

B. Underground piping, conduit, and wiring which are to be abandoned and do not interfere with new work may be left in place, unless otherwise shown on the Drawings. Plug and seal ends of underground piping to be abandoned. Grout fill abandoned pipes in accordance with plans. Do not leave abandoned branches of piping and wiring “live”. Isolate abandoned branches by closing branch valve at main or by disconnecting branch at main. Plug, cap, and seal active branch at isolating valve or point of disconnection.

C. Properly disconnect, seal and plug utility services to structures and buildings which are completely demolished. Properly disconnect, seal, and plug utility lines within structures and buildings which are partially demolished.

3.04 DISPOSAL

A. Equipment, piping, and materials which are designated to remain the property of the Owner shall be moved to a location within the project site designated by the Owner.

B. All removed equipment, piping, and materials not specifically designated to remain the property of the Owner shall become the property of the Contractor and shall be removed from the site.

C. Do not allow debris and rubbish to accumulate on the site. Remove debris and rubbish from the site.

D. If the Contractor uses Manatee County Sanitary Landfill for disposal, the Contractor shall be required to pay a

tipping fee when crossing the landfill weighting scales.

3.05 FILLING

A. Backfill excavations resulting from demolition.

B. Backfill excavations which will not be beneath new structures, buildings, piping, or other new work as specified in this paragraph.

C. Backfill excavations more than three feet deep or more than five cubic yards in volume as specified in Section 02200 - Earthwork.

D. Place and compact backfill in other excavations to produce an adequate foundation for grassing.

3.06 CLEAN-UP

A. Clean-up in areas where other work is to be done following demolition shall be as specified in the applicable Sections.

B. Clean-up the job site in areas where no other work is to be done under this Contract following demolition. Remove all debris and rubbish, temporary facilities, and equipment. Level surface irregularities to eliminate depressions. Leave the work in a neat and presentable condition.

END OF SECTION

SECTION 02110

CLEARING AND GRUBBING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without written permission from the Owner.

B. Protection: Provide temporary fences, barricades, coverings, or other protection to preserve existing items indicated to remain and to prevent injury or damage to persons or property. Provide protection for adjacent properties as required.

C. Restore or replace damaged work to existing or better condition than prior to start of Work.

D. Protect existing trees and vegetation from physical damage. Do not store materials or equipment within tree drip lines. Use licensed arborist for tree damage repair. Replace damaged trees that cannot be restored to full growth, as determined by arborist, unless otherwise acceptable to the Owner.

E. Existing Services: Locations indicated are approximate; determine exact location before commencing Work. Coordinate with local utility service requirements and comply with their instructions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Site Clearing: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions as indicated or that interfere with new construction. Removal includes digging out stumps and roots, together with subsequent off-site disposal.

B. Strip and stockpile topsoil that will be reused in the Work.

C. Remove existing improvements, both above-grade and below-grade, to extent indicated on the drawings or as otherwise required to permit new construction.

D. Salvableable Items: Carefully remove items indicated to be salvaged and store on premises where indicated or directed by the Owner.

E. Control air pollution caused by dust and dirt; comply with governing regulations.

F. Fill depressions and voids resulting from site-clearing operations. Using satisfactory soil materials, place in maximum 6-inch-deep horizontal layers and compact each layer to density of surrounding original ground.

G. Grade ground surface to conform to required contours and to provide surface drainage.

H. Dispose of waste materials, including trash, debris, and excess topsoil, off property.

I. Burning of any waste materials on site is not permitted.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes digging of excavations for structures, piping and roadways; backfilling around structures and piping; shaping and contouring the ground surface to conform to established grades and elevations; compacting of earth or rock materials to specified densities; bracing, sheeting and shoring; dewatering; removal of surplus excavated materials; and related work as shown on the Drawings and as specified herein.

1.02 DEFINITIONS

A. Excavation: Removal of earth and rock to form cavities for the construction of foundations and structures and to form trenches for the installation of piping or conduits.

B. Cavity: Formed by the removal of earth and rock.

C. Earth: Unconsolidated material in the crust of the earth derived by weathering and erosion. Earth includes:

1. Materials of both inorganic and organic origin

2. Boulders less than 1/3 cubic yard in volume, gravel, sand, silt, and clay

3. Materials which can be excavated with a backhoe, trenching machine, drag line, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers

D. Rock: A natural aggregate of mineral particles connected by strong and permanent cohesive forces. Rock includes:

1. Limestone, sandstone, dolomite, granite, marble, and lava

2. Boulders 1/3 cubic yard or more in volume

3. Materials which cannot be excavated by equipment which is used to remove earth overburden without the use of explosives, rock rippers, rock hammers, or jack hammers.

E. Undercutting: Excavation of rock and unsuitable earth below the bottom of a foundation, structure, pipe or conduit to be constructed or installed.

F. Subgrade: Undisturbed bottom of an excavation

G. Bedding: Earth placed in trench to support pipe and conduit.

H. Backfill and Fill: Earth placed around structures from the bottom of an excavation to finished grade, or to the subbase of pavement. Earth placed in a trench from the top of bedding to finished grade, or to subbase of pavement.

I. Structural Compact Fill: Required to establish the finished grade should consist of clean cohesion less fill comprising the SP to SP-SM unified soil classification or ASSHTO A-3 Classification. Each lift, which should not exceed 12 inches, should be uniformly compacted to not less that 95% of the modified proctor maximum density.

J. Topsoil: Earth containing sufficient organic materials to support the growth of grass.

1.03 JOB CONDITIONS

A. Carefully maintain bench marks, monuments and other reference points, and if disturbed or destroyed, replace as directed.

B. Should the Contractor encounter unusual subsurface and/or latent conditions at the site, he shall immediately give notice to the Owner and Engineer of such conditions before they are disturbed.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation and landfill work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service: The Owner will retain a Soils Engineer to perform soil testing and inspection

service for quality control testing of earthwork operations. Tests revealing satisfactory results will be paid for by the Owner. The cost of tests revealing unsatisfactory results will be deducted from monies due to the Contractor.

PART 2 PRODUCTS

2.01 MATERIALS

A. Earth for Fill and Backfill: Earth used for fill or backfill shall be of such gradation and moisture content that it will compact to the specified density and remain stable.

B. Pipe Bedding: Pipe bedding material for Type A-2 trenches shall be No. 57 crushed stone with gradation as noted in Table 1 of Section 901 of the FDOT Standard Specifications.

C. Pipe Cover Material: Pipe cover material shall consist of durable particles ranging in size from fine to coarse (No. 200 to 1-inch) in size, in a substantially uniform combination. Unwashed bank run sand and crushed bank-run gravel will be considered generally acceptable. Bedding material may be used for cover material.

D. Special Backfill: Special backfill shall be the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

Group Symbols	Typical Name
GW	Well-graded gravels and gravel-sand mixtures, little or no fines
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
SW	Well-graded sands and gravelly sands, little or no fines
SP	Poorly graded sands and gravelly sands, little or no fines

E. Suitable Backfill: Suitable backfill shall be the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

Group Symbols	Typical Name
GW	Well-graded gravels and gravel-sand mixtures, little or no fines
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures
SW	Well-graded sands and gravelly sands, little or no fines
SP	Poorly graded sands and gravelly sands, little or no fines
SM	Silty sands, sand-silt mixtures
SC	Clayey sands, sand-clay mixtures
ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays

F. Unsuitable Materials: Materials which are unsuitable for backfill include stones greater than 6-inches in their largest dimension, pavement, rubbish, debris, wood, metal, plastic, and the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

Group Symbols	Typical Name
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
CH	Inorganic clays of high plasticity, fat clays

OH	Organic clays of medium to high plasticity
PT	Peat, muck, and other highly organic soils

G. Structural Compact Fill: Preparation of the subgrade prior to pond backfilling will necessitate removal and replacement of pond bottom silts as well as the very loose silty soils on the flanks of the pond (see the Geotechnical Report for further requirements). The entire tank footprint, plus a margin of at least 5 feet outside the foundation perimeter should be striped down to the existing pond bottom elevation including over-excavation of any accumulated sediments, followed by proof-rolling with heavy vibratory compaction equipment. The contractor should anticipate the excavation would extend to approximate EL +15 feet. Compaction should consist of no less than ten (10) complete coverages throughout the entire tank area plus a margin of not less than 5 feet beyond the tank perimeters. The perimeter foundation area for the tank structures should be densified at the bottom of footing elevation. Compaction should continue so as to develop a uniform density of not less than 95% of the modified proctor maximum dry density per ASTM D-1557. Compaction tests should be conducted at intervals of no less than 1 test for each 2500 square feet and each 50 foot of foundation perimeter at a depth of 1 foot and at the compacted subgrade elevation.

PART 3 EXECUTION

3.01 PROTECTION OF EXISTING FACILITIES

A. Support and protect all poles, fences, utility pipes, wire, conduits, buildings and structures.

B. Proceed with caution during excavation so the exact location of underground utilities and structures, both known and unknown, may be determined. Contractor shall be responsible for the repair of utilities and structures when broken or otherwise damaged.

C. Wherever water, or other pipes or conduits cross the excavation, the Contractor shall support said pipes and conduits without damage to them and without interrupting this Contract. The manner of supporting

such pipes, or similar items, shall be subject to the approval of the Engineer.

D. When utilities that have to be removed or relocated are encountered within the areas of operations, the Contractor shall notify the Owner in ample time for the necessary measure to be taken to prevent interruption of the service.

E. The Contractor shall so conduct the work that no equipment, material, or debris will be placed or allowed to fall upon private property in the vicinity of the work, unless he shall have first obtained the property Owner's written consent to do so and shall have shown said written consent to the Owner.

F. All excavated material shall be piled in a manner that will not obstruct driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Drainageways shall be kept clear or other satisfactory provisions made for drainage.

G. Natural watercourses shall not be obstructed, except where specifically permitted for the construction of outfall and subaqueous crossings.

3.02 CLEARING

A. Before excavating, clear and remove logs, stumps, brush, vegetation, rubbish, and other perishable matter from the project site.

B. Do not remove or damage trees that do not interfere with the finished work. Completely remove trees required to be removed, including stumps and roots. Replace trees removed unnecessarily. Properly treat damaged trees which can be saved.

3.03 STRIPPING AND STOCKPILING TOPSOIL

A. Strip topsoil and vegetation from the areas to be excavated. Clean topsoil may be stockpiled for reuse; the Contractor shall coordinate with the Owner for location of excavated stockpiled materials.

3.04 EXCAVATING

A. Make excavations to elevations and dimensions necessary to permit bracing, sheeting, erection of forms, inspection of foundation and installation of piping or conduits. Excavate trenches to the required alignment, depth and width. Excavate trenches in advance of pipe and conduit installation only as far as necessary to provide proper alignment and grade. Plan trenching operations to cause a minimum of danger to adjacent property and a minimum of inconvenience to the public.

B. The width of trenches at the top of the pipe shall be ample to permit the pipe to be laid and joined properly and to allow the backfill to be placed and compacted as specified. Maximum trench width shall be such that design loadings on pipe will not be exceeded. Trenches shall be of such extra width, when required, to permit the placement of supports, sheeting, bracing, and appurtenances.

C. Depth of trenches shall be such as to allow installation of pipelines at the grades or elevations shown.

D. Trees, boulders, and other surface encumbrances, located so as to create a hazard to anyone involved in the excavation work or who is in the vicinity of the work at anytime during operations, shall be removed or made safe before excavating is begun.

E. Contractor shall be responsible for the determination of the angle of repose of the soil in which the excavating is to be done. Excavate all slopes to at least the angle of repose except for areas where solid rock allows for line drilling or presplitting.

F. Sides, slopes, and faces of all excavations shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing, or other equally effective means. Give special attention to slopes which may be adversely affected by weather or moisture content.

G. Flatten the excavation sides when an excavation has water conditions, silty materials, loose boulders, and areas where erosion and slide planes appear.

H. Shore or otherwise support sides of excavations in hard or compact soil when the excavation is more than five feet in depth. In lieu of shoring, the sides of the excavation above the five-foot level may be sloped to preclude collapse, but shall not be steeper than a one-foot rise to each 1/2-foot horizontal.

I. Use diversion ditches, dikes, or other suitable means to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Do not allow water to accumulate in an excavation. If possible, the grade should be away from the excavation.

J. Excavations shall be inspected by a competent Contractor's representative after every rainstorm or other hazard-increasing occurrence, and the protection against slides and cave-ins shall be increased if necessary.

K. Do not store excavated or other material nearer than four feet from the edge of any excavation. Store and retain materials as to prevent materials from falling or sliding back into the excavation. Install substantial stop log or barricades when mobile equipment is utilized or allowed adjacent to excavations.

3.05 DEWATERING

A. Keep excavations free from water until foundations, structures, and piping are completed and will safely withstand forces generated by water. Provide sufficient dewatering equipment and make proper arrangements for the disposal of water from dewatering operation. Dewatering shall not damage property, create nuisances, or interfere with other work. Do not use sanitary sewers for the disposal of water from dewatering operations.

3.06 SHEETING

A. The Contractor has the option of sheeting excavations.

B. Supporting systems, such as piling, cribbing, shoring, and bracing shall be designed by a qualified Contractor's representative and meet accepted engineering requirements. When tie rods are used to restrain the top of sheeting or other retaining

systems, securely anchor the tie rods well back of the angle of repose. When tight sheeting or sheet piling is used, assume full loading due to groundwater table, unless prevented by weep holes or drains or other means. Provide additional stringers, ties, and bracing to allow for any necessary temporary removal of individual supports.

C. Materials used for sheeting, sheet piling, cribbing, bracing, shoring and underpinning shall be in good, serviceable condition. Timbers shall be sound, free from large or loose knots, and of proper dimensions.

D. Take special precautions in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation or a fill, particularly when the separation is less than the depth of the excavation. Pay particular attention to joints and seams of material comprising a face and to the slope of such seams and joints.

E. If it is necessary to place or operate power shovels, derricks, trucks, materials, or other heavy objects on a level above or near an excavation, sheet-pile, shore, and brace the side of the excavation as necessary to resist the extra pressure due to such superimposed loads.

F. If the stability of adjoining buildings or walls is endangered by excavations, provide shoring, bracing, or underpinning as necessary to ensure the safety of adjoining buildings or walls. Such shoring, bracing or underpinning shall be inspected daily or more often, as conditions warrant, by a competent Contractor’s representative and the protection effectively maintained.

G. The Contractor shall be held responsible for the sufficiency of all sheeting and bracing used, and for all damage to persons or property resulting from the improper quality, strength, placing, maintaining, or removing of the same. This includes damage to trees, sidewalks, and other property on the project site as well as on the private grounds.

H. Drive sheeting ahead of excavation. Do not remove sheeting until the excavation backfill has reached within two feet of the top of the excavation, except that the lower course of sheeting may be removed from a double sheeted excavation. When sheeting is drawn, completely fill all cavities remaining in or adjoining

the excavation. When sheeting is left in place, completely fill all cavities behind such sheeting.

3.07 ROCK REMOVAL

A. Rock, boulders or other hard, lumpy or unyielding materials encountered in trench bottoms shall be removed to a depth at least 12-inches below the bottom of any pipes to be installed. All rock and other hard foundation material under structures shall be freed of all loose material, cleaned, and cut to a firm surface; either level, stepped vertically and horizontally or serrated, as may be directed. All seams shall be cleaned out and filled with concrete or mortar.

B. Blasting of rock or other hard to remove materials will not be permitted on this project.

3.08 SUBGRADES

A. Do not construct foundations, footings, slabs, or piping on loose soil, mud, or other unstable or unsuitable soil.

B. Fill excess cuts under foundations, footings, and slabs with concrete.

C. Fill excess cuts under piping with compacted bedding as specified in this Section.

3.09 FOUNDATION SOILS REMOVAL AND COMPACTION

A. In areas where buildings, structure foundations, and precast concrete tanks are located just below the surface, the site shall be proofrolled using a large vibratory roller (Dynapac CA-25 or equivalent). Proofrolling shall consist of at least ten overlapping passes. Water shall be added in order to achieve moisture content near optimum to facilitate compaction. Purpose of the proofrolling is to detect any areas of unstable or unsuitable soils as well as to density the near-surface soils. Materials which yield excessively during the proofrolling shall be undercut and replaced with well-compacted structural fill.

B. The Owner will retain a Soils Engineer to be present during proofrolling operations to observe the

proofrolling and recommend the nature and extent of any remedial work.

C. In areas where foundations and prestressed concrete tanks are located, preparation of the subgrade prior to pond backfilling will necessitate removal and replacement of pond bottom silts as well as the very loose silty soils on the flanks of the pond (see the Geotechnical Report for further requirements). The entire tank footprint, plus a margin of at least 5 feet outside the foundation perimeter should be striped down to the existing pond bottom elevation including over-excavation of any accumulated sediments, followed by proof-rolling with heavy vibratory compaction equipment. The contractor should anticipate the excavation would extend to approximate EL +15 feet. Compaction should consist of no less than ten (10) complete coverages throughout the entire tank area plus a margin of not less than 5 feet beyond the tank perimeters. The perimeter foundation area for the tank structures should be densified at the bottom of footing elevation. Compaction should continue so as to develop a uniform density of not less than 95% of the modified proctor maximum dry density per ASTM D-1557. Compaction tests should be conducted at intervals of no less than 1 test for each 2500 square feet and each 50 foot of foundation perimeter at a depth of 1 foot and at the compacted subgrade elevation.

D. Any fill required to achieve finished grade in structural areas or used as structural compact fill shall be inorganic, non-plastic granular soil containing less than 10% material passing a No. 200 sieve. Fill shall be placed in level lifts not to exceed 12-inches loose thickness and compacted to a minimum of 95% of the modified Proctor maximum dry density as determined by ASTM Specification D-1557. In-place density tests will be performed on each lift to verify that the specified degree of compacting has been achieved.

3.10 BACKFILLING FOUNDATION AND STRUCTURE EXCAVATIONS

A. Remove debris and other unstable or unsuitable materials from excavations before backfilling is started.

B. Backfill excavations in areas to be paved with Special Backfill. Place Special Backfill in 12-inch lifts.

Compact each lift of backfill to not less than 100% of the maximum dry density as determined in accordance with AASHTO T99, Method A. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Do not compact backfill by puddling, unless permitted by the Engineer.

C. Backfill excavations not requiring Special Backfill with Suitable Material. Place backfill and fill materials in lifts no greater than 12-inches in loose depth. Place backfill and fill materials in lifts no greater than four inches in loose depth where hand tampers are used. Backfill and fill shall be within 2% of optimum moisture content. For soils containing less than 5% material passing a No. 200 sieve, moisture content may be increased to within 3% of optimum. Compact backfill and fill to not less than 95% of the maximum dry density. Compact backfill and fill for restoration of dirt driveways shall be not less than 100% of the maximum dry density for last lift. Tests for determination of maximum dry density shall meet the requirements of ASTM D698 Method C. Use compaction equipment which is suited to the soil being compacted.

D. If suitable, use stored excavated material for backfill and fill. Provide additional material, if required, to complete backfill and fill. Additional backfill and fill material shall be provided at no additional cost to the Owner.

E. Do not use the following materials for backfill:

1. Unsuitable materials

2. Materials which are too wet or too dry to be compacted to the densities specified in this Section.

F. Place the backfill and fill in a manner which will not overload foundations or structures. Place backfill and fill evenly on all sides of foundations and structures. Do not use equipment that will overload foundations or structures during filling or backfilling.

G. Do all cutting, filling, and grading necessary to bring the entire area around foundations and outside of structures to the following subgrade levels:

1. To the underside of the respective surfacing for walks and pavement

2. To finished grade for lawns and planted areas within the project site.

3.11 BACKFILLING PIPING TRENCHES

A. Do not backfill trenches and excavations until all utilities have been inspected by the Owner's representative and until all underground utilities and piping systems are installed in accordance with the requirements of the specifications and the drawings.

B. Remove debris and other unsuitable materials from excavations before backfilling is started.

C. Place and tamp bedding and backfilling in a manner which will not damage pipe coating, wrapping, or encasement.

D. Bedding procedures shall be as specified in the particular Section for the applicable pipe material.

E. If bedding does not cover the pipe, place pipe cover material from the top of bedding to 12-inches over the pipe. Compact pipe cover material to the density required to allow backfill over the pipe cover material to be compacted to the density specified.

F. Do not use the following materials for backfilling:

1. Unsuitable Materials

2. Materials which are too wet or too dry to be compacted to the densities specified in this Section.

G. If suitable, use stored excavated material for backfill and fill. Provide additional material, if required, to complete backfill and fill. Additional backfill and fill material shall be provided at no additional cost to the Owner. Backfill excavations in areas to be paved with Special Backfill. Place Special Backfill in 12-inch lifts. Compact each lift of backfill to not less than 100% of the maximum dry density as determined in accordance with AASHTO T99, Method A. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Backfill and fill materials shall be within 2% of optimum moisture content. Do not compact backfill by puddling, unless permitted by the Engineer.

H. Backfill trenches not requiring Special Backfill with Suitable Material. Place backfill and fill materials in lifts no greater than 12-inches in loose depth and compact to produce an adequate foundation for seeding. The top 4-inches of backfill shall not contain stones or other objects larger than 1-inch in maximum dimension. Mound backfill above finish grade to allow for settlement. Fill and restore any settlement of the backfill. Grade area to be restored to finish grade after settlement of backfill and immediately before restoration of vegetated areas.

3.12 SHELL BASE

A. Construction of a base course composed of shell shall be as specified in Section 250 of the FDOT Standard Specifications.

3.13 FINISH GRADING

A. Shape the surface of all earthwork to conform to the lines, grades, contours and cross-sections shown on the drawings. Hand dressing may be required in certain areas or in confined areas where equipment operation is restricted.

B. In final shaping of the surface of the earthwork a tolerance of 0.1 foot above or below the plan elevation will be allowed with the following exceptions:

1. Earthwork shall be shaped to slope away from all buildings and structures.

2. Earthwork shall be shaped to match adjacent pavement, curb, sidewalks, and similar appurtenances.

3. Ditch bottoms and swales shall be shaped so that no water will be impounded except in areas designated for impoundment.

3.14 CLEANUP AND MAINTENANCE

A. Cleanup the job site as grading is completed. Remove excess earth, rock, bedding, materials, and backfill materials. Remove unused piping materials, structure components, and appurtenances. Restore items moved, damaged, or destroyed during construction.

B. Maintain the job site until the work has been completed and accepted. Fill excavations which settle when settlement is visible. Restore items damaged by construction or improper restorations. Keep dust conditions to a minimum.

3.15 STORAGE AND REMOVAL OF EXCAVATED MATERIAL

A. Suitable excavated material required for filling and backfilling operations may be stockpiled on the job site.

B. Remove unsuitable materials from the job site as unsuitable materials are excavated. Remove surplus suitable materials from the job site as excavations are backfilled.

C. Excavated suitable surplus materials shall remain the Owner’s property and shall be stockpiled at the location(s) designated by the Owner.

3.16 DUST CONTROL

A. The Contractor shall take all steps possible to prevent and reduce dust arising from the construction activity. The Contractor shall have adequate water trucks on the site at all times and water, as necessary, the areas where dust may arise. He shall cooperate fully with the Owner’s Representative and water immediately when instructed to do so.

END OF SECTION

SECTION 02211

STEEL SHEET PILES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install steel sheet piles to brace and shore open excavations for workers, safety and/or protection of adjacent facilities, or as required by these specifications or as shown on the Drawings.

1.02 SUBMITTALS

A. Submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples and shall include details of the construction and erection of the steel sheet piling, shoring and bracing and the procedure the Contractor intends to follow in performing the work.

B. Submit complete erection drawings showing bolt locations and details of openings, etc. Erection drawings shall show all necessary secondary steel framing members required to support the steel pilings.

C. Drawings of the sheeting and bracing and design computations shall be submitted to the Owner and construction shall not be started until such drawings are received. The drawings and computations shall be prepared and sealed by a Florida registered Engineer employed by the contractor and shall be in sufficient detail to disclose the method of operation for each of the various stages of construction, if required, for the completion of the substructures.

PART 2 PRODUCTS

2.01 MATERIAL

A. Steel Sheet Piles

1. Steel Sheet Piles shall conform to ASTM A328. Steel pile sections shall be the continuously interlocking deep arch equal to PLZ23. The section modulus per linear foot shall not be less than 30.2 cubic inches and the weight shall be not less than 22.6 pounds per square foot of wall.

Sheet pile sections shall be not less than 3/8-inch thick.

2. All sheet piles shall be furnished with standard pulling holes located approximately four inches below the top of the pile, unless specified otherwise.

B. Wales and Caps: Structural steel shapes and plates shall conform to ASTM A36. Bolts shall conform to ASTM A307.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures or roadways from undermining or other damage. If the County's Representative is of the opinion that sufficient or proper supports have not been provided, the County's Representative may order additional supports put in at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

B. All sheeting and bracing shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, by watering or otherwise as may be directed.

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

sheeting and bracing to prevent any caving or moving of the ground.

D. Prior to setting, the sheet piles shall be thoroughly cleaned and inspected for defects and for proper interlock dimensions. The Contractor shall provide a tool for checking the interlock dimensions.

E. Each sheet pile shall have sufficient clearance in the interlocks to slide, under its own weight, in the interlock of the sheet pile previously placed during the setting operation until the top of existing ground is reached by the tip of the sliding pile. In no case during the setting operation shall a vibratory or drive hammer be used to force the interlock of a pile into the interlock of an adjacent pile.

F. Before driving is started, check the sheet piles for position and alignment. Vertical alignment of each sheet pile shall be not more than 1/8 inch per foot from the vertical in all directions. Provide a plumb line or other device for checking vertical alignment.

G. Excavation shall not be carried in advance of the steel sheet piling.

H. Drive sheet piles in rotating stages such that the tip of any sheet pile is not more than 5 feet below the tip of any adjacent sheet pile nor more than 8 feet below the tip of any other sheet pile in the bulkhead.

I. Use a suitable driving head to keep deformation of the driving end to a minimum. If any sheet pile is driven out of interlock, it shall be removed and replaced at the Contractor’s sole expense.

J. Piles shall be driven with air, steam, or diesel hammer having sufficient energy to achieve the required penetration. However, the means and methods selected by the Contractor shall be to prevent damage to any nearby structures.

K. Obstructions encountered before the specified penetration for the piles is obtained shall be removed. Damaged piling or one with faulty alignment shall be withdrawn and new piling driven properly in its place. The cost of such additional work shall be considered as part of the pile driving and shall be borne by the Contractor.

L. Cut the tops of the sheet piles on a true horizontal line with a tolerance of plus or minus 1/2 inch by burning or other suitable method that will not damage the pile. For trench sheeting of pipes, no sheeting is to be withdrawn if driven below mid-diameter of pipe.

END OF SECTION

SECTION 02221

TRENCHING, BEDDING AND BACKFILL FOR PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to perform all excavation, backfill, fill, grading, trench protection or other related work required to complete the piping work shown on the Drawings and specified herein. The work shall include, but not be limited to: vaults; duct conduit; pipe; roadways and paving; backfilling; required fill or borrow operations; grading; disposal of surplus and unsuitable materials; and all related work such as sheeting, bracing and dewatering.

B. Prior to commencing work, the Contractor shall examine the site and review test borings if available, or undertake his own subsurface investigations and take into consideration all conditions that may affect his work.

C. The Contractor is responsible for the protection of every tree which is scheduled to remain in the project area. This includes trees which may or may not be shown on the plans. Every tree shall be adequately protected in place at no additional cost to the County. This includes, but is not limited to protecting the root systems and adjusting grades as necessary for tree/root protection.

1.02 PROTECTION

A. Sheeting and Bracing in Excavations

1. In connection with construction of underground structures, the Contractor shall properly construct and maintain cofferdams. These shall consist of: sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures, existing yard pipe and/or foundation material from disturbance, undermining, or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

2. Trench sheeting for pipes: no sheeting is to be withdrawn if driven below, mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot above the top of any pipe unless otherwise directed by the Engineer. During the progress of the work, the Engineer may direct the Contractor in writing to leave additional wood sheeting in place. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given for an alternate method of removal.

3. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. Unless otherwise approved or indicated on the Drawings or in the Specifications, all sheeting and bracing shall be removed after completion of the piping or structure, care being taken not to disturb or otherwise injure the pipeline or finished masonry. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools specifically made for that purpose, by watering, or as may otherwise be directed.

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

5. Drawings of the cofferdams and design computations shall be submitted to the Engineer and approved prior to any construction. However, approval of these drawings shall not relieve the Contractor of the responsibility for the cofferdams. The drawings and computations shall be prepared and stamped by a Registered Professional Engineer in

the State of Florida and shall be in sufficient detail to disclose the method of operation for each of the various stages of construction, if required, for the completion of the pipeline and substructures.

B. Dewatering, Drainage and Flotation

1. The Contractor shall construct and place all pipelines, concrete work, structural fill, bedding rock and limerock base course, in-the-dry. In addition, the Contractor shall make the final 24" of excavation for this work in-the-dry and not until the water level is a minimum of 6" below proposed bottom of excavation.

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

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

4. Wellpoints may be required for dewatering the soil prior to final excavation for deeper in-ground structures or piping and for maintaining the lowered groundwater level until construction has been completed to avoid the structure, pipeline, or fill from becoming floated or otherwise damaged. Wellpoints shall be surrounded by suitable filter sand and no fines shall be removed by pumping. Pumping from wellpoints shall be continuous and standby pumps shall be provided.

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

6. Where required, the Contractor shall provide a

minimum of two operating groundwater observation wells at each structure to determine the water level during construction of the pipeline or structure. Locations of the observation wells shall be at structures and along pipelines as approved by the Engineer prior to their installation. The observation wells shall be extended to 6 inches above finished grade, capped with screw-on caps protected by 24" x 24" wide concrete base and left in place at the completion of this Project.

7. Prior to excavation, the Contractor shall submit his proposed method of dewatering and maintaining dry conditions to the Engineer for approval. Such approval shall not relieve the Contractor of the responsibility for the satisfactory performance of the system. The Contractor shall be responsible for correcting any disturbance of natural bearing soils for damage to pipeline or structures caused by an inadequate dewatering system or by interruption of the continuous operation of the system as specified.

8. As part of his request for approval of a dewatering system, the Contractor shall demonstrate the adequacy of the proposed system and wellpoint filter sand by means of a test installation. Discharge water shall be clear, with no visible soil particles in a one quart sample. Discharge water shall not flow directly into wetlands or Waters of the State as defined by FDEP and SWFWMD.

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

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

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials for use as fill and backfill shall be as described below. For each material, the Contractor shall notify the Engineer of the source of the

material and shall furnish the Engineer, for approval, a representative sample weighing approximately 50 pounds, at least ten calendar days prior to the date of anticipated use of such material.

2. Additional materials shall be furnished as required from off-site sources and hauled to the site.

B. Structural Fill

1. Structural fill shall be used below spread footing foundations, slab-on-grade floors and other structures as backfill within three feet of the below grade portions of structures.

2. Structural fill material shall be a minimum of 60 percent clean sand, free of organic, deleterious and/or compressible material. Minimum acceptable density shall be 98 percent of the maximum density as determined by AASHTO T-180. Rock in excess of 2-1/2" in diameter shall not be used in the fill material. If the moisture content is improper for attaining the specified density, either water shall be added or material shall be permitted to dry until the proper moisture content for compaction is reached.

C. Base Course

1. Asphalt, crushed concrete, soil cement or approved equal, shall be used as base course for bituminous paved roads and parking areas.

D. Common Fill

1. Common fill material shall be free from organic matter, muck or marl and rock exceeding 2-1/2" in diameter. Common fill shall not contain broken concrete, masonry, rubble or other similar materials. Existing soil may be used to adjust grades over the site with the exception of the construction area.

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

E. Crushed Stone

1. Crushed stone may be used for pipe bedding, manhole bases, as a drainage layer below structures with underdrains and at other locations indicated on the Drawings.

2. Crushed stone shall be size No. 57 with gradation as noted in Table 1 of Section 901 of Florida Department of Transportation, Construction of Roads and Bridges.

PART 3 EXECUTION

3.01 FILL PLACEMENT

A. General

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

2. Limerock base course material, structural fill and screened limerock, may be provided as borrow.

3. Fill shall be brought up in substantially level lifts throughout the site, starting in the deepest portion of the fill. The entire surface of the work shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section. Fill shall not be placed against concrete structures until they have attained sufficient strength.

4. Fill shall be dumped and spread in layers by a bulldozer or other approved method. During the process of dumping and spreading, all roots, debris and stones greater in size than specified under Materials, shall be removed from the fill areas. The Contractor shall assign a sufficient number of

men to this work to insure satisfactory compliance with these requirements.

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

6. All fill materials shall be placed and compacted "in-the-dry". The Contractor shall dewater excavated areas and is required to perform the work in such manner as to preserve the undisturbed state of the natural inorganic soil.

3.02 COMPACTION

A. Structural fill, limerock base course and screened limerock in open areas, shall be placed in layers not to exceed nine inches in depth as measured before compaction. Each layer shall be compacted by a minimum of six coverages (3 passes each way) with the equipment described below, to at least 98 percent of the maximum density, as determined by AASHTO T-180. Incidental compaction due to traffic by construction equipment will not be credited toward the required minimum six coverages.

B. Common fill shall be placed and compacted in a manner similar to that described above for structural fill, with the following exceptions: layer thickness prior to compaction may be increased to 12-inches in open areas; and common fill except dike fill, required below water level in peat excavation areas may be placed as one lift, in-the-wet, to an elevation one foot above the water level at the time of filling.

C. Compaction equipment in open areas shall consist of a medium-heavy vibrator roller (minimum static weight of 10 tons) operated at resonant frequency and at a speed of 2 fps or less or other compaction equipment approved by the Engineer.

D. Areas adjacent to pipelines, structures and other confined areas inaccessible to the vibrator roller shall be compacted with a manually operated sled-type vibratory compactor. The Contractor shall also conform to additional backfill requirements at pipelines and structures as specified in the Contract Documents. Compaction of the fill by such means shall be to the same degree of compaction as obtained by the rubber-tired

equipment, and the Engineer may make the necessary tests to determine the amount of compactive effort necessary to obtain equal compaction. Unless such tests indicate that modifications may be made, the fill compacted by mechanical compactors shall be placed in 6-inch layers and thoroughly tamped over the entire surface.

Compaction equipment is subject to approval by the Engineer.

E. It is the intention that the fill materials with respect to moisture be used in the condition they are excavated insofar as this is practicable. Material which is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits.

F. If the Engineer determines that added moisture is required, water shall be applied by sprinkler tanks or other sprinkler systems, which will insure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued.

G. The Contractor shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment and all other materials and equipment necessary to place the water in the fill in the manner specified.

3.03 TRENCH EXCAVATION AND BACKFILLING

A. Excavation for all trenches required for the installation of pipes and electrical ducts shall be made to the depths indicated on the Drawings and in such manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches.

B. Rock shall be removed to a minimum 6" clearance around the bottom and sides of all the pipe or ducts being laid.

C. Where pipes or ducts are to be laid in limerock bedding or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

D. Where the pipes or ducts are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated manually, shall be done in such

a manner that will give a flat bottom true to grade so that pipe or duct can be evenly supported on undisturbed material. Bell holes shall be made as required.

E. Backfilling over pipes shall begin as soon as practicable after the pipe has been laid, jointed and inspected and the trench filled with suitable compacted material to the mid-diameter of the pipe.

F. Backfilling over ducts shall begin not less than three days after placing concrete encasement.

G. All backfilling shall be prosecuted expeditiously and as detailed on the Drawings.

H. Any space remaining between the pipe and sides of the trench shall be packed full by hand shovel with selected earth, free from stones having a diameter greater than 2" and thoroughly compacted with a tamper as fast as placed, up to a level of one foot above the top of the pipe.

I. The filling shall be carried up evenly on both sides with at least one man tamping for each man shoveling material into the trench.

J. The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted by rolling, ramming, or puddling, as the Engineer may direct, sufficiently to prevent subsequent settling.

3.04 GRADING

A. Grading shall be performed at such places as are indicated on the Drawings, to the lines, grades and elevations shown or as directed by the Engineer and shall be made in such a manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.

B. If at the time of excavation it is not possible to place any material in its proper section of the permanent pipeline structure, it shall be stockpiled in approved areas for later use.

C. Minute adjustments in lines or grades may be made if found necessary as the work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction.

D. Stones or rock fragments larger than 2-1/2" in their greatest dimensions shall not be permitted in the top 6" of the subgrade line of all dikes, fills or embankments.

E. All fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings, or as directed by the Engineer.

F. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All fill slopes shall be uniformly dressed to the slope, cross section and alignment shown on the Drawings or as directed by the Engineer.

G. No grading is to be done in areas where there are existing pipelines that may be uncovered or damaged until such lines which must be maintained are relocated, or where lines are to be abandoned and removed, all required valves are closed and drains plugged at manholes.

END OF SECTION

SECTION 02276

TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of furnishing, maintaining, and removing temporary erosion and sedimentation controls as necessary.

B. Temporary erosion controls include, but are not limited to, sodding, mulching, netting, watering, and reseeding on-site surfaces and spoil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the Owner.

C. Temporary sedimentation controls include, but are not limited to, silt dams, traps, floating turbidity barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the Owner.

D. The Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

1.02 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

PART 2 PRODUCTS

2.01 EROSION CONTROL

A. Sod specified in Section 02900 – Seeding and Sodding.

B. Netting - fabricated of material acceptable to the Owner.

2.02 SEDIMENTATION CONTROL

A. Bales - clean, seedfree cereal hay type.

B. Netting - fabricated of material acceptable to the Owner.

C. Filter stone - crushed stone conforming to Florida Dept. of Transportation specifications.

D. Concrete block - hollow, non-load-bearing type.

E. Concrete - exterior grade not less than one inch thick.

PART 3 EXECUTION

3.01 EROSION CONTROL

A. Minimum procedures for grassing are:

1. Scarify slopes to a depth of not less than six inches and remove large clods, rock, stumps, roots larger than 1/2 inch in diameter and debris.

2. Sow seed within twenty-four (24) hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.

3. Apply mulch loosely and to a thickness of between 3/4-inch and 1-1/2 inches.

4. Apply netting over mulched areas on sloped surfaces.

5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit unsatisfactory growth. Backfill and seed eroded areas.

3.02 SEDIMENTATION CONTROL

A. Install and maintain silt dams, traps, barriers, and appurtenances as shown on the approved descriptions and working drawings. Hay bales which deteriorate and filter stones which are dislodged shall be replaced.

3.03 PERFORMANCE

A. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results which comply with the requirements of the State of Florida, Contractor shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

END OF SECTION

SECTION 02513

ASPHALT CONCRETE PAVING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment necessary to complete all asphalt concrete paving as shown on the Drawings.

1.02 QUALITY ASSURANCE

A. Qualifications of Asphalt Concrete Producer: Use only materials which are furnished by a bulk asphalt concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete.

B. Qualification of Testing Agency: The Owner will employ commercial testing laboratories to conduct tests and evaluations of asphalt concrete materials and design.

1. Provide asphalt concrete testing and inspection service acceptable to Engineer.

2. Include sampling and testing asphalt concrete materials proposed, and tests and calculations for asphalt concrete mixtures.

3. Provide field testing facilities for quality control testing during paving operations.

C. Requirements of Regulatory Agencies: Comply with applicable requirements of:

1. Manatee County Public Works Deptartment

2. Florida Deptartment of Transportation

1.03 PAVING QUALITY REQUIREMENTS

A. General: In addition to other specified conditions, comply with following minimum requirements:

1. Test in-place asphalt concrete courses for compliance with requirements for density, thickness and surface smoothness.
2. Provide final surfaces of uniform texture, conforming to required grades and cross sections.

3. Take not less than four inch diameter pavement specimens for each completed course, from locations as directed by the Engineer.

4. Repair holes from test specimens as specified for patching defective work.

B. Density:

1. Compare density of in-place material against laboratory specimen of same asphalt concrete mixture, when subjected to 50 blows of standard Marshall hammer on each side of specimen.

2. Minimum acceptable density of in-place course material is 98% of the recorded laboratory specimen density.

C. Thickness: In-place compacted thicknesses will not be acceptable if less than the thicknesses shown on the Drawings.

D. Surface Smoothness:

1. Test finished surface of each asphalt concrete course for smoothness, using a 10 ft. straightedge applied parallel to and at right angles to centerline of paved areas.

2. Check surfaced areas at intervals directed by Engineer.

3. Surfaces will not be acceptable if exceeding the following:

a) Base Course: 1/4 in. in 10 ft.

b) Surface Course: 3/16 in. in 10 ft.

c) Crowned Surfaces:

1) Test crowned surfaces with a crown template, centered and at right angles to the crown.

2) Surfaces will not be acceptable if varying more than 1/4 in. from the template.

1.04 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

B. Samples: Provide samples of materials for laboratory testing and job-mix design.

C. Test Reports: Submit laboratory reports for following materials tests:

1. Coarse and fine aggregates from each material source and each required grading:

a) Sieve Analysis: ASTM C 136 (AASHTO T 27)

b) Unit Weight of Slag: ASTM C29 (AASHTO T 19)

c) Soundness: ASTM C 88 (AASHTO T 104) for surface course aggregates only.

d) Sand Equivalent: ASTM D 2419 (AASHTO T 176)

e) Abrasion of Coarse Aggregate: ASTM C131 (AASHTO T 96), for surface course aggregates only.

2. Asphalt cement for each penetration grade:

a) Penetration: ASTM D5 (AASHTO T49)

b) Viscosity (Kinematic): ASTM D2170 (AASHTO T 201)

c) Flash Point: ASTM D92 (AASHTO T 48)

d) Ductility: ASTM D 113 (AASHTO T 51)

e) Solubility: ASTM D 4 (AASHTO T 44)

f) Specific Gravity: ASTM D 70 (AASHTO T 43).

3. Job-mix design mixtures for each material or grade:

a) Bulk Specific Gravity for Coarse Aggregate: ASTM C 117 (AASHTO T 85)

b) Bulk Specific Gravity for Fine Aggregate: ASTM C 128 (AASHTO T 84)

4. Uncompacted asphalt concrete mix: Maximum Specific Gravity: ASTM D 2041 (AASHTO T 209).

5. Compacted asphalt concrete mix:

   a) Bulk Density: ASTM D 1188 (AASHTO T 166)

   b) Marshall Stability and Flow: ASTM D 1559

6. Density and voids analysis:

   a) Provide each series of asphalt concrete mixture text specimens, in accordance with A.I. MS-2 "Mix Design Methods for Asphalt Concrete".

   b) Use Marshall method of mix design unless otherwise directed or acceptable to the Engineer.

   c) Report the quantity of absorbed asphalt cement in pounds of dry aggregate, percent air voids, and percent voids in mineral aggregate.

7. Sampling and testing of asphalt concrete mixtures for quality control during paving operations:

   a) Uncompacted asphalt concrete mix.

      1) Asphalt Cement Content: ASTM D 2172 (AASHTO T 164)

      2) Penetration of Recovered Asphalt Cement: ASTM D 5 (AASHTO T 49)

      3) Ductibility of Recovered Asphalt Cement: ASTM D 113 (AASHTO T 51)

   b) Compacted asphalt concrete mix:

      1) Bulk Density: ASTM D 1188 (AASHTO T 166)

      2) Marshall Stability and Flow: ASTM D 1559)

   c) Perform at least one test for each day's paving.

8. Asphalt plant inspection: ASTM D 290.

9. Additional testing:

   a) Perform as may be required if any of the previous tests indicate insufficient values, or if directed by the Engineer.

   b) Continue testing until specified values have been attained.

10. Asphalt concrete materials not complying with specified requirements will not be permitted in the work.

1.05 JOB CONDITIONS

A. Weather Limitations:

1. Apply bituminous prime and tack coats only when the ambient temperature in the shade is above 50 degrees F. and when the temperature has not been below 35 degrees F. for 12 hours immediately prior to application.

2. Do not apply when the base surface is wet or contains an excess of moisture which would prevent uniform distribution and the required penetration.

3. Construct asphalt concrete surface course only when atmospheric temperature is above 40 degrees F., when the underlying base is dry, and when weather is not rainy.

4. Base course may be placed when air temperature is not below 30 degrees F. and rising, when acceptable to the Engineer.

B. Grade Control: Establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.

C. Traffic Control: Maintain vehicular and pedestrian traffic during paving operations, as required for other construction activities.

PART 2 PRODUCTS

2.01 MATERIALS

A. Shell Marl Stabilized Sub-Base: as specified in FDOT Section 260, “Shell tabilized Base,” and on the plans.

B. Limerock Base Course: as specified in FDOT Section 200, “Limerock Base,” and on the plans.

C. Aggregate for Asphalt Concrete, General:
   1. Sound, angular crushed stone, crushed gravel, or crushed slag: ASTM D 692.

   2. Sand, stone, or slag screening: ASTM D 1073.

   3. Provide aggregate in gradations for various courses to comply with local highway standards.

D. Surface Course Aggregates: Provide natural sand, unless sand prepared from stone, slag, or gravel or combinations are required to suit local conditions.

E. Asphalt Cement: Comply with ASTM D 946 for 85-100 penetration grade.

F. Prime Coat:

   1. Cut-back liquid asphalt.

   2. Medium-Curing type: ASTM D 2027, Grade MC-70.

2.02 ASPHALT-AGGREGATE MIXTURES

A. Job-mix criteria:

   1. Provide job-mix formulas for each required asphalt-aggregate mixture. Provide FDOT Section 333 Type III asphaltic concrete.

   2. Establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to aggregate, and a single temperature at which asphalt concrete is to be produced.

   3. Comply with the mix requirements of local governing highway standards.

4. Maintain material quantities within allowable tolerances of the governing standards.

2.03 TRAFFIC AND PARKING MARKING MATERIALS

A. Traffic lane marking paint with chlorinated rubber base.

B. Factory mixed, quick drying and non bleeding, FS TT-P-115C, Type III.

C. Color: Driving Lane Dividers - White

D. No Parking Zone – Yellow

E. Parking Dividers - White

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Subbase Preparation:

1. The Contractor shall remove from the area all organic substance encountered to a depth of six or eight inches (6" or 8"), or to such depth and width as directed by the Engineer. The entire area shall be plowed and dragged prior to placing a stabilizing additive, if required to meet minimum bearing value.

2. Subbase shall be compacted to a minimum density of 98 percent of the maximum as determined by the Modified Proctor Density AASHTO T180, and shall have a minimum bearing value of 40 pounds per square inch as determined by the Florida Bearing Test.

B. Base Course:

1. Check subgrade for conformity with elevations and section immediately before placing base material.

2. Place base material in compacted layers not more than 6 inches thick, unless continuing tests indicate the required results are being obtained with thicker layers.

3. In no case will more than 8-inches of compacted base be placed in one lift.

4. Spread, shape, and compact all base material deposited on the subgrade during the same day.

5. Compact base course material to be not less than 95% of maximum density: ASTM D 1557, Method D (98 percent maximum density: AASHTO T-180).

6. Test density of compacted base course: ASTM D 2167.

7. Conduct one test for each 250 sq. yds. of in-place material, but in no case not less than one daily for each layer.

C. Loose and Foreign Material:

1. Remove loose and foreign material from compacted subbase surface immediately before application of paving.

2. Use power brooms or blowers, and brooming as required.

3. Do not displace subbase material.

D. Prime Coat:

1. Uniformly apply at rate of 0.20 to 0.5 gal. per sq. yd. over compacted and cleaned subbase surface.

2. Apply enough material to penetrate and seal, but not flood the surface.

3. Allow to cure and dry as long as required to attain penetration and evaporation of volatile, and in no case less than 24 hours unless otherwise acceptable to the Engineer.

4. Blot excess asphalt with just enough sand to prevent pick-up under traffic.

5. Remove loose sand before paving.

E. Tack Coat:

1. Dilute material with equal parts of water and apply to contact surfaces of previously constructed asphalt concrete or portland cement concrete and similar surfaces.

2. Apply at rate of 0.05 to 0.15 gal. per sq. yd. of surface.

3. Apply tack coat by brush to contact surfaces of structures projecting into or abutting asphalt concrete pavement.

4. Allow surfaces to dry until material is at condition of tackiness to receive pavement.

3.02 FRAME ADJUSTMENTS (IF APPLICABLE)

A. Placing frames:

1. Surround frames set to elevation with a ring of compacted asphalt concrete base prior to paving.

2. Place asphalt concrete mixture up to 1 in. below top of frame, slope to grade, and compact by hand tamping.

B. Adjust frames to proper position to meet paving.

C. If permanent covers are not in place, provide temporary covers over openings until completion of rolling operations.

D. Set cover frames to grade, flush with surface of adjacent pavement.

3.03 PREPARING THE MIXTURE

A. Comply with ASTM D 995 for material storage, control, and mixing, and for plant equipment and operation.

B. Stockpiles:

1. Keep each component of the various-sized combined aggregates in separate stockpiles.

2. Maintain stockpiles so that separate aggregate sizes will not be intermixed and to prevent segregation.

C. Heating:

1. Heat the asphalt cement at the mixing plant to viscosity at which it can be uniformly distributed throughout mixture.

2. Use lowest possible temperature to suit temperature-viscosity characteristics of asphalt.

3. Do not exceed 350 degrees F. (176.6 degrees C.).

D. Aggregate:

1. Heat-dry aggregates to reduce moisture content to not more than 2.0%.

2. Deliver dry aggregate to mixer at recommended temperature to suit penetration grade and viscosity characteristics of asphalt cement, ambient temperature, and workability of mixture.

3. Accurately weigh or measure dry aggregates and weigh or meter asphalt cement to comply with job-mix formula requirements.

E. Mix aggregate and asphalt cement to achieve 90-95% of coated particles for base mixtures and 85-90% of coated particles for surface mixture, when tested in accordance with ASTM D 2489.

F. Transporting:

1. Transport asphalt concrete mixtures from mixing site in trucks having tight, clean compartments.

2. Coat hauling compartments with a lime-water mixture to prevent asphalt concrete mixture from sticking.

3. Elevate and drain compartment of excess solution before loading mix.

4. Provide covers over asphalt concrete mixture when transporting to protect from weather and to prevent loss of heat.

5. During periods of cold weather or for long-distance deliveries, provide insulation around entire truck bed surfaces.

3.04 EQUIPMENT

A. Provide size and quantity of equipment to complete the work specified within project time schedule.

B. Bituminous Pavers: Self-propelled that spread hot asphalt concrete mixtures without tearing, shoving or

gouging surfaces, and control pavement edges to true lines without use of stationary forms.

C. Rolling Equipment:

1. Self-propelled, steel-wheeled and pneumatic-tired rollers that can reverse direction without backlash.

2. Other type rollers may be used if acceptable to the Engineer.

D. Hand Tools: Provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters, and other miscellaneous small tools to complete the work specified.

3.05 PLACING THE MIX

A. Place asphalt concrete mixture on prepared surface, spread and strike-off using paving machine.

B. Spread mixture at a minimum temperature of 225 degrees F. (107.2 degrees C.).

C. Inaccessible and small areas may be placed by hand.

D. Place each course at thickness so that when compacted, it will conform to the indicated grade, cross-section, finish thickness, and density indicated.

E. Paver Placing:

1. Unless otherwise directed, begin placing along centerline of areas to be paved on crowned section, and at high side of sections on one-way slope, and in direction of traffic flow.

2. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.

3. Complete base courses for a section before placing surface courses.

4. Place mixture in continuous operation as practicable.

F. Hand Placing:

1. Spread, tamp, and finish mixture using hand tools in areas where machine spreading is not possible, as acceptable to Engineer.

2. Place mixture at a rate that will insure handling and compaction before mixture becomes cooler than acceptable working temperature.

G. Joints:

1. Carefully make joints between old and new pavements, or between successive days' work, to ensure a continuous bond between adjoining work.

2. Construct joints to have same texture, density and smoothness as adjacent sections of asphalt concrete course.

3. Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat.

4. Offset transverse joints in succeeding courses not less than 24 inches.

5. Cut back edge of previously placed course to expose an even, vertical surface for full course thickness.

6. Offset longitudinal joints in succeeding courses not less than 6 inches.

7. When the edges of longitudinal joints are irregular, honeycombed, or inadequately compacted, cut back unsatisfactory sections to expose an even, vertical surface for full course thickness.

3.06 COMPACTING THE MIX

A. Provide sufficient rollers to obtain the required pavement density.

B. Begin rolling operations as soon after placing when the mixture will bear weight of roller without excessive displacement.

C. Do not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set.

D. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

E. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs.

F. Do not roll centers of sections first under any circumstances.

G. Breakdown Rolling:

1. Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge.

2. Operate rollers as close as possible to paver without causing pavement displacement.

3. Check crown, grade, and smoothness after breakdown rolling.

4. Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling.

H. Second Rolling:

1. Follow breakdown rolling as soon as possible, while mixture is hot and in condition for compaction.

2. Continue second rolling until mixture has been thoroughly compacted.

I. Finish Rolling:

1. Perform finish rolling while mixture is still warm enough for removal of roller marks.

2. Continue rolling until roller marks are eliminated and course has attained specified density.

J. Patching:

1. Remove and replace defective areas.

2. Cut-out and fill with fresh, hot asphalt concrete.

3. Compact by rolling to specified surface density and smoothness.

4. Remove deficient areas for full depth of course.

5. Cut sides perpendicular and parallel to direction of traffic with edges vertical.

6. Apply tack coat to exposed surfaces before placing new asphalt concrete mixture.

3.07 MARKING ASPHALT CONCRETE PAVEMENT

A. Cleaning:

1. Sweep surface with power broom supplemented by hand brooms to remove loose material and dirt.

2. Do not begin marking asphalt concrete pavement until acceptable to the Engineer.

B. Apply paint with mechanical equipment.

1. Provide uniform straight edges.

2. Not less than two separate coats in accordance with manufacturer's recommended rates (min. wet film thickness of 15 mils).

3. Width of Stripe: Width shall be 4-inches unless shown otherwise.

3.08 CLEANING AND PROTECTION

A. Cleaning: After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of the Engineer.

B. Protection:

1. After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened, and in no case sooner than 6 hours.

2. Provide barricades and warning devices as required to protect pavement.

3. Cover openings of structures in the area of paving until permanent coverings are placed (if applicable).

END OF SECTION

SECTION 02900

SEEDING AND SODDING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials and equipment necessary to satisfactorily return all construction areas to their original conditions or better.

B. Work shall include furnishing and placing seed or sod, fertilizing, planting, watering and maintenance until acceptance by Engineer/Owner.

1.02 RELATED WORK NOT INCLUDED

A. Excavation, filling and grading required to establish elevation shown on the Drawings are included under other sections of these Specifications.

1.03 QUALITY ASSURANCE

A. Requirements

1. It is the intent of this Specification that the Contractor is obliged to deliver a satisfactory stand of grass as specified. If necessary, the Contractor shall repeat any or all of the work, including grading, fertilizing, watering and seeding or sodding at no additional cost to the Owner until a satisfactory stand is obtained. For purposes of grassing, a satisfactory stand of grass is herein defined as a full lawn cover over areas to be sodded or seeded, with grass free of weeds, alive and growing, leaving no bare spots larger than 3/4 square yard within a radius of 8 feet.

2. All previously grassed areas where pipelines are laid shall be sodded. All sodding and grassing shall be installed in accordance with these Specifications or as directed by the Engineer.

1.04 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fertilizer

1. The fertilizer shall be of the slow-release type meeting the following minimum requirements: 12 percent nitrogen, 8 percent phosphorus, 8 percent potassium; 40 percent other available materials derived from organic sources. At least 50 percent of the phosphoric acid shall be from normal super phosphate or an equivalent source which will provide a minimum of two units of sulfur. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or other container. Fertilizer shall be uniform in composition, dry and free flowing delivered to sites in original unopened containers bearing manufacturer's statement or guarantee.

B. Seeding/Grassing

1. The Contractor shall grass all unpaved areas disturbed during construction which do not require sod. All grassing shall be completed in conformance with FDOT Specifications, Sections 570 and 981. The grassed areas shall be mulched and fertilized in accordance with FDOT Specifications, except that no additional payment will be made for mulching, fertilizing and/or watering.

C. Sodding

1. Sod shall be provided as required on the construction drawings or at locations as directed by the Engineer in accordance with Florida Department of Transportation, Specifications Section 575 and 981. The Contractor shall furnish Bahia grass sod or match existing sod whichever is more stringent. Placement and watering requirements shall be in accordance with FDOT Specifications Section 575, except that no additional payment will be made for placement and/or watering. This cost shall be included in the Contract price bid for sodding.

D. Topsoil

1. Topsoil stockpiled during excavation may be used as

necessary. If additional topsoil is required to replace topsoil removed during construction, it shall be obtained off site at no additional cost to the Owner. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants and grassing specified herein.

E. Water

1. It is the Contractor's responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The Contractor shall make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for his work. He shall also furnish all necessary hose, equipment, attachments and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 EXECUTION

3.01 INSTALLATION

A. When the trench backfill has stabilized sufficiently, the Contractor shall commence work on lawns and grassed areas, including fine grading as necessary and as directed by the Engineer.

B. Finish Grading

1. Areas to be seeded or sodded shall be finish graded, raked, and debris removed. Soft spots and uneven grades shall be eliminated.

C. Protection

1. Seeded and sodded areas shall be protected against traffic or other use by placing warning signs or erecting barricades as necessary. Any areas damaged prior to acceptance by the Owner shall be repaired by the Contractor as directed by the Engineer.

3.02 CLEANUP

A. Soil or similar materials spilled onto paved areas shall be removed promptly, keeping those areas as clean as possible at all times. Upon completion of seeding and

sodding operations, all excess soil, stones and debris remaining shall be removed from the construction areas.

3.03 MAINTENANCE

A. Any existing seeded or sodded areas damaged or altered during construction by the Contractor shall be restored or replaced.

B. Maintain new seeded or sodded areas for a period of 90 days immediately following complete installation of work or until Owner accepts project. Watering, weeding, cultivating, restoration of grade, mowing and trimming, protection from insects and diseases, fertilizing and similar operations as needed to ensure normal growth and good health for live plant material shall be included at no additional cost to the Owner.

3.04 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATORS

A. Lawn areas planted under this Contract and all lawn areas damaged by the Contractor's operation shall be repaired at once by proper soil preparation, fertilizing and sodding, in accordance with these Specifications.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

B. Related Specification Sections:

1. Section 03900 - Hydraulic Structures Testing

2. Section 09900 – Painting and Coatings

1.02 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

1. Cast-in-place concrete includes the following:

a) Foundations and footings

b) Slabs-on-grade

c) Tank & trench walls

d) Elevated slabs

e) Equipment pads and bases

1.03 SUBMITTALS

A. General: All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

1. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials and others if requested by Engineer.

2. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Shop drawings to show proposed location of all construction joints. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures. Engineer’s review is for general compliance only. The Contractor will be responsible for size, number and lengths of reinforcing.

3. Shop drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually. Engineer's review is for general applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.

4. The testing laboratory shall submit three (3) copies of results of concrete cylinder tests to Engineer together with one (1) copy each to Owner, Contractor, and Concrete Supplier.

5. Ready-mixed concrete delivered shall be accompanied by delivery tickets showing the following:

   a) Date and time leaving the plant

   b) Type of cement and weight

   c) Quantity of water and time added

   d) Aggregate moisture correction factor

   e) Admixtures and weight

   f) Site arrival time

   g) Site leaving time

   h) Type of fly ash and weight

6. Laboratory test reports for concrete materials and mix design test. Contractor shall submit three (3) copies.

7. Material certificates in lieu of material laboratory test reports when permitted by Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

8. Hot weather and cold weather concreting plan shall include curing method and specific curing plan, ready mixed supplier plan, contingency plans and materials list as a minimum. All hot weather plans shall meet requirements of ACI 305. All cold weather plans shall meet requirements of ACI 306.

9. A pouring plan will be submitted by the Contractor to the Engineer for approval showing the location of all construction joints and sawed contraction joints.

1.04 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the latest revision of the following codes, specifications and standards, except where more stringent requirements are shown or specified:

1. American Concrete Institute (ACI) 211 “Proportions for Normal, Heavyweight and Mass Concrete.”

2. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."

3. ACI 318, "Building Code Requirements for Reinforced Concrete."

4. ACI 347 “Recommended Practice for Concrete Formwork.”

5. ACI 350 “Environmental Engineering Concrete Structures.”

6. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

7. ASTM C 94 Standard Specifications for Ready-Mix Concrete.

8. Florida Building Code 2007 edition.

9. ACI 305 “Specification for Hot Weather Concreting” and 306 “Standard Specification for Cold Weather Concreting.”

B. Concrete Testing Service: Owner will engage a testing agency to perform material evaluation tests.

C. Materials and installed work may require testing and retesting at any time during progress of Work. Any retesting of rejected materials for installed Work, shall be done at Contractor's expense.

D. Review requirements for submittals, status of coordinating work and availability of materials. Establish preliminary work progress schedule and procedures for materials inspection, testing and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:

1. Contractor's superintendent

2. Agency responsible for concrete design mixes

3. Agency responsible for field quality control

4. Ready-mix concrete producer

5. Concrete subcontractor

6. Primary admixture manufacturers

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

B. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade

or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

C. Forms for Unexposed Finish Concrete: Plywood, lumber, metal or another acceptable material. Provide lumber dressed on at least two (2) edges and one (1) side for tight fit.

D. Forms for Cylindrical Columns and Supports: Metal, glass-fiber-reinforced plastic, or paper or fiber tubes that will produce smooth surfaces without joint indications. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.

E. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

F. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.

G. Provide ties that, when removed, will leave holes not larger than 1 inch and no smaller than ½ inch in diameter in the concrete surface. Form ties for exposed concrete shall be of the cone-washer type. The cones shall be made of approved wood or plastic. Ties for liquid containment structures shall have an integral waterstop that is tightly welded to the tie. Common wire will not be allowed for form ties.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615 Grade 60 deformed

B. Steel Wire: ASTM A 82, plain, cold-drawn steel

C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

D. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

E. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

F. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150

1. Type I/II

B. Fly Ash: ASTM C 618, Class F

1. Use one brand of cement and fly ash throughout Project unless otherwise acceptable to Engineer.

C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

2.04 WATER

A. Mixing water shall meet specified requirements of ASTM C 94, Section 5.

2.05 ADMIXTURES, GENERAL

Provide concrete admixtures that contain not more than one tenth of one percent (0.1%) chloride ions.

A. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a) Monex Air or Monex NVR, Monex Resources, Inc.

b) Air-Tite, Cormix Construction Chemicals

c) Air-Mix or Perma-Air, Euclid Chemical Co.

d) Darex AEA or Daravair, W.R. Grace & Co.

e) MB-VR or Micro-Air, Master Builders, Inc.

f) Sealtight AEA, W.R. Meadows, Inc.

g) Sika AER, Sika Corp.

B. Water-Reducing Admixture: ASTM C 494, Type A or D.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a) Monex Resources, Inc.

b) Chemtard, ChemMasters Corp.

c) PSI N, Cormix Construction Chemicals

d) Eucon WR-75, Euclid Chemical Co.

e) WRDA, W.R. Grace & Co.

f) Pozzolith Normal or Polyheed, Master Builders, Inc.

g) Metco W.R., Metalcrete Industries

h) Prokrete-N, Prokrete Industries

i) Plastocrete 161, Sika Corp.

C. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a) Monex SP or Mighty RD, Monex Resources, Inc.

b) Super P, Anti-Hydro Company, Inc.

c) Eucon 37, Euclid Chemical Company

d) WRDA 19 or Daracem, W.R. Grace and Company

e) Rheobuild or Polyheed, Master Builders, Inc.

f) Superslump, Metalcrete Industries

g) PSP, Prokrete Industries

h) Sikament 300, Sika Corp.

2.06 CALCIUM CHLORIDE

A. The use of calcium chloride will not be permitted.

2.07 RELATED MATERIALS

A. Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217- inch-thick galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized sheet steel, not less than 0.0336 inch thick with bent tab anchors. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.

C. Waterstops: Provide ribbed-type waterstops at construction joints exposed to water pressure, including groundwater pressure, and other joints as indicated. Provide ribbed type with centerbulb waterstops at expansion joints. In general waterstops shall be 9″ wide. Install 6″ wide waterstops at intersections with reinforced sections with 3″ of clear cover. All waterstops shall be a minimum of 3/8″ thick. All waterstops shall be provided with either metal grommets or integral tie wires located along the top and bottom of the waterstop spaced at 12″. Other styles or sizes of waterstops may be considered based on their specific application.

D. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

a) BoMetals, Inc.

b) The Burke Co.

c) Greenstreak Plastic Products Co.

d) Meadows, Inc.

e) Progress Unlimited

f) Schlegel Corp.

g) Vinylex Corp.

E. Sand Cushion: Clean, manufactured or natural sand.

F. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:

1. Polyethylene sheet not less than 6 mils thick.

G. Water-resistant barrier consisting of heavy kraft papers laminated together with glass-fiber reinforcement and overcoated with black polyethylene on each side.

H. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd., complying with AASHTO M 182, Class 2.

I. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper

2. Polyethylene film

3. Polyethylene-coated burlap

J. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade and class to suit Project requirements.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a) Burke Epoxy M.V., The Burke Co.

b) Spec-Bond 100, Conspec Marketing and Mfg. Co.
c) Resi-Bond (J-58), Dayton Superior

d) Euco Epoxy System #452 or #620, Euclid Chemical Co.
e) Epoxtite Binder 2390, A.C. Horn, Inc.

f) Epabond, L&M Construction Chemicals, Inc.

g) Concresive Standard Liquid, Master Builders, Inc.

h) Rezi-Weld 1000, W.R. Meadows, Inc.

i) Metco Hi-Mod Epoxy, Metalcrete Industries

j) Sikadur 32 Hi-Mod, Sika Corp.

k) Stonset LV5, Stonhard, Inc.

l) Series, Symons Corp.

2.08 PROPORTIONING AND DESIGNING MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301, ACI 211, and ACI 350. For the trial batch method, use an independent testing agency acceptable to Engineer for preparing and reporting proposed mix designs.

B. Do not use the same testing agency for field quality control testing.

C. Limit use of fly ash to not exceed twenty-five percent (25%) of the total cementitious content by weight. Fly ash shall be used either as an admixture or as a partial cement replacement. Fly ash may be used in all structural concrete.

D. Submit written reports to Engineer of each proposed mix for each class of concrete at least fifteen (15) days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Engineer.

2.09 COMPRESSIVE STRENGTHS

A. Design mixes to provide concrete with the following properties as indicated on schedules:

CLASS	7 DAY	28 DAY	MAXIMUM WATER - CEMENTITIOUS RATIO	MINIMUM CEMENTITIOUS MATERIAL (LBS/CY)
Structural	2670	4000	0.44	564
Non-Structural	2000	3000	0.50	470
Structural, High Density	3000	4500	0.40	650

2.10 STRUCTURAL HIGH DENSITY CONCRETE

A. Structural, High Density Concrete shall be used in all structures where concrete is intended to be watertight in service.

2.11 SLUMP LIMITS

A. Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs and sloping surfaces: Not more than 3 inches.

B. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.

C. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2 - 3 inch slump concrete.

2.12 CONCRETE MIX ADJUSTMENTS

A. Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results or other circumstances warrant, as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in Work.

2.13 ADMIXTURES

A. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.

B. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content of five percent (5%) with a tolerance of plus or minus one percent (1%).

2.14 READY-MIXED CONCRETE

A. Comply with requirements of ASTM C 94, and as specified.

1. When air temperature is between 85 °F and 90 °F, reduce mixing and delivery time from one and a half (1-1/2) hours to seventy-five (75) minutes, and when air temperature is above 90 °F, reduce mixing and delivery time to sixty (60) minutes.

2.15 WATERPROOFING

A. Provide above and below-grade surface applied coatings in accordance with Project Specification Section 09900.

2.16 CRACK INJECTION MATERIALS

A. Hydrophilic Resin:

1. Shall be a low viscosity, expanding polyurethane resin. It shall cure into a flexible rubber-like material that has the potential for unrestrained increase in volume in excess of 100 percent in the presence of water.

2. Prepare substrate and install in accordance with the manufacturers recommendations.

3. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a) Sika Injection 29, by Sika Corporation.

b) Duroseal Inject, as manufactured by BBZ USA, Inc.
c) Or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier and other related materials with placement of forms and reinforcing steel.

B. Forms

1. General: Design, erect, support, brace and maintain formwork to support vertical, lateral, static and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

a) Provide Class A tolerances for concrete surfaces exposed to view.

b) Provide Class C tolerances for other concrete surfaces.

C. Construct forms to sizes, shapes, lines and dimensions shown and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

E. Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

F. Chamfer all exposed corners and edges, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints. Chamfer edges to be ¾″ unless otherwise approved by Engineer, or noted on the construction drawings.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

B. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.

C. Clean reinforcement of loose rust and mill scale, earth, ice and other materials that reduce or destroy bond with concrete.

D. Accurately position, support and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as approved by Engineer.

E. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

F. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one (1) full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.03 JOINTS

A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Engineer.

B. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

C. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

D. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

E. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

F. Joint fillers and sealants shall be as follows:

1. Joint Fillers

a) Self-expanding Cork Joint Filler: Preformed strips complying with ASTM D 1752 for Type III.

b) Cork Joint Filler: Preformed strips complying with ASTM D 1752 for Type II.

c) Sponge Rubber Joint Filler: Preformed strips complying with ASTM D 1752 for Type I.

d) Bituminous Fiber Joint Filler: Performed strips complying with ASTM D 1751: Granulated cork with asphalt binder encased between two (2) layers of saturated felt of glass-fiber felt of width and thickness indicated.

2. Joint Sealers shall be appropriate for their intended use and installations. Follow manufactures instruction for use and installation. All joint sealants shall be in accordance with ACI 504R.

3.04 INSTALLING EMBEDDED ITEMS

A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.05 PREPARING FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, non-residual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

C. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.06 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams

or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

E. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

F. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate. A spare vibrator will be on-site for emergency use at all times.

G. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints or expansion joints, until completing placement of a panel or section.

H. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.

I. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

J. Maintain reinforcing in proper position on chairs during concrete placement.

K. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical

damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

L. When air temperature has fallen to or is expected to fall below 40 °F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 °F and not more than 80 °F at point of placement.

M. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

N. Do not use salt, other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs. Calcium chloride will not be allowed.

O. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

P. Cool ingredients before mixing to maintain concrete temperature at time of placement to be in accordance with ACI. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Ice can not be used to replace more than half of the design total water content. Using liquid nitrogen to cool concrete is Contractor's option.

Q. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

R. Fog spray forms, reinforcing steel and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

S. Use water-reducing retarding admixture when required by high temperatures, low humidity or other adverse placing conditions, as acceptable to Engineer.

3.07 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by

form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off. Finish shall be a Class C in accordance with ACI 347.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed. Finish shall be a Class A in accordance with ACI 347.

C. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.

1. Combine one part Portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard Portland cement and white Portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.

2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least thirty-six (36) hours after rubbing.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

E. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.

1. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 25 (floor flatness) and F(L) 20 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture. Class of surface shall be a class C surface in accordance with 347 R.

F. Non-slip Broom Finish: Apply a non-slip light broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.

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

G. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work. All grout shall be non-shrinking.

H. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

I. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

J. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp and non-slip broom concrete surfaces.

K. Below Grade Concrete: Waterproof the exterior (grade) side of tank and building walls. Prepare surface based upon manufacturers recommendations. Material may be spray, brush or roller applied. Conform to manufacturers recommendations for chosen application.

3.08 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist for not less than fourteen (14) days as required due to weather.

C. Curing Methods: Cure concrete by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

1. Provide moisture curing by the following methods:

a) Keep concrete surface continuously wet by covering with water.

b) Use continuous water-fog spray.

c) Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch lap over adjacent absorptive covers.

2. Provide moisture-retaining cover curing as follows:

a) Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by

waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. As soon as initial set has occurred, place a soil soaker hose along the tops of all walls to keep concrete forms wet during the curing period. If forms are removed, continue curing by methods specified above, as applicable, for the remainder of the curing period. If forms are removed before the end of the curing period, then the concrete shall be continuously moist for the remainder of the curing period by fog spraying or covering with moist burlap.

4. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping and other flat surfaces, by applying the appropriate curing method.

5. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.09 SHORES AND SUPPORTS

A. General: Comply with ACI 347 for shoring and reshoring in multistory construction, and as specified.

B. Extend shoring from ground to roof for structures four (4) stories or less, unless otherwise permitted.

C. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.

D. Keep reshores in place a minimum of fifteen (15) days after placing upper tier, or longer, if required, until concrete has attained its required twenty-eight (28) day strength and heavy loads due to construction operations have been removed.

3.10 REMOVING FORMS

A. Formwork, such as columns, beam soffits, elevated slabs, joists, walls and other structural elements, may not be removed until concrete has attained at least seventy percent (70%) of design minimum compressive strength at twenty-eight (28) days. No earth loads or live loads will be structurally placed against or on any poured structurally reinforced concrete until the concrete has reached its twenty-eight (28) day compressive strength or otherwise approved by the Engineer. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

B. Form-facing material may be removed four (4) days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.11 REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Engineer.

3.12 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Engineer.

B. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

C. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

E. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets and other objectionable conditions.

F. Correct high areas in unformed surfaces by grinding after concrete has cured at least fourteen (14) days.

G. Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Engineer.

H. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

I. Additional repair of concrete cracks in formed and unformed surfaces: All concrete for liquid retaining structures, elevated slabs subject to rainfall and washdown, below grade members and all concrete in contact with earth, water or exposed directly to the elements shall be watertight. All leaks through concrete that exhibit any dampness or flowing water and any cracks, holes or other defective concrete in areas

of potential leakage, shall be repaired and made watertight by CONTRACTOR. Where it is not possible to verify that a crack is not leaking, it shall be repaired. Determination of leakage and / or dampness shall be made by Engineer. Repair, removal, and replacement of defective concrete as directed by ENGINEER shall be at no additional cost to the OWNER.

1. Method of Repair: Cracks shall be pressure grouted using hydrophilic resin. Apply in accordance with the manufacturer's directions and recommendations.

3.13 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Contractor will employ a testing agency to perform tests and to submit test reports. The testing agency shall be approved by the Engineer. Any retesting due to non-acceptable work or materials shall be at the Contractors expense.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Engineer.

C. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

D. Slump: ASTM C 143; one (1) test at point of discharge for each compressive strength test; additional tests when concrete consistency seems to have changed or as directed by the Engineer.

E. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one (1) for each compressive strength test.

F. Concrete Temperature: ASTM C 1064; one (1) test hourly when air temperature is 40 °F and below, when 90 °F and above, and one (1) test for each set of compressive-strength specimens.

G. Compression Test Specimen: ASTM C 31; one (1) set of four (4) standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

H. Compressive-Strength Tests: ASTM C 39; one (1) set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd.

of each concrete class placed in any one (1) day; one (1) specimen tested at seven (7) days, two (2) specimens tested at twenty-eight (28) days, and one (1) specimen retained in reserve for later testing if required.

I. When frequency of testing will provide fewer than five (5) strength tests for a given class of concrete, conduct testing from at least five (5) randomly selected batches or from each batch if fewer than five (5) are used.

J. When strength of field-cured cylinders is less than eighty-five percent (85%) of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

K. Strength level of concrete will be considered satisfactory if averages of sets of three (3) consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

L. Test results will be reported in writing to Engineer, ready-mix producer, and Owner within twenty-four (24) hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at twenty-eight (28) days, concrete mix proportions and materials, compressive breaking strength, and type of break for both seven (7) day tests and twenty-eight (28) day tests.

M. Nondestructive Testing: Impact hammer, sonoscope or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

N. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. These additional tests shall be at the Contractor’s expense.

END OF SECTION

SECTION 03455

PRECAST CONCRETE MANHOLES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all materials, labor and equipment and construct manholes consisting of precast sections as shown on the Drawings and as specified herein.

B. The manholes shall have an invert channel shaped to correspond with the lower half of the pipe. The top of the shelf shall be sloped to drain toward the flowing channel. Every effort shall be made by the Contractor to construct watertight structures. Structures that are not watertight or do not meet the requirements of ASTM C-433 are unacceptable.

C. The forms, dimensions, concrete and construction methods shall be available for inspection by the Owner's Representative in advance of construction. The Owner's Representative shall reserve the right to inspect the facilities of the manufacturer.

D. Flexible gasket connectors for connecting pipes shall meet the requirements of ASTM C-443 or latest revision, and are required in all manholes.

E. Lifting devices shall not penetrate the walls of the manholes.

1.02 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

B. Submit shop drawings showing details of construction, reinforcing, joints, buoyancy calculations openings and all other specified details.

1.03 INSPECTION

A. The quality of all materials, the process of manufacture and the finished sections shall be subject to inspection and approval by the Owner's Representative. Such inspection may be made at the place of manufacture, and/or at the site. Wherever possible, the precast sections shall be inspected prior to unloading from the delivery truck and marked by the inspector showing

acceptance or rejection. However, discovery at any time of failure to meet requirements of these Specifications is cause for rejection.

B. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job site at once. All sections which are damaged after delivery, will be rejected and if already installed, shall be acceptably repaired, if permitted, or removed and replaced entirely at the Contractor's expense, as determined by the Owner’s Representative.

C. All sections shall meet the manufacturing tolerance requirements of ASTM C-478 or the following casting tolerances, whichever are more severe:

Wall Thickness	± 3/8"
Inside Diameter	± 3/8"
Outside Diameter	+ 1/2"
Height or Length	+ 3/8"

D. Pipe openings shall meet the recommended tolerances of the individual manufactured pipe to manhole connectors; however, the horizontal location shall be within ± 2 degrees of arc of that detailed on shop drawings.

E. At the time of inspection, the sections will be carefully examined for compliance with ASTM C478 latest revision, these Specifications and the approved manufacturer's drawings. All sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

F. Imperfections may be repaired subject to the approval of the Owner’s Representative after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at 7 days and 5,000 psi at 28 days. Epoxy mortar may be utilized for repairs subject to the approval of the Owner’s Representative.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE SECTIONS

A. General

1. Except as modified in the Specifications, manholes shall meet the requirement of ASTM C478, most recent revision, Specification for Precast Reinforced Concrete Manhole Sections. Cement shall meet the requirements of ASTM C150, or most recent revision, Specification for Portland Cement, Type II. Concrete shall have a compressive strength of 4,000 psi. Minimum wall thickness for manholes shall be 8" or 1/12 the inside manhole diameter, whichever is greater. Sections shall be custom made with openings to meet indicated pipe alignment conditions and invert elevations. Contractor shall submit shop drawings, consisting of manufacturer's standard details of various sections, for approval prior to manufacture. Drawings of individual manholes showing invert elevations, pipe sizes and similar details are required. Manufacturer shall submit concrete mix designs together with certified test results for the Engineer's review prior to commencing manufacture.

2. Manufacturer shall make a minimum of four standard test cylinders for each 100 cubic yards of concrete (or part thereof) that is cast each day. These test cylinders, along with sections cast that day, shall be marked in such a way that the test results can be matched with the appropriate castings. Two cylinders shall be cured with the product until the forms are stripped. At this time, one cylinder shall be broken to ascertain that a minimum strength of 2000 psi has been reached prior to moving the product from the forming location. The remaining two cylinders shall be cured and tested in accordance with ASTM C192-81 and C39-84. The average compressive strength for each day's production shall be greater than 4000 psi with no more than 10% of the tested cylinders falling below 4000 psi. In no case shall any cylinder strength fall below 3500 psi. All cylinder strengths shall be certified by a Florida Licensed Professional Engineer. Failure to meet these requirements for any day's production is cause for rejection of all sections cast that day.

B. Joints

1. Form joint contact surfaces with machined castings. Surfaces shall be parallel and the tongue equipped with a proper recess for the installation of a rubber gasket. Gaskets shall meet the requirements of Specifications for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (ASTM C-443). In addition to this rubber gasket joint, the installation contractor may, at his own choice, add an exterior seal such as "Waterstop Rx", "Adeka Ultra Seal" or "Cadilloc Sealing Bands".

C. Masonry for Grade Adjustment

1. Precast grade rings or brick shall be used for final grade adjustment. Bricks shall be wetted prior to laying. Bricks shall be set true to line with each coarse plumb. No mortar shall be used which has begun to set. The grade rings or bricks used on manholes with fiberglass linings shall also be protected in the same manner.

D. Masonry

1. Brick: ASTM C32 most recent revision, Specification for Sewer and Manhole Brick (made from clay or shale). Sound, hard and uniformly burned, regular and uniform in shape and size of compact texture. Grade MA.

2. Cement: Portland, ASTM C150-180 most recent revision, Specification for Portland Cement, Type II. Approved: Atlas Florida; Lehigh.

3. Sand: Washed silica sand, ASTM C144, latest revision. Specification for Aggregate for Masonry Mortar.

E. Invert Construction

1. Inverts: Use precast preformed inverts from the manufacturer constructed specifically for each manhole or form with Type II cement and sand mortar and brick to provide a smooth flowing channel of similar shape and size of the sewer to which it connects.

2. Straight Run Manholes: Shape inverts while manholes are under construction. Cut off pipe at inside face of manhole and construct invert to exact shape and size of pipe indicated.

3. Junction Manholes: Shape inverts while manholes are under construction. Cut off pipe at inside face of manhole and construct invert to shape and size of pipe indicated. All inverts shall follow grades of pipes entering manholes. Provide a true curve of the largest radius possible for changes in direction of sewer and entering branch or branches.

F. Manhole Frames and Lids

1. ASTM A48 most recent revision, Specification for Gray Iron Castings, Class 30 or Grade 60-45-10 Ductile Iron meeting the requirements of ASTM A536 most recent revision, Specification for Ductile Iron Castings. Cast in a true symmetrical pattern of tough, dense and even grained iron, free from warping, scales, lumps, blisters, sandholes, or any defects of any kind. Provide indented pattern lids with lettering as shown on the Drawings. Machine or grind frames and lids at touching surfaces to provide firm seats and prevent rocking. Remove and replace any set not matching perfectly. All frames and covers shall be designed to withstand an HS20-44 wheel loading as defined by AASHTO specifications.

G. Protective Coating

1. A coal tar epoxy protective coating shall be applied to interior and exterior walls of manholes. Two coats shall be applied to the inside, and one coat shall be applied to the outside. Each coat shall yield a final dry film thickness of 9 mils. Coating shall be Tnemec Polyamide Epoxy-Coal Tar 46H-413, or approved equal.

2. The Plant Drain Pump Station wetwell exterior walls shall be coated with 9 mils DFT of coal tar epoxy. The interior walls, floor and ceiling shall be coated with aliphatic amine epoxy mortar per Section 09900 of the specifications.

PART 3 MANHOLE CONSTRUCTION

3.01 PRECAST CONCRETE MANHOLE INSTALLATION

A. Precast concrete sections shall be set vertical and in true alignment. Rubber gaskets shall be installed in the previously set sections. All manholes shall meet the following installation tolerances:

1. The finished manholes shall not be out of plumb by more than 3/8" per 10 feet of height. For manholes

exceeding 40'-0" high, the variation from plumb shall not exceed 1-1/2".

2. Any jog or offset of wall surface each side of a joint shall not exceed 1/2".

3. Variation in the joint width around the circumference of the manhole shall not exceed 3/8".

4. Lifting holes in the concrete sections required for handling or other purposes shall be plugged with a non-shrink grout or by grout in combination with concrete plugs.

3.02 GRADE ADJUSTMENT

A. Brick masonry shall be erected or precast concrete grade rings shall be set on top of manhole slabs and precast concrete manhole cones to provide grade adjustment in setting manhole frames.

3.03 SETTING MANHOLE FRAMES

A. Manhole frames and lids shall be set to conform accurately to the finished ground or pavement grade as shown on the Drawings or as directed by the Owner's Representative. Frames on manholes shall be set concentric with the masonry and in a full bed or mortar so that the space between the top of the manhole masonry and the bottom flanges of the frame will be completely filled and made watertight. A ring of mortar shall be placed around the outside of the bottom flange at least one inch thick and pitched to shed water away from the frame. Mortar shall be extended to the outer edge of the masonry and finished smooth and flush with the top of the flange.

3.04 TESTING

A. After construction to its finished height and before being backfilled, each manhole shall be tested for water tightness in one of the following manners:

1. Plug holes and fill the manhole with clean water. After eight hours, the water level shall be checked for loss of water. This loss shall not exceed 0.05 gals/hr/ft.dia/ft. head and for a 4'-0" diameter manhole, the allowable level change is shown in the following table:

Allowable Drop in Water Level
of 4'-0" Dia. Manholes

Head of Water Ft.	Level Drop Inches
4	0.8
5	1.0
6	1.2
7	1.4
8	1.6
10	2.0
12	2.45
16	3.3
20	4.0
24	4.9

2. Plug pipe lines and perform vacuum test. Observing all recommended safety measures induce a backpressure of 5.0 p.s.i. equivalent to 10" Hg (mercury). The manhole assembly is considered satisfactory if the vacuum loss is less than 1" Hg for the length of time listed in the following table:

Time of Test in Seconds

Depth Feet	Manhole Diameter Feet 4	5	6
4	10	13	16
8	20	26	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
T	5	6.5	8

Note: Add "T" seconds for each additional 2'-0" of depth.

B. Failure to pass one of these tests requires the contractor to correct the problems and retest. The Contractor will replace leaking gaskets and/or concrete sections and retest the completed manhole. No manhole will be accepted without successfully passing one of these tests.

3.05 CONNECTION TO EXISTING MANHOLES

A. The Contractor shall connect, where shown on the Drawings or directed by the Owner’s Representative, new lines into existing manholes. Unless existing stubs of correct size and location are found to exist, he shall remove a portion of the manhole wall masonry. All new piping entering existing manholes shall be accomplished

by mechanical rotary core boring of the manhole riser. After installation of piping, the annular space between piping and concrete shall be sealed with "Link-Seal" "Thunderline Seals" or approved equal.

END OF SECTION

SECTION 03600

GROUTING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes grouting of equipment bases and such locations as shown on the Drawings and as specified.

B. The types of grouting include the following:

1. Portland Cement Grout

2. Non-shrink, Non-expanding Grout

1.02 DELIVERY AND STORAGE

A. Prevent damage to or contamination of grouting materials during delivery, handling and storage.

B. Store all grouting materials in undamaged condition with seals and labels intact as packaged by the manufacturer.

1.03 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

PART 2 PRODUCTS

2.01 PREMIXED GROUTS

A. Portland Cement Grout

B. (For grouting CMU cells and similar items – f’c=3000 psi minimum)

1. Portland Cement: ASTM C150, Type I

2. Sand: ASTM C33, Fine Aggregate

3. Water: Potable

4. Pea Gravel: ASTM C33. Coarse aggregate, graded so that at least 90% passes 3/8-inch sieve and 90% is retained by a number 4 sieve.

C. (Grout Mortar for use as fillets and leveling)

1. Portland Cement: ASTM C150, Type I

2. Sand: ASTM C33, Fine Aggregate (Marson's sand)

3. Water: Potable

4. Mix 1-part Portland cement to 3-parts sand.

D. Pre-Mixed non-shrink, Non-expanding Grout (Nonmetallic). Non-shrink grout as shown on the Drawings shall be a mixture of selected silica sands, Portland cement, water reducing agents, plasticizing and shrinkage compensating agents. Grout shall be nonmetallic non-corrosive, non-staining and comply with CRD-C-588, Type D.

E. The grout shall be non-shrink in accordance with ASTM C827, ASTM C191, and ASTM C109. The water-grout ratio shall be approximately 8 to 10 quarts of water per cubic foot of grout adjustable for varying job conditions.

F. Grout shall not contain calcium chloride or other salt; aluminum or other metals; chemical additives, gypsum or expansive cements. Grout shall not expand after set.

G. Grout shall be used and applied in accordance with the manufacturer's written instructions.

H. Subject to compliance with requirements provide from the following:

1. L&M Construction Chemicals, Inc. – Crystex

2. Grout Corp. - Five Star Non-shrink Grout or equivalent

2.02 NONSHRINK GROUT

A. Non-shrink grout shall conform to the following requirements:

1. Manufactured under rigid quality control specifically for grout used in transferring heavy loads.

2. Contain nonmetallic aggregates specially graded to minimize bleeding.

3. Have an initial setting time of approximately one hour at 70°F.

4. Produce no settlement or drying shrinkage at 3 days or later.

5. Have higher strength at all ages than plain cement grout of the same flowability.

6. Resist attack by oil and water and have lower absorption than plain cement grout of the same flowability.

7. Minimum compressive strength, in accordance with ASTM C-109, shall be 2500 psi after 1 day and 7000 psi after 28 days.

2.03 MIXES

A. For less than 2-inch clearance, or where size or shape of space makes grouting difficult, grout mix shall consist of Portland cement, fine aggregate and water.

B. For greater than 2-inch clearances where coarse aggregate will not obstruct free passage of the grout, extend grout by adding 50 pounds of pea gravel per 100 pounds grout material.

C. Use minimum amount of water necessary to produce a flowable grout without causing either segregation or bleeding.

D. Portland cement mortar for raked-out edges of non-shrink grout: one part Portland cement, two parts sand and 0.50 part water by weight.

2.04 MIXING

A. Mix grout in accordance with manufacturer’s printed specifications.

B. Mix grouting materials and water in a mechanical mixer for no less than 3-minutes.

C. Mix grout as close to the work area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials.

D. After the grout has been mixed, do not add more water for any reason.

PART 3 EXECUTION

3.01 PROCEDURES

A. Installation methods and procedures shall be approved by Engineer and shall be in accordance with manufacturer’s printed specifications before work is begun.

3.02 SURFACE PREPARATION

A. Surface preparation shall be in accordance with manufacturer’s printed specifications.

B. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by bush-hammering, chipping, or other similar means, until a sound, clean concrete surface is achieved.

C. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout. Cover concrete areas with waterproof membrane until ready to grout. Immediately before grouting remove waterproof membranes and clean any contaminated surfaces.

D. Remove foreign materials from metal surfaces in contact with grout. Align, level and maintain final positioning of all components to be grouted.

E. Saturate concrete surfaces with clean water; remove excess water and leave none standing.

3.03 PLACING

A. Placing shall be in accordance with manufacturer’s printed specifications.

B. Place non-shrink grouting material quickly and continuously by the most practical means permissible; pouring, pumping or under gravity pressure.

C. Do not use either pneumatic-pressure or dry packing methods without written permission of the Engineer.

D. Apply grout from one side only to avoid entrapping air.

E. Final installation shall be thoroughly compacted and free from air pockets.

F. Do not vibrate the placed grout mixture or allow it to be placed if the area is being vibrated by nearby equipment.

G. Do not remove leveling shims for at least 480 hours after grout has been placed. After shims have been removed, fill voids with plain cement-sand grout.

H. After non-shrink grout has reached initial set, rake out exposed edges approximately 1-inch into the grouted area and paint with Portland cement mortar.

3.04 CURING

A. Cure grout for 3-days after placing by keeping wet and covering with curing paper or by another approved method.

END OF SECTION

SECTION 03900

HYDRAULIC STRUCTURES TESTING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope

1. The Contractor shall perform cleaning, flushing and testing for all hydraulic structures in accordance with the requirements of the Contract Documents.

2. The Work shall include all labor and materials required to prepare a structure for testing and to convey reclaimed water to the point of use from the source designated by Owner, and all labor and materials required to drain, and dispose of reclaimed water used for testing.

B. Related Divisions and Sections

1. Section 03300 – Cast-In-Place Concrete

1.02 QUALITY ASSURANCE

A. Reference Standards: Comply with the applicable provisions and recommendations of the following unless otherwise shown or specified.

1. ACI 350, Code Requirements for Environmental Engineering Concrete Structures and Commentary (ACI 350R).

1.03 CONTRACTOR SUBMITTALS

A. All submittals The Contractor shall submit a minimum fourteen (14) day advance written notice of the proposed testing schedule for a given structure for review and concurrence of the Engineer and Owner. The Contractor's proposed plans for water conveyance, control and disposal shall also be submitted in writing.

B. Contractor shall submit all testing data collected for each structure/cell tested in accordance with ACI 350 for approval.

C. All submittals for this Specification shall be in accordance with Section 01340 – Shop Drawings, Project Data and Samples.

PART 2 PRODUCTS

2.01 MATERIALS REQUIREMENTS

A. Temporary valves, bulkheads or other water control equipment and materials, shall be as determined by the Contractor subject to the Engineer's review. Cost of all materials required for testing, supply and discharge of testing water shall be included in the Base Bid.

PART 3 EXECUTION

3.01 GENERAL

A. Reclaimed water for testing will be furnished by the Owner. The Contractor shall make all necessary provisions for conveying the reclaimed water from the source to the points of use.

B. All hydraulic structures and appurtenant pressure piping connections shall be tested.

C. Concrete coatings, paint and/or liners shall not be applied until all leak testing operations have been completed and the structure is accepted.

D. Release of water from structures, after testing has been completed, shall be as approved by the Engineer. Discharge location shall be approved by Owner.

E. Clean structures after testing and prepare substrates for coating installation in accordance with relevant specification sections.

3.02 LEAKAGE TESTING OF HYDRAULIC STRUCTURES

A. Analysis of data from leakage tests of hydraulic structures will be performed by the Contractor following the requirements of ACI 350, ACI 350R and as

specified herein. The Contractor shall supply all materials and labor as needed to assist the Engineer in obtaining data from the test.

B. Prior to the start of leakage testing, the following requirements shall be met.

1. All elements of the structure that resist any portion of the retained liquid pressure shall be in place and at specified strength levels. All concrete shall be fully cured.

2. Structure walls shall not be backfilled prior to leakage testing.

3. All valves, gates, blind flanges and other non-concrete items that control the flow of, or otherwise retain the liquid contents of the structure, shall be checked for water-tightness. If not watertight, means shall be taken to assure water-tightness during the period of the leakage test.

4. The portions of the structure to be tested shall be cleaned of all construction debris and other foreign materials.

5. Defective concrete shall be repaired.

6. Standing water, soil, construction materials and any other material that interferes with the exposed concrete surfaces of the structure shall be removed.

7. The Contractor shall notify the Engineer and Owner a minimum of seventy-two (72) hours prior to start of filling of structure for leakage testing. Leakage testing shall not start until the structure is inspected by the Engineer.

8. The structure shall be tested prior to the application of all coating systems and the installation of masonry block veneer, if applicable.

C. The following special requirements apply:

1. All structures which contain basins, channels and/or chambers that are independent or are separated by a common wall shall be tested independently unless otherwise agreed to by Engineer. All leakage occurring between/through common walls shall be repaired in addition to all other repair requirements.

2. Each influent, effluent or overflow trough shall be tested independently.

D. Filling Structure with Reclaimed Water:

1. The portion of the structure to be tested shall be filled at a rate not to exceed 2 feet per hour.

2. Structure shall be filled to the normal operating depth of the structure as indicated on the Contract Drawings. Where no operating depth is indicated or where operating depth is controlled by flowing over a weir, the structure shall be filled to a depth 6 inches below the weir or top of wall elevation, whichever is lower.

3. Reclaimed water in the structure shall be maintained at the specified test elevation for a minimum of three (3) days.

E. After reclaimed water has been brought to the test elevation, the exposed elements of the structure shall be inspected for leakage. All locations that exhibit any amount of leakage flow or dampness shall be repaired prior to the start of leakage testing. Dampness is defined as any visible water staining the following:

1. At Exterior Walls – the exterior sides of the walls.

2. At Interior Walls – the opposite sides of the walls containing the water.

F. Leakage test duration shall be determined by the Engineer based on ACI 350.1R but shall not be less than three (3) days.

G. Leakage Allowance:

1. For concrete structures, the maximum allowable leakage rate shall be 0.075 percent of the volume per twenty-four (24) hour period.

H. Test Locations:

1. Structure cells which are less than 1000 square feet in area shall have measurements of water level taken at two (2) locations that are located approximately 180 degrees apart.

2. Structure calls which are greater than 1000 square feet in area shall have measurements of water level taken at four (4) locations that are located approximately 90 degrees apart.

3. Each test location shall be marked and given a reference number. A reference point shall be marked on the face of the wall above the test water surface in a manner that will prevent its movement or deterioration during the period of the test.

I. Evaporation and Precipitation Measuring:

1. In open structures, a clear plastic calibrated open top container not less than 18 inches in diameter and depth shall be partially filled, floated in the tank, and held in position near each measurement location.

2. The container shall be located so as to not be shaded by tank walls and away from any items passing over it such as beams or pipes.

J. Test Measurements:

1. Leakage tests shall not be started when periods of severe weather conditions or major changes in average daily temperature are predicted.

2. The following measurements shall be recorded at each test location at the start of the test

period and at twenty-four (24) hour intervals thereafter.

a) Distance from reference point to test water surface.
b) Depth of reclaimed water in the floating container.

c) Temperature of the test reclaimed water at 18 inches below water surface.

d) Temperature of the reclaimed water in the evaporation-precipitation container at mid-depth.

K. Leakage Determination:

1. The change in water surface elevation at each test location shall be averaged and adjusted as follows:

a) The total change in test water surface elevation shall be adjusted by the average change in water surface elevation in the evaporation-precipitation containers.

b) Where averaged water temperature measurements vary by more than 3 degrees from start to completion of the test period, adjustment in tank volume shall be determined by change of water density resulting from the change in the average water temperature.

L. Retesting:

1. The leakage test shall be considered as failed if the specified leakage allowance is exceeded or if any leakage or dampness is observed.

2. If the test becomes unreliable due to excessive precipitation or other external factors, it shall be restarted.

3. If a leakage test fails, it may be retested immediately without repairs if approved by the Engineer. If subsequent leakage tests fail, the Contractor shall repair all probable areas of leakage and the leakage test shall be repeated until it meets the specified leakage criteria.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Metal fabrications include items made from iron, steel or aluminum shapes, plates, bars, strips, tubes, pipes and castings which are not specified elsewhere.

B. Extent of metal fabrications is indicated on the drawings or as required to complete the work.

1.02 RELATED SECTIONS

A. Painting metal items is specified in Section 09900 – Painting and Coatings.

1.03 TYPES OF WORK

A. Types of work in this section include metal fabrication for:

1. Miscellaneous framing and supports

2. Miscellaneous castings

3. Floor drains

4. Fasteners

1.04 SHOP ASSEMBLY

A. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.05 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

B. Product Data: Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

C. Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications including but not limited to rain diverters and prefabricated steel tank cradles. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others.

PART 2 PRODUCTS

2.01 ALUMINUM STAIRS

A. Stairs shall be of aluminum construction with stringers and treads as shown. Treads shall have non-skid surface with abrasive nosing.

2.02 FERROUS METALS

A. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled names and roughness.

B. Steel Plates, angles, channels and Bars: ASTM A 36. Item requiring to be galvanized to be Hot Dipped Galvanized - 2 Oz. Per SF.

C. Wide Flange Sections: ASTM A 572 (Fy=50 ksi).

D. Steel Tubing: Cold-formed, ASTM A 500, Grade B (Fy=46 ksi).

E. Steel Pipe: Standard weight Schedule 40, ASTM A53, Grade B (Fy=35 ksi).

F. Gray Iron Castings: ASTM A 48, Class 30.

2.03 ALUMINUM METALS AND FABRICATIONS

A. Miscellaneous Aluminum: ASTM B 221, Alloy 6063.

Plate and Sheet	ASTM B209	6061-T6	T651 Alloy
Structural Shapes	ASTM B308	6061-T6	Alloy
Extruded Shapes	ASTM B221	6061-T6	
Castings	ASTM B108		214 Alloy

2.04 FASTENERS

A. Provide Type 316 stainless steel fasteners for all exterior and interior work unless otherwise shown or specified.

B. Bolting

1. Either

a) Bolts - Astm A193 Grade B8

b) Nuts - Astm A194 Grade M

2. Or

a) Bolts - Astm 276 Type 316 Stainless Steel

b) Nuts - Astm 276 Type 316 Stainless Steel

2.05 GALVANIZING

A. Galvanizing

1. Shapes ASTM A-123 2.0 OZ/SF

2. Hardware ASTM A-153 2.0 OZ/SF

B. STAINLESS STEEL

1. STAINLESS SHAPES ASTM A276 TYPE 316

2. STAINLESS PLATE ASTM A240 TYPE 316

2.6 FABRICATION, GENERAL

A. Workmanship: Use materials of size and thickness indicated, or if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of work.

B. Aluminum fabrication shall be in conformance with the Aluminum Association, Inc. "Specifications for Aluminum Structures".

C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed

welds smooth and flush to match and blend with adjoining surfaces.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners whenever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts.

E. Provide for anchorage of type indicated, coordinated with supported structure. Fabricate and space anchoring devices to provide adequate support for intended use.

F. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

G. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

H. Surface Preparation: Prepare ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications, unless otherwise specified.

1. Exterior (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning".

2. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning".

I. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work.

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

A. Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or

masonry construction. Coordinate delivery of such items to project site.

3.02 TOUCH-UP PAINTING

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paints, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. All aluminum surfaces to come in contact with concrete or dissimilar metals shall be coated with a minimum two coats of bituminous paint.

END OF SECTION

SECTION 05520

HANDRAILS AND GUARD RAILS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes providing handrails and guard rails as shown on the Drawings and includes miscellaneous handrails and guard rails not included in other metal systems in other sections of these specifications.

B. Height for stair rails, handrails, and guard rails shall conform to all applicable codes.

C. Handrails and guard rails used to extend existing facilities shall match the existing as closely as possible unless noted otherwise.

1.02 QUALITY ASSURANCE

A. Codes and Standards:

1. Florida Building Code, latest version

2. ANSI A117.1

3. OSHA Part 1920.23 and 1910.24

4. Life Safety Code 101

5. AWS "Structural Welding Code"

B. Qualification for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

C. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. However, do not delay job process; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the work.

D. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for

shipping and handling limitations. Clearly mark units for reassembly and coordinate installation.

1.03 SUBMITTALS

A. Submit Certificates of Compliance with specified requirements. Obtain shop drawings for fabrication and erection. After verifying details and dimensions provide three sets of final drawings and installation instructions to Engineer for use in observing installation and for Record Drawings.

B. All submittals for this Specification shall be in accordance with Section 01340 – Shop Drawings, Project Data and Samples.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aluminum Extrusions: ASTM B221-76; alloy 6061-T6, T6510; except alloy 6061-T6 for pipe; unless otherwise indicated.

B. Aluminum Castings: ASTM B108-76; alloy 214 unless otherwise indicated.

C. Aluminum Sheet or Plate: ASTM B209-76; alloy 6061-T6, unless otherwise indicated.

D. Finish: Clear anodized finish AA C22A41R1X, medium matte, nondirectional, minimum 0.7 mil clear anodized, clear lacquer coating, unless otherwise indicated.

E. Nonshrink, Nonferrous Grout: CE CRD C588.

2.02 FABRICATION

A. The Contractor shall provide a "manufacturer's system" using welded connections.

B. Exposed work shall be formed true to line and level with accurate angles and surfaces and straight sharp edges.

C. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise shown.

D. Use bent-metal corners formed to the smallest radius possible without causing grain separation or otherwise impairing the work.

E. Welded Connections: Cope intersections of rails and posts, weld joints and grind smooth. Butt weld end-to-end joints of railings or use welding connectors, at fabricator's option.

F. Weld corners and seams continuously and in accordance with the recommendations of AWS. Grind exposed welds smooth and flush to match and blend with adjoining surfaces. Discoloration of finished surfaces will not be acceptable.

G. Form exposed connections with flush, smooth, hairline joints, using concealed fasteners wherever possible. Use exposed fasteners of the type shown, or if not shown, use Phillips flathead (countersunk) screws or bolts.

H. Provide anchorage of the type shown, coordinated with the supporting structure. Fabricate and space anchoring devices as shown and as required to provide adequate support.

I. Toe Boards: Fabricate toe boards to the dimensions and details shown. If not shown, use 1/4-inch thick x 4-inch plate secured to each post of railing.

J. Brackets, Flanges and Anchors: Provide brackets, flanges, and anchors for railing posts and for handrail supports. Furnish inserts and sleeves as required for anchorage masonry work.

K. Furnish cast metal brackets, flanges, and exposed anchors of the same material and finish as rail supports, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which handrails and guard rails are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Furnish setting drawings, diagrams, templates, instructions and directions for the installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors which are to be embedded in concrete or masonry construction. Coordinate the delivery of such items to the project site.

3.03 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing handrails and guard rail items to in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as required.

B. Use railing manufacturer's standard methods of installation when acceptable to the Engineer.

C. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

D. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Grind joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surface of units which have been coated or finished after fabrication, and are intended for field connections. Adjust railings prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than 6-feet on centers, unless otherwise shown. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

E. Anchor posts in concrete by means of pipe sleeves set and anchored into the concrete. Provide sleeves of galvanized, steel pipe, not less than 6-inches long and having an inside diameter not less than 1/2-inch greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to the bottom of the sleeve and of width and length not less than

1-inch greater than the outside diameter of the sleeve. After the posts have been inserted into the sleeves, fill the annular space between post and sleeve solid with nonshrink, nonferrous grout. Cover anchorage joint with a round metal flange finished to match post.

F. Anchor rail ends into concrete and masonry with round flanges welded to rail ends and anchored into the wall construction with lead expansion shields and bolts.

G. Field Welding: Comply with AWS Code for the procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting the work.

H. Dissimilar Materials: Where dissimilar metals contact each other or there is a condition such as aluminum against concrete, they shall be protected from each other with a pressure sensitive tape, bitumastic coating or other protective method.

I. Toe Boards: Provide toe boards where shown and as required by code.

J. Toe boards shall be provided wherever people can pass or work beneath the open sides or wherever falling material could create a hazard to moving machinery or equipment.

END OF SECTION

SECTION 05532

ALUMINUM GRATING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of aluminum grating shall include all necessary fasteners and accessory items to make a complete system.

1.02 QUALITY ASSURANCE

A. Codes and Standards: Provide the aluminum grating to conform to the following codes and standards per current edition:

1. ASTM B 221: Specification for Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

2. ANSI/NAAMM MBG 531: Metal Bar Grating Manual

3. ASTM E-448: Test Method for Strength of Anchors in Concrete and Masonry Elements

4. ASCE 7: Minimum Design Loads for Buildings and Other Structures.

5. AWS D1.2: Structural Welding Code - Aluminum

1.03 SUBMITTALS

A. Submit manufacturer's specifications, load tables, dimensions, diagrams, anchor details and installation instructions in accordance with Section 01340 – Shop Drawings, Project Data and Samples.

B. On request, furnish reports of load versus deflection tests conducted on assembled grating panels. Such tests shall be certified by an independent, nationally recognized testing laboratory.

C. Shop Drawings: Submit shop drawings for the fabrication and erection of all assemblies of work which are not completely shown by the manufacturer's data sheets. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.

1. Include setting drawings and templates for location and installation of items anchorage devices.

1.04 JOB CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. However, don't delay job progress; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the work.

B. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units as the project site Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.05 WARRANTY/GUARANTEE

A. Manufacturer's Standard Warranty: The grating sections shall be free of defects in material and workmanship for one year from date of shipment. If the materials are defective, the manufacturer shall repair or replace them at no additional cost.

PART 2 PRODUCTS

2.01 ALUMINUM GRATING

A. The Aluminum Grating design shall be manufactured with alloy 6063-T6.

B. The bar grating size shall be as noted on the construction drawings.

C. Walking Surface Finish: The grating surface shall have a plain fluted pattern surface.

D. Color: The grating color shall be natural aluminum.

2.02 ACCESSORIES

A. Fastener: Provide stainless steel fasteners with hold down clips for sectional and frame attachment with stainless steel Allen wrench screw type by the manufacturer.

B. Frame: Provide where required extruded aluminum alloy 6063-T6 frame by the grating manufacturer. The frame finish shall match that of the specified grating.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify that the grating installation will not disrupt other trades and verify that the substrate is clean and free of foreign matter. Correct all defects prior to installation.

3.02 INSTALLATION

A. General: Install the grating in accordance with the project drawings, specifications, approved shop drawings, and manufacturer’s installation standards.

B. Grating panels shall be fabricated to be square within manufacturer’s tolerances and free from warping and any defect that may affect serviceability and reliability.

C. Install the grating with a min. 1-1/2 inch bearing surface at the frame or support ends. The grating shall be fastened to the frame or support substrate using fasteners and clips supplied by the grating manufacturer. Fastening shall be consistent with the manufacturer’s instructions.

D. Tolerances between sections shall not exceed the dimensional spacing of the grating style type. Adjacent sections shall line up to form an uninterrupted straight line, where possible.

E. Grating sections shall be installed to be removable unless indicated otherwise.

F. Openings may be field cut by the installer where indicated to permit field installation of wiring, equipment, piping, etc. All rectangular cutouts shall be made to the next bearing section past the obstruction. The cutout clearance to obstruction from the edge of the grating shall be no larger than 2 inches. Cutouts may be done in the field (unless otherwise requested), however weld a rectangular band bar of the same material and height of the bearing bars along the edge of the cut out.

END OF SECTION

SECTION 09900

PAINTING AND COATINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work includes furnishing all plant, labor, materials and equipment required to complete the painting and coatings as indicated on the Drawings and in these specifications.

B. Surface preparation, paint and coatings materials, and their application shall be as recommended by the coating manufacturer and approved by the Engineer. The Contractor shall take all health and safety precautions necessary to prevent accidents during the storage, handling, application, and drying of any of the coatings described.

C. Paints and coatings used to furnish the surfaces of structures or vessels which come into contact with potable water shall meet the applicable requirements of the County Health Department and the State Department of Environmental Protection or other regulatory agencies having jurisdiction.

D. Related Work Specified Elsewhere:

1. Section 09902 - Pipe and Equipment Painting

1.02 QUALITY ASSURANCE

A. The Contractor is responsible for a satisfactory paint application which will adhere without peeling, flaking, blistering or discoloration. Before application of any painting materials, the Contractor shall submit a letter of Certification from the manufacturer of the materials selected for the application proposed.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are limited to the following:

1. Ameron - Corrosion Control Division

2. Carboline Company

3. Rust-Oleum Corporation

4. Tnemec Company, Inc.

5. Kerneos, Inc.

6. Raven Lining Systems

1.03 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

B. Data Sheets and Color Charts:

1. The full name of each product and descriptive literature shall be submitted along with a list of water and wastewater plants in Florida where the product has been used.

2. Within a minimum of 30 days prior to application of paints and coatings, the Contractor shall submit six sets of color charts and data sheets for selection by the Owner. Before work is commenced, the Contractor shall prepare samples as required until the color and textures are satisfactory to the Owner.

3. Resubmit samples as requested until required sheen, color and texture is achieved.

4. On 12-inch x 12-inch hardboard, provide two samples of each color and material, with texture to simulate finish conditions. On actual wood surfaces, provide two 4-inch x 8-inch samples for stained wood finish. On concrete Masonry, provide two 4-inch square samples of masonry for each type of finish and color, defining filler, prime and finish coats. On actual wall surfaces and other building components, duplicate painted finish of acceptable samples, as directed by the Engineer.

1.04 DELIVERY AND STORAGE

A. Deliver materials to job site in new, original, and unopened containers bearing manufacturer’s name, trade name, and label analysis. Store where directed in accordance with manufacturer’s instructions. All paint materials used on the job shall be kept in a single

place which shall be kept neat and clean. All oily rags, waste or debris shall be removed every night and all precautions taken to avoid the danger of fire.

B. Extra Stock: At the conclusion of the project, the Contractor shall provide the Owner with a minimum of one quart from each 50 gallons or fraction thereof for each paint system used on the project. The paint or coating container shall indicate the applicable paint system as indicated in these specifications.

1.05 JOB CONDITIONS

A. Painting or coating and finishing of interior and exterior items and surfaces, unless otherwise indicated:

1. Paint all new construction and portions of existing facilities disturbed by new construction.

2. Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated. If not designated colors will be selected by the Owner’s Representative from standard colors available for the coatings required.

3. Includes field painting of bare and covered pipes and ducts (including color coding), and hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work.

4. Painting shall be done at such times as the Contractor and Owner’s Representative may agree upon in order that dust-free and neat work be obtained. Painting shall be done strictly in accordance with the manufacturer’s instructions and shall be performed in a manner satisfactory to the Owner’s Representative.

5. ”Shop” painting as referred to defines the paint coat which shall be applied in the shop or plant immediately after manufacturer, fabrication or assembly and prior to shipment to the site of installation. “Field” painting defines the paint coats to be applied at the project site where the structure or equipment is completed, erected, or installed in place as specified.

B. Materials and Application:

1. Obtain painting materials from one manufacturer. Painting materials not obtainable from the prime manufacturer shall be obtained from a second source recommended by the prime manufacturer.

2. There shall be a perceptible difference in shades of successive coats of paint so that the application of successive coats of paint can be properly and uniformly spread and inspected. Pipes, sheet metal ducts and other metal items which are to be installed in inaccessible locations shall be painted prior to installation.

3. Each coat shall be allowed to dry for the period of time recommended by the manufacturer before the next coat is applied.

C. Equipment, Machinery, and Shop Fabricated Items:

1. Pumps, motors, machinery, equipment and other manufactured items shall have surfaces prepared, primed and finish-coated in accordance with the standard practice of the manufacturer. Finish coat colors shall be as approved by the Engineer.

2. Shop-fabricated items and components for field assembly shall have surfaces prepared and shop-primed. Finish coat colors shall be as approved by the Engineer. Items for submerged service shall be field sandblasted and primed per Paint System B-3.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS - ALL SYSTEMS

A. The film thickness designated and/or the number of coats to be applied shall not be decreased and shall be increased where required to meet other manufacturer’s recommendations.

B. There shall not be a change from the generic type of coating specified.

C. Manufacturer’s recommendations as to which finish coat should be used with a particular primer shall be observed. In all cases, the prime coat and finish coat shall be from the same manufacturer. All paint shall be mildew resistant.

D. Tnemec products are given as examples for a majority of painting and coating systems identified in the following paragraphs. The products of other manufacturer's (listed in Paragraph 1.02.B.) may be used as long as they are of the same quality and approved by the Owner's Representative.

2.02 GROUP A - CONCRETE AND MASONRY

A. System A-1. For use on above grade interior walls and ceilings and architectural surfaces not subject to high moisture, corrosion, splashing or fumes.

1. Surface Preparation: Level protrusions and remove mortar splatter from all surfaces. Allow new concrete to cure 28 days.

2. First Coat:

a) Concrete and dense block - Acrylic latex coating, matte finish, 2-3 mils of Tnemec 6 Tneme - Cryl, or Equal.

b) Lightweight or porous concrete block surfaces - two component, inorganic hybrid water-based epoxy, 80-110 S.F./Gal - Tnemec Surface Coat 54WB, or Equal.

3. Second Coat:

a) Concrete and dense block - Acrylic latex coating, semi-gloss type, minimum 2 mils dry thickness of Tnemec 1029 Enduratone, or Equal.

b) Lightweight or porous concrete block surfaces - acrylic latex coating, matte finish, 2-3 mils DFT, Tnemec 6 Tneme - Cryl, or Equal.

4. Third Coat:

a) Concrete and dense block - None.

b) Lightweight or porous concrete block surfaces - acrylic latex coating, semi-gloss type, 2-3 mils DFT, Tnemec 1029 Enduratone SG, or Equal.

B. System A-2. For use on above and below grade - interior walls, inside surfaces of tanks, ceilings, and non-traffic slabs, and subject to high moisture, corrosion,

splashing or fumes. Use for immersion and non-immersion exposures.

1. Surface Preparation:

   a) Concrete - Brush-off blast, to remove laitance, fines, curing compounds, form release oils, other contaminants, open up bugholes, and establish a surface profile equal to ICRI CSP 5. Re-surface concrete and fill voids and bugholes using Tnemec Series 218 MortarClad, applied @ 1/16".

   b) Concrete Block Surfaces - Clean and dry, level protrusions and remove mortar splatter from all surfaces.

2. First Coat:

   a) Concrete - Two-component, polyamidoamine cured epoxy, semi-gloss 4-6 mils DFT - Tnemec N69 HB Epoxoline II, or Equal.

   b) Concrete Block Surfaces - Two component, inorganic hybrid water-based epoxy, 80-110 S.F./Gal - Tnemec Surface Coat 54WB, or Equal.

3. Second Coat:

   a) Concrete- Two-component, polyamidoamine cured epoxy, semi-gloss 4-6 mils DFT - Tnemec N69 HB Epoxoline II, or Equal.

   b) Concrete Block- Two-component, polyamidoamine cured epoxy, semi-gloss 4-6 mils DFT - Tnemec N69 HB Epoxoline II, or Equal.

4. Third Coat:

   a) Concrete- NA

   b) Concrete Block- Two-component, polyamidoamine cured epoxy, semi-gloss 4-6 mils DFT - Tnemec N69 HB Epoxoline II, or Equal.

C. System A-3. For use on exterior walls above grade to a point six inches below finish grade.

1. Surface Preparation. Fill voids with grout; remove loose protrusions and mortar splatter. Allow new concrete and stucco to cure 28 days.

2. First Coat:

   a) Concrete & Stucco: Acrylic latex coating, matte finish, 2-3 mils dry thickness of Tnemec 6 Tneme - Cryl, or Equal.

   b) Concrete Block: Two component, inorganic hybrid water-based epoxy, 80-110 S.F./Gal - Tnemec Surface Coat 54WB, or Equal.

3. Second Coat:

   a) Concrete and Stucco: Acrylic latex coating, semi-gloss type, 2-3 mils DFT of Tnemec 1029 Enduratone - or Equal.

   b) Concrete Block: Acrylic latex coating, matte finish, 2-3 mils DFT - Tnemec 6 Tneme - Cryl, or Equal.

4. Third Coat:

   a) Concrete: None

   b) Concrete Block & Stucco: Acrylic latex coating, semi-gloss type, 2-3 mils DFT-Tnemec 1029 Enduratone or Equal.

D. System A-4: For use on exterior walls below a point six inches below finish grade.

1. Surface Preparation: Brush-off blast.

2. First Coat: Asphalt base high build coal tar epoxy foundation coating, 8-10 mils DFT Tnemec 46H-413 hi-Build Tneme - Tar, or Equal.

3. Second Coat: Asphalt base high build coal tar epoxy foundation coating applied at right angles to First Coat, 8-10 mils DFT Tnemec 46H-413 hi-Build Tneme - Tar, or Equal.

E. System A-5: For use on interior concrete block walls.

1. Surface Preparation: Clean and dry, level protrusions and remove mortar splatter from all surfaces.

2. First Coat: Two component, inorganic hybrid water-based epoxy, 80-110 S.F./Gal - Tnemec Surface Coat 54WB, or Equal.

3. Second Coat: High performance acrylic epoxy, 4-6 mils DFT - Tnemec Series 113 H.B. Tneme-Tufcoat, or Equal.

2.03 GROUP B - STRUCTURAL STEEL; CONCRETE AND STEEL TANKS; EQUIPMENT AND PIPING

A. System B-1: For use on exposed structural and miscellaneous steel, piping, equipment, and tanks, both interior and exterior - not exposed to corrosion, splash, fumes, or immersion conditions.

1. Surface Preparation: Commercial blastclean per SSPC SP-6.

2. First Coat: One coat of Modified Aromatic Polyurethane Primer: Tnemec Series 1 Omnithane, 2.5-3.5 mils DFT.

3. Second Coat: One coat of two-component, polyamidoamine cured epoxy, semi-gloss 4-6 mils DFT - Tnemec N69 HB Epoxoline II, or Equal.

4. Third Coat:

a) Interior: One coat of two-component, polyamidoamine cured epoxy, semi-gloss 4-6 mils DFT - Tnemec N69 HB Epoxoline II, or Equal

b) Exterior: One coat of semi-gloss acrylic polyurethane, 2.0-4.0 mils DFT-Tnemec Series 73 Endurashield, or Equal.

B. System B-2: For use on bituminous coated cast iron, ductile iron or steel pipe.

1. Surface Preparation: Hand or power tool clean, scarify or wire brush per SSPC SP-2 and SP-3.

2. First Coat: One coat of two-component, polyamidoamine cured epoxy, semi-gloss 4-6 mils DFT - Tnemec N69 HB Epoxoline II, or Equal. If the bituminous coating “bleeds through” after application of the first coat, allow the bleed

through to dry prior to application of the second coat.

3. Second Coat: Same as first coat.

4. Third Coat (exterior exposure only): One coat of semi-gloss acrylic polyurethane finish, 2-3 mils DFT - Tnemec 73 Endura - Shield, or Equal.

C. System B-3: For use on interior walls of steel tanks, piping and equipment, submerged or non-submerged, exposed to spray, splash or corrosive atmosphere, excluding chains and sprockets and similar items. This system shall be used for all materials submerged or in contact with wastewater.

1. Surface Preparation. FIELD sandblast to a near white metal blast cleaning according to SSPC-SP10.

2. First Coat: One coat of Modified Aromatic Polyurethane Primer: Tnemec Series 1 Omnithane, 2.5-3.5 mils DFT.

3. Second Coat: One coat of Hydrophobic Aromatic Polyurethane, Tnemec Series 446 Perma-Shield MCU, 6.0-8.0 mils DFT.

4. Third Coat: Same as second coat

D. System B-4: For use on structural steel, tanks, equipment and piping subject to severe abrasion, corrosive atmosphere, splash or spray, not in contact with wastewater or where a color finish is desired.

1. Surface Preparation: Submerged surfaces, near white metal blast according to SSPC-SP 10. Non-submerged surfaces, commercial blast according to SSPC-SP 6.

2. First Coat: One coat of Modified Aromatic Polyurethane Primer: Tnemec Series 1 Omnithane, 2.5-3.5 mils DFT.

3. Second Coat: One coat of Hydrophobic Aromatic Polyurethane, Tnemec Series 446 Perma-Shield MCU, 6.0-8.0 mils DFT.

4. Third Coat:

a) Interior - Same as second coat.

b) Exterior Exposure - One coat of semi-gloss polyurethane, 2-4 mils DFT - Tnemec 73 Endura - Shield, or Equal.

E. System B-5: For use on hollow metal (steel) doors and frames, steel embedments, and steel lintels:

1. Surface Preparation: Pre-primed with alkyd primer.

2. First Coat (touch-up only): Universal alkyd primer, 2-4 mils DFT, Tnemec 37H Chem-Prime HS, or Equal.

3. Second Coat: One coat of high-gloss HDP acrylic polymer, Tnemec Series 1028, 2.0-3.0 mils DFT.

4. Third Coat: Same as second coat.

2.04 GROUP C - GALVANIZED AND NON-FERROUS METALS

A. System C-1: For use in interior corrosive areas, submerged or non-submerged surfaces, non-potable water applications, galvanized steel and aluminum, including ductwork.

1. Surface Preparation: Solvent cleaning followed by brush-off blast to provide a 1 to 2 mil profile suitable for mechanical adhesion per SSPC-SP1.

2. First Coat: One coat of two-component, polyamidoamine cured epoxy, semi-gloss 2.5-3.5 mils DFT - Tnemec N69 HB Epoxoline II, or Equal.

3. Second Coat: Same as first coat.

B. System C-2: For use in interior dry galvanized steel and aluminum, including ductwork.

1. Surface Preparation: Solvent clean per SSPC-SP1.

2. First Coat: One coat of Two-component, polyamidoamine cured epoxy, semi-gloss 2.5-3.5 mils DFT - Tnemec N69 HB Epoxoline II, or Equal.

3. Second Coat: Same as first coat.

C. System C-3: For use in exterior areas, non-immersion, subject to occasional corrosive spray or fumes, galvanized steel and aluminum materials, including ductwork.

1. Surface Preparation: Solvent cleaning followed by brush-off blast to provide a 1 to 2 mil profile suitable for mechanical adhesion per SSPC-SP7.

2. First Coat: One coat of Two-component, polyamidoamine cured epoxy, semi-gloss 2.5-3.5 mils DFT - Tnemec N69 HB Epoxoline II, or Equal.

3. Second Coat: One coat of polyurethane finish, 2.5-3.5 mils DFT -Tnemec 73 Endura - Shield, or Equal.

2.05 GROUP D – Gypsum Board

A. System D-1. For use on interior surfaces not exposed to moisture or corrosive conditions.

1. First Coat: One coat of Tnemec Series 6, 2-3 mils DFT, or Equal.

2. Second Coat: Semi-Gloss Finish: One coat of Tnemec Series 1029, 2-3 mils DFT, or Equal.

B. System D-2: For use on interior surfaces exposed to moisture, abrasion or mild chemicals.

1. First Coat: Tnemec Series 151, 250-350 SF/gal, or Equal.

2. Second Coat: Tnemec Series 113 H.B. Tneme-Tufcoat @ 4.0-6.0 mils DFT. One (1) coat is spray applied. Two (2) coats if applied by roller or brush.

2.06 GROUP E - WOOD

A. System E-1. For use on interior surfaces not exposed to moisture or corrosive conditions.

1. Surface Preparation: Sand smooth, seal knots with white shellac (fill holes with vinyl putty after prime).

2. First Coat: One coat of white pigmented, non penetrating alkyd-based primer, 2-3 mils DFT - Tnemec 10, or Equal.

3. Second Coat: One coat of matte finished acrylic coating, 2-3 mils DFT - Tnemec 6 Tneme - Cryl, or Equal.

4. Third Coat: One coat of semi-gloss acrylic, 2-3 mils DFT, Tnemec 1029 Enduratone SG, or Equal.

B. System E-2: For use on interior surfaces exposed to moisture or corrosive conditions, exterior wood, and exterior wood surfaces.

1. Surface Preparation: Sand smooth, seal knots with white shellac (fill holes with vinyl putty after prime).

2. First Coat: One coat of Two-component, polyamidoamine cured epoxy, semi-gloss 2.5-3.5 mils DFT - Tnemec N69 HB Epoxoline II, or Equal.

3. Second Coat: Same as first coat.

C. System E-3: For use on interior wood paneling and trim.

1. Surface Preparation: Sand smooth, seal knots with white shellac (fill holes with vinyl putty after prime).

2. First Coat: One coat of white pigmented non-penetrating alkyd based primer, 2-3 mils DFT, Tnemec 10, or Equal.

3. Second Coat: One coat of semi-gloss acrylic finish, 1.5-2.5 mils DFT, Tnemec 1029 Enduratone, or Equal.

4. Third Coat: Same as second coat.

2.07 GROUP L - WALLS OF CONCRETE PROCESS TANKS

A. System L-1. For use on exterior of concrete tank walls below a point 6 inches below finish grade.

1. Surface Preparation: Fill voids with grout; remove loose protrusions and mortar splatter, brush-off blast.

2. One coat of high build coal tar epoxy, 14-20 mils DFT, Tnemec 46 H-413 Hi-Build Tneme-Tar, or Equal.

B. System L-2. For use on the interior of open top concrete tanks submerged or non-submerged, exposed to spray, splash or corrosive atmosphere and/or in contact with wastewater.

1. Surface Preparation. Brush-off blast, to remove laitance, fines, curing compounds, form release oils, other contaminants, open up bugholes, and establish a surface profile equal to ICRI CSP 5. Re-surface concrete and fill voids and bugholes using Tnemec Series 218 MortarClad, applied @ 1/16”.

2. First Coat: One coat of Hydrophobic Aromatic Polyurethane, Tnemec Series 446 Perma-Shield MCU, 6.0-8.0 mils DFT.

3. Second Coat: Same as first coat.

C. System L-3: For use on interior walls and ceiling of concrete wet wells, submerged or non-submerged, exposed to spray, splash or corrosive atmosphere, and in contact with wastewater.

1. Surface Preparation. Brush-off blast, to remove laitance, fines, curing compounds, form release oils, other contaminants, open up bugholes, and establish a surface profile equal to ICRI CSP 5. Re-surface concrete and fill voids and bugholes using Tnemec Series 218 MortarClad, applied @ 1/16”.

2. First Coat: One coat of amine cured epoxy 100% VOC free/100% solids Raven 405, minimum 80 mils DFT and as recommended by Coating manufacturer, or Equal. Application shall be by manufacturer’s qualified applicator (letter of qualification from the manufacturer shall be required).

3. Testing:
   (a) Coating shall be spark tested.
   (b) Wet film thickness gauge per ASTM D4414
   (c) Pull-off adhesive strength of coatings per ASTM D7234.

D. System L-4: For use on exterior walls and domes of reject storage tanks.

1. Surface Preparation: Per manufacturer’s recommendations.

2. First Coat: One coat of modified waterborne acrylic from 4.0-6.0 mils DFT, Tnemec Enviro-Crete Series 156 or equal

3. Second Coat: One coat of modified waterborne acrylic from 4.0-6.0 mils DFT, Tnemec Enviro-Crete Series 156 or equal

2.07 GROUP M - SPECIAL COATINGS

A. System M-1. For use as barrier between dissimilar materials and metals.

1. Prime: None

2. Finish: One component coal tar solution, Tnemec Series 46-465, 8.0-10.0 mils DFT

B. System M-2. For sealing concrete floors where concrete is shown as natural in the Finish Schedules and on all exposed concrete floors where no finish has been shown.

1. Surface Preparation: Mechanically abrade floor to achieve a profile equal to ICRI CSP 2-CSP 3.

2. First Coat: One coat of clear epoxy floor sealer, 8-10 mils DFT, Tnemec 201 Epoxoprime, or Equal.

C. System M-3. For coating of PVC piping interior or exterior.

1. Surface Preparation: SSPC SP1 first then scarify surface.

2. Prime: Epoxy equal to Tnemec Series 66 at 2.0 to 3.0 mil DFT.

3. Finish: Epoxy equal to Tnemec Series 73 at 2.0 to 3.0 mil DFT.

2.08 FINISH COAT OVER EXISTING FINISH

A. The required painting shall consist of one coat of the system “Finish Coat” to provide continuity of texture and color over previously painted surfaces.

2.09 THINNING

A. Where thinning is necessary, only the products for the particular purpose and by the manufacturer furnishing the paint shall be allowed. All thinning shall be done strictly in accordance with the manufacturer’s instructions and with the full knowledge and approval of the Engineer.

PART 3 EXECUTION

3.01 SHOP PAINTING

A. All ferrous and non-ferrous surfaces shall be solvent cleaned before priming. Primer shall be applied in the shop to protect surfaces from rust during shipment and storage.

B. Apply two coats of paint to surfaces which are inaccessible after assembly or erection.

3.02 FIELD PREPARATION

A. All surfaces to be painted shall be prepared in a workmanlike manner with the objective of obtaining a smooth, clean and dry surface. No painting shall be done before the prepared surfaces are approved by the Engineer.

B. Surface preparation for miscellaneous surfaces to be painted, not specifically covered in these specifications, shall be as recommended by the manufacturer of the paint selected for use and as approved by the Engineer.

C. Perform preparation and cleaning procedures in strict accordance with coating manufacturer’s instructions for each substrate condition.

D. Remove hardware and accessories, machined surfaces, plates, lighting fixtures and similar items in place and not to be finish-painted, or provide surface-applied protection. Reinstall removed items after painting is completed. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes to masonry walls unless moisture content of surfaces are below 12 percent.

3.03 APPLICATION

A. Mix, prepare, and store painting and finishing materials in accordance with manufacturer’s directions.

B. Apply painting and finishing materials in accordance with the manufacturer’s directions. Use applicators and techniques best suited for the material and surfaces to which applied.

C. Workmanship for applying paint shall be of professional quality. The painter shall apply each coat at the rate recommended by the manufacturer smoothly without runs, sags, or holidays. If the material has thickened or must be diluted for use with a spray gun, the coating shall be built up to the same thickness as achieved with undiluted materials. In other words, one gallon of paint as originally furnished by the manufacturer shall not cover a great square foot area when applied by spray gun than when applied by brush. Deficiencies in film thickness shall be corrected by the application of additional coat or coats of paint. On masonry, application rates will vary according to the surface texture; however, in no case shall the manufacturer's stated coverage rate be exceeded. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint. Before succeeding coats are applied to a surface, the preceding coat shall have been approved by the Engineer.

D. Drying time shall be construed to mean "under normal conditions". Where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying times will be necessary. Additional coats of paint shall not be applied, nor shall units be placed in service, until paints are thoroughly dry.

TABLE 09900-1
PAINTING SCHEDULE

A. Anoxic/Aerobic Basin Internal Recycle:

1. Submerged ductile iron pipe, fittings, valves, equipment and supports - System B-3.
2. Non-submerged ductile iron pipe, fittings, valves, equipment, motors and supports - System B-4.
3. Galvanized and non-ferrous metals – System C-3.
4. PVC pipe and conduit– System M-3.

B. Lake Filters :

1. Structural steel and decking – System B-4.
2. Ductile iron pipe, valves, fittings, equipment, motors and supports - System B-4.
3. Galvanized and non-ferrous metals – System C-3.
4. Exterior concrete tank walls 6-inches below grade – System L-1.

5. Interior concrete tank walls (top of tank to 2-ft below lowest weir elevation) - System L-2.
6. PVC pipe and conduit– System M-3.

C. Plant Drain Pump Station:

1. Ductile iron pipe, valves, fittings and supports in or out of vaults - System B-4.
2. Galvanized and non-ferrous metals – System C-3.
3. Exterior walls of wet well and vaults- System L-1.
4. Interior walls, floor and ceiling of vaults – System L-2.
5. Interior walls, floor and ceiling of wet well - System L-3.
6. PVC pipe and conduit– System M-3.

Notes:

1. Cast iron, ductile iron or steel pipe that will be exposed to view and has been inadvertently coated with a bituminous system shall receive System B-2.

END OF SECTION

SECTION 09902

PIPE AND EQUIPMENT PAINTING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes pipe painting and identification as required for this project.

1.02 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

PART 2 PRODUCTS

2.01 PAINTING AND IDENTIFICATION

A. Exposed piping (except stainless steel) shall be painted. Metal pipe shall be painted B-3 or B-4 depending on location. Seal coats shall be used over bitumen coated surfaces as applicable utilizing System B-2. Plastic pipe shall be painted in accordance with pipe manufacturer's recommendations utilizing System M-4.

B. General Notes and Guidelines:

1. All color numbers and names herein refer Tnemec to master color card. Colors of specified equal manufacturers may be substituted with approval of the Engineer.

2. Pipe lines, equipment, or other items which are not listed here shall be assigned a color by the Engineer and shall be treated as an integral part of the Contract.

3. When color coding is specified or directed by the Engineer, it shall consist of color code painting and identification of all exposed conduits, through lines and pipelines for the transport of gases, liquids, or semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and any operating accessories which are

integral to a whole functional mechanical pipe and electrical conduit systems.

4. Description on titles (Abbreviated Code on Pipe/Equipment) to be lettered on pipes or equipment will be black or white to contrast with color of pipes and equipment and shall be stenciled applied, as approved by the Engineer.

5. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be Safety Orange 04SF.

6. All safety equipment shall be painted in accordance with OSHA standards.

7. All inline equipment and appurtenances not assigned another color shall be painted the same base color as the piping. The pipe system shall be painted with the pipe color up to but not including the flanges attached to pumps and mechanical equipment assigned another color.

8. All pipe hangers and pipe support floor standards shall be painted.

9. All conduit shall be painted to match its background surface.

10. Building surface colors shall be painted as scheduled in the Finish Schedule or as selected by the Engineer.

11. Doors and frames shall be painted as scheduled in the Finish Schedule or as selected by the Engineer.

12. Wood casework, frames, doors, etc. shall be finished with urethane as specified except as specifically noted otherwise.

2.02 PAINT COLOR CODE SCHEDULE

A. In situations where two colors do not have sufficient contrast to easily differentiate between them, a six-inch band of contrasting color should be painted on one of the pipes at approximately 30-inch intervals. The name of the liquid or gas should also be painted (stenciled) on the pipe in a contrasting color. In

some cases, it may be advantageous to paint arrows indicating the direction of flow.

Description of Title to be Lettered on Pipes and Equipment	Color of Title Letters	Pipe and Equipment Color	
		Color Name	Color Number
EQUIPMENT			
Conveyors, Sludge Hoppers, & Related Equip.	White	Safety Orange	04SF
Bar Screens	White	Safety Orange	04SF
Grit Collector Housing and Screw Conveyors	White	Safety Orange	04SF
Sump Pumps	White	Light Gray	A0385
Bridge Cranes, Monorails and Track	White	Safety Orange	04SF
Blowers	Black	Cypress Green	G0383
Sluice Gate Operators	White	Safety Orange	04SF
Scum Pumps	White	April Green	J8187
Pneumatic Ejectors	White	April Green	J8187
Air Compressors	White	Palm Green	G3102
Waste Sludge Pumps	White	Tan Bark	J6512
Air Filter Housings	White	Cypress Green	G0383
Sodium Hypochlorite Pumps	Black	Safety Yellow	02SF
Effluent Reuse Pumps	White	Pantone Purple	522-C
Filter and Effluent Sample Pumps	White	Aquamarine	G0427
Flash Mixers	White	Safety Orange	04SF
Flocculator Drives	White	Safety Orange	04SF
Clarifier Bridges and Pumps	White	Safety Orange	04SF
Odor Control System and Blowers	Black	Egg Shell	J6963
Alum Feed System	Black	Safety Orange	04SF
Polymer Feed System	Black	Oriental Yellow	D0852

Description of Title to be Lettered on Pipes and Equipment	Color of Title Letters	Pipe and Equipment Color	
		Color Name	Color Number
Polymer Tanks and Mixers	Black	Oriental Yellow	D0852
Polymer Pumps	Black	Oriental Yellow	D0852
Grit Screw Conveyor	White	Safety Orange	04SF
Sludge Pumps	White	Antique Brown	L9398
Conduit	White	Cypress Green	G0383
Conduit Trays	White	Cypress Green	G0383
Fans	White	Egg Shell	J6963
PIPES			
Raw Wastewater Pipe	White	Light Gray	A0385
S. Steel Air Pipe Appurtenances	Black	Silver	Match S. Steel
Scum Pipe	White	April Green	J8187
Waste Sludge Pipe	White	Tan Bark	J6512
Sump Pump Pipe	White	Light Gray	A0385
Chlorine Pipe and Header	Black	Safety Yellow	02SF
Effluent Reuse Pipe	White	Pantone Purple	R3910
Chlorine Sample Pipe	Black	Safety Yellow	02SF
Polymer Pipe	Black	Oriental Yellow	D0852
Thickened Waste Sludge Pipe	White	Antique Brown	L9398
Cold Water	Black	Azure	J8162
Hot Water	Black	Azure	J8162
Soil Pipes	White	Light Gray	A0385
Fuel Pipe	White	Safety Red	06SF
Waste and Vent Pipes (Interior)	White	Match Background	

2.03 PAINTING OF EXISTING STRUCTURES, PIPING, VALVING AND EQUIPMENT

A. Touch up existing structures and equipment where finish has been damaged by new construction.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 11001

EQUIPMENT – BASIC REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

A. Provisions: Requirements specified in Division 1 form a part of this Section.

B. Work Included in this Section. The Contractor shall provide all the required labor, project equipment and materials, tools, construction equipment, safety equipment, transportation, and test equipment for furnishing, installation, adjustment, and full test loading of all the mechanical work shown on the Contract Drawings and included in these Specifications.

C. Unless otherwise specified, the work of this division is also subject to the requirements of all other divisions of these specifications including, but not limited to: Divisions 9, 13, 15 and 16. Unless otherwise specified, all other sections of this division are subject to the requirements of this section.

1.02 QUALITY ASSURANCE

A. Incorporated Documents: Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to work of these Specifications where cited below. In every situation, the latest specifications, standards, tests, etc., shall apply unless otherwise noted.

B. Variances: In instances where two codes are at variance, the more restrictive requirements shall apply.

C. Contractor's Expense: The Contractor shall obtain and pay for the required bonds, insurance, licenses, permits, and inspections (unless otherwise specified), and pay all taxes, fees and utility charges that shall be required for the construction work.

D. Extra Work: Work that is not included in the Contract Documents shall not be performed, except when approved in writing by the Owner.

E. Standard of Quality: Items of equipment are specified herein by the name of a manufacturer for the purpose of establishing a standard of quality and acceptable experience. Alternate equipment will be given consideration, per Section 01600 – Material and Equipment.

F. Data: Unless otherwise specified, all equipment furnished shall have a data plate fabricated of 316 stainless steel with a minimum thickness of 1/16 inch and embossed or preprinted lettering, and fastened to the frame with corrosion-resisting pins. Nameplates shall have stamped on them the manufacturer, serial number, model number, type, operating and performance data, and other pertinent data. Letters and numerals shall not be smaller than 3/16 inch high.

G. Taggings: Where the size of the equipment prevents the fastening of data plates, name tags shall be provided and attached to the equipment and device item to identify it. The name tags shall have a rectangular configuration with square corners and shall be approximately 1-1/2 inches by 3 inches in size. They shall be made from brass or stainless steel sheet metal and have a minimum thickness of 0.032-inch. Letters and numerals shall be engraved or etched in the name tags by a professional engraver and shall not be smaller than 3/16 inch high in size. The name and number for each item of equipment, as designated on the Contract Drawings, shall appear on the name tag for the item. Valve tag information shall conform to Section 15100 – Valves and Appurtenances. A 3/16-inch diameter hole shall be provided in the upper left-hand corner of each name tag and shall be used to attach the name tags to the equipment and device items with 1/8-inch stainless steel cable.

1.03 DRAWINGS

A. Project Drawings: The Drawings are diagrammatic and show the general layout of the complete construction work.

1. Locations of equipment, inserts, anchors, motors, panels, conduits, stub-ups, fittings, fixtures, air, water, power and process inlets, unless specifically dimensioned on the Contract Drawings, shall be determined to suit field conditions encountered, and the Contractor shall be responsible for ensuring clearance between pipes,

equipment, and similar appurtenances, without extra cost to the Owner.

2. The Contractor shall review the Contract Drawings and Specifications of other trades and shall include the mechanical work shown thereon that will be required for the installations.

3. Should there be a need to deviate from the Contract Drawings and Specifications, the Contractor shall submit written details and reasons for all changes to the Engineer for approval before making such changes. All extra costs to make the changes will be borne by the Contractor.

4. In the event of varying interpretations of the Contract Documents, the Engineer's interpretation shall govern.

B. Shop Drawings

1. Prior to fabrication, the Contractor shall obtain, from the manufacturer, shop drawings for all equipment. Shop drawings shall include fabrication, assembly, unit support drawings, installation drawings, and wiring diagrams together with detailed specifications and data covering materials used, power drive assembly, parts, devices, and other accessories forming a part of the equipment to be furnished.

2. The Contractor shall submit Certified performance or Certified test curves, as specified for all pumps furnished under this Contract. The Contractor shall notify the Engineer three weeks prior to all testing should the Engineer elect to witness the tests.

3. Submit shop drawings and material lists for approval as specified in applicable Sections and in conformance with the requirements of Section 01340 – Shop Drawings, Project Data and Samples.

1.04 ADAPTATION OF EQUIPMENT

A. Should any alternate equipment selected require any revision to the structure, piping, electrical, or other work shown on the Contract Drawings, the Contractor shall include the cost of such revisions in his bid for the equipment and no extra payment shall be made for

such revision. All such revisions shall be subject to the approval of the Engineer.

1.05 UTILITY SERVICE AND PROCESS INTERRUPTION

A. All utility service and/or process interruptions initiated by the Contractor in the prosecution of his work shall be scheduled in advance and approved in writing by the appropriate Utility Company and the Owner.

1.06 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall submit to the Engineer operation and maintenance manuals on all mechanical equipment in accordance Specification 01730 – Operation and Maintenance Data. Two (2) copies of draft manuals shall be submitted for approval not later than the date of shipment of the equipment. Five (5) final conformed copies shall be submitted and available to Owner's personnel at least two weeks prior to start-up and instruction for each piece of equipment. Refer to Division 1.

1.07 INSTALLATION MANUALS

A. In addition to operation and maintenance manuals, the Contractor shall submit to the Engineer three (3) copies of all installation manuals for each piece of equipment. This manual shall be submitted at the same time as the operation and maintenance manual. Installation of equipment shall not be performed until installation manuals are received.

1.08 EQUIPMENT GUARANTEE

A. The Contractor shall furnish and replace, without cost to Owner, all equipment parts that are defective or show undue wear within 3 years from the date of substantial completion of the work by the Owner unless extended periods of warranty for specific pieces of equipment are specified elsewhere. In addition to performance guarantees, all processes or systems shall comply with the requirements of applicable portions of the Sections of these Specifications describing those systems.

PART 2 PRODUCTS

2.01 MATERIALS AND WORKMANSHIP

A. All equipment furnished under this Division shall be new and guaranteed free from defects in materials, design, and workmanship. These Specifications, to the extent possible, identify service conditions and requirements for all equipment; however, it shall be the manufacturer's responsibility to ascertain, to his satisfaction, the conditions and service under which the equipment will operate and to warrant that operation under those conditions will be successful. All parts of the equipment shall be amply proportioned for all stresses that may occur during fabrications, erection, and intermittent or continuous operation.

B. All equipment shall be designed, fabricated, and assembled in accordance with the best modern engineering and shop practice. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests. Materials shall be suitable for service conditions.

C. Except where otherwise specified, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the American Institute of Steel Construction. All structural members shall be considered as subject to shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment, shall have a minimum nominal thickness of 1/4 inch. The location of the fabricator and his shop schedule shall be furnished to the Engineer prior to the beginning of fabrication so that the Engineer can schedule shop inspection if so desired.

2.02 EQUIPMENT BASES AND BEDPLATES

A. Unless otherwise indicated, a 316 Stainless Steel (SS) base shall be provided for each item of equipment which is to be installed on a concrete foundation. Equipment assemblies, unless otherwise specified, or shown on the Contract Drawings, shall be mounted on a single, heavy, 316 SS bedplate. Bases and bedplates shall be provided

with machined support pads, tapered dowels for alignment of mating, or adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. All seams and contact edges between SS plates and shapes shall be continuously welded and ground smooth. The plates shall have a minimum thickness of 1/4 inch. All pump bedplates must include a drip lip and provision for directing accumulated gland leakage to a single disposal drain point.

2.03 JACKING SCREWS AND ANCHOR BOLTS

A. Jacking screws shall be provided in the equipment bases and bedplates to aid in leveling prior to grouting.

B. Equipment suppliers shall furnish anchor bolts, nuts, washers, and sleeves of adequate design as required for proper anchorage of the bases and bedplates to the concrete bases. Sleeves shall be a minimum of 1-1/2 times the diameter of the anchor bolts. Unless otherwise shown or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-inch of grout beneath the baseplate and to provide adequate anchorage into structural concrete. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Anchor bolts shall be 316 stainless steel which conforms to ASTM A-167 and ASTM A-267.

2.04 LUBRICATION

A. Lubrication of equipment shall ensure constant presence of lubricant on all wearing surfaces. Lubricant fill and drain openings shall be readily accessible. Easy means for checking the lubricant level shall be provided. Prior to testing and/or operation, the equipment shall receive the prescribed amount and type of lubricant as required by the equipment manufacturer. The Contractor shall provide to the Owner a 1-year supply of lubricants for each piece of equipment installed. All lubricants shall be properly packaged, labeled, and delivered to the Owner concurrent with equipment installation. An inventory listing of lubricant types by equipment and quantities shall be provided.

PART 3 EXECUTION

3.01 COORDINATION

A. The Contract Drawings show, in a diagrammatic form, the arrangements desired for the principal apparatus, piping, and similar appurtenances, and shall be followed as closely as possible. Proper judgment must be exercised in carrying out the work to secure the best possible headroom and space conditions throughout, to secure neat arrangement of piping, valves, fixtures, hangers, and similar appurtenances, and to overcome local difficulties and interference of structural conditions wherever encountered.

B. The Contractor shall take all measurement for his work at the installation sites, verify all subcontractor Drawings prior to required submittal and be responsible for the proper installation, within the available space, of the apparatus specified and shown on the Drawings. The Contractor must secure the approval of the Engineer for all variations and/or substitutions before making any changes.

3.02 PROTECTION

A. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry and clean at all times. Pumps, blowers, motors, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weather tight storage facilities such as warehouses. All materials and equipment showing evidence of rust, dirt contamination, or other surface or subsurface deterioration shall be cleaned and restored to the Engineer's satisfaction prior to installation.

B. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted in accordance with the requirements of Section 09900 – Painting and Coatings to the satisfaction of the Engineer.

C. Electrical equipment, controls, and insulation shall be protected against moisture or water damage.

D. The Contractor shall maintain equipment storage facilities in accordance with the provisions of Division 1.

E. All equipment shall be stored in the designated storage facilities from delivery until installation.

F. All mechanical equipment, whether in the Contractor's designated storage facility prior to final installation, or whether installed, but not yet placed into service or accepted by the Owner, shall be periodically exercised at intervals, and in accordance with procedures prescribed by each manufacturer, if such a recommendation is included in the manufacturer's installation, operation and maintenance instructions.

3.03 INSTALLATION CHECK

A. The Contractor shall have an experienced, competent, and authorized representative of the manufacturer or supplier of each major item of equipment visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The Contractor shall have the equipment supplier's representative revisit the job site as often as necessary until all problems are corrected and the equipment installation and operation is satisfactory to the Engineer.

B. Each equipment supplier's representative shall furnish to the Owner, through the Contractor, a written report certifying that the equipment: (1) has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from all stress imposed by connecting piping or anchor bolts; and, (4) has been operated successfully under full load conditions.

C. Equipment manufacturers shall furnish the services of competent, factory-trained personnel during the warranty period specified to inspect, service, and repair the equipment where required. Service requests shall be answered and acted upon promptly. This requirement shall not include normal maintenance and service of equipment, which will be the responsibility of the Owner.

D. All costs for this work shall be included in the price bid by the Contractor.

3.04 EQUIPMENT INSTALLATION

A. All equipment shall be installed in full accordance with the equipment manufacturer's recommendations and good practice. Where specified in other parts of this Division, factory-trained service personnel shall be on-site to supervise the installation. Sufficient notice shall be given to the Engineer prior to equipment installation in order that the Engineer or his representative may be present during installation. In general, the following installation practices shall be followed:

1. Examine equipment for damage in shipping and handling. The examination shall include checking for corrosion, poor workmanship, dirt or deleterious substances, and poor fits.

2. Level the base plate or bedplate

3. Install equipment

4. Check alignment of couplings

5. If grout has been used, check alignment and levelness after the grout has set.

6. Check direction of rotation and correct, if necessary, to insure proper operation.

7. Ensure that all submerged or intermittently submerged powered equipment does not have power and control cable splices of any kind inside wells or pits.

3.05 PLACING IN OPERATION

A. Prior to being placed in operation, equipment shall be inspected by the manufacturer's factory-trained personnel. All defects discovered during this inspection shall be corrected prior to initial equipment start-up. Internal coatings applied at the factory shall be removed if required. Lubricant shall be applied in the proper places and levels shall conform to the manufacturer's recommendations. In the presence of the Engineer, full-load operational testing shall be performed and the results of such tests shall be recorded. Unsatisfactory performance shall be corrected and tests shall be repeated until the equipment performance meets the Specifications. The Contractor shall furnish all power, materials,

services, test equipment and labor required to successfully complete all full load equipment testing specified. The Contractor shall certify in writing to the Engineer, in triplicate, that all tests were conducted in accordance with these Specifications and that all components within each system successfully function as required. The Contractor shall notify the Engineer ten (10) calendar days in advance of the time when the equipment will be placed into operation. During the course of initial operation, the Contractor shall instruct Owner's personnel in the proper operation and maintenance of the equipment, as specified herein.

3.06 INSTRUCTION

A. After the equipment specified in Divisions 11, 13, 15 and 16 have been installed, tested, adjusted, and placed in satisfactory operating condition, services of representatives of each equipment manufacturer shall be provided to instruct the operating personnel in the use and maintenance of the equipment. The instruction period shall be scheduled at a time mutually agreed upon with the Owner, prior to final acceptance. The manufacturer's representatives shall fully instruct the Owner's personnel regarding use and maintenance of the equipment. During this instruction period, it shall be the responsibility of the manufacturer to answer all questions from the Owner's operating personnel. Manufacturer shall also demonstrate lubrication, disassembly, adjusting, routine parts replacement, and other "hands-on" activities related to maintenance of the equipment. Provide a minimum of not less than eight (8) hours for this instruction for each piece of equipment or set of identical pieces of equipment provided unless otherwise specified. More days shall be provided if called for in the individual equipment specification. Each manufacturer shall include the service in the price of his equipment. Training session schedules shall be coordinated with the Owner and Engineer and under no circumstances shall more than two training sessions be scheduled for the same day. The Contractor shall designate an individual through whom manufacturer's training will be coordinated. This individual will coordinate all training sessions through Owner's designated training coordinator.

3.07 SPECIAL TOOLS AND ACCESSORIES

A. All special tools, special tool lists, equipment, or accessories required for the installation and

maintenance of equipment specified in Division 11, as well as three (3) copies each of instruction manuals necessary for the proper use of such tools, equipment, or accessories shall be provided by the equipment manufacturer. Special tools shall be defined as those items manufactured by the equipment supplier specifically for performing maintenance and installation of their respective equipment, including knocker wrenches for gearboxes.

3.08 SHOP PAINTING

A. Except as specifically supplemented or superseded by requirements herein, shop painting shall conform to requirements in Section 09900 – Painting and Coatings. Electric motors, gears, starters, and other similar self-contained or enclosed components shall be shop primed and finished with a high-grade oil-resistant acrylic enamel. Surfaces which will be inaccessible after assembly shall be painted or otherwise protected before assembly by a method which provides protection for the life of the equipment.

B. Surfaces to be painted at the project site shall be shop painted with one or more coats of a primer which will adequately protect the equipment until finishes are applied at the project site. Primers shall be as specified in Section 09900 – Painting and Coatings. All equipment shall be primed with primer compatible with the coating system selected by the Contractor, and if not, the Contractor shall reprime the equipment such that it is compatible and in conformance with Section 09900 – Painting and Coatings.

C. Machined and polished metallic surfaces which are not to be painted shall be coated with a rust preventive compound as specified in Section 09900 – Painting and Coatings.

3.09 DAMAGED PRODUCTS

A. The Contractor shall notify the Engineer in the event that any equipment or material is damaged subsequent to receipt at the job site, and prior to acceptance of the installation by the Owner.

B. Repairs to damaged products in lieu of replacement shall not be made without prior approval by the Engineer.

END OF SECTION

SECTION 11100

PUMPS - GENERAL

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall provide all pumps and pumping appurtenances, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section shall apply to all pumps and pumping equipment except where otherwise indicated in the Contract Documents.

C. The requirements of Section 11001 – Equipment Basic Requirements apply to this Section.

D. Unit Responsibility: The CONTRACTOR shall be made responsible for furnishing the WORK. The Pump Manufacturer shall be responsible for the coordination of design, assembly and factory testing of the Pumps, if required. The Contractor shall be responsible to the OWNER for compliance with the requirements of each pump.

E. Single Manufacturer: Where 2 or more pump systems of the same type or size are required, the pumps shall all be produced by the same manufacturer.

1.02 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01310 – Shop Drawings, Project Data and Samples.

B. Shop Drawings: Shop Drawings shall contain the following information:

1. Pump name, identification number, and specification Section number.
2. Performance data curves showing head, capacity, horsepower demand, NPSH required, and pump efficiency over the entire operating range of the pump. The equipment manufacturer shall indicate separately the head, capacity, horsepower demand,

overall efficiency, and minimum submergence required at the design flow conditions and the maximum and minimum flow conditions. Performance curves at intervals of 100 rpm from minimum speed to maximum speed shall be furnished for each centrifugal pump equipped with a variable speed drive.

3. The CONTRACTOR shall require the manufacturer to indicate the limits on the performance curves recommended for stable operation without surge, cavitation, or excessive vibration. The stable operating range shall be as wide as possible based on actual hydraulic and mechanical tests.
4. Assembly and installation drawings including shaft size, seal, coupling, bearings, anchor bolt plan, part nomenclature, material list, outline dimensions, and shipping weights.
5. Elevation of proposed local control panel showing panel-mounted devices, details of enclosure type, single line diagram of power distribution, and current draw of panel, and list of all terminals required to receive inputs or to transmit outputs from the local control panel.
6. Wiring diagram of field connections with identification of terminations between local control panels, junction terminal boxes, and equipment items.
7. Complete electrical schematic diagram.

C. Technical Manual: The Technical Manual shall contain the required information for each pump Section.

D. Spare Parts List: A spare parts list shall contain the required information for each pump Section.

E. Factory Test Data: Signed, dated, and certified factory test data for each pump system which requires factory testing, submitted before shipment of equipment.

F. Certifications
1. Manufacturer or manufacturer representative certification of proper installation.
2. CONTRACTOR'S certification of satisfactory field testing.

PART 2 – PRODUCTS

2.01 GENERAL

A. Compliance with the requirements of the individual pump Sections may necessitate modifications to the manufacturer's standard equipment.

B. Performance Curves: All centrifugal pumps shall have a continuously rising curve or the system operating range shall not cross the pump curve at two different capacities or “dip region.” Unless indicated otherwise, the required pump shaft horsepower at any point on the performance curve shall not exceed the rated horsepower of the motor or engine or encroach on the service factor.

C. All components of each pump system provided under the pump Sections shall be entirely compatible. Each unit of pumping equipment shall incorporate all basic mechanisms, couplings, electric motors or engine drives, variable speed controls, necessary mountings, and appurtenances.

2.02 MATERIALS

A. All materials shall be suitable for the intended application; materials not indicated shall be high-grade, standard commercial quality, free from all defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended, and shall conform to the following requirements:

1. Cast iron pump casings and bowls or volutes shall be of close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or equal.
2. Bronze pump impellers shall conform to ASTM B 62 - Composition Bronze or Ounce Metal Castings, or B 584 - Copper Alloy Sand Castings for General Applications, where dezincification does not occur.
3. Stainless steel pump shafts shall be Type 416 or 316. Miscellaneous stainless steel parts shall be Type 316.

4. Anchor bolts, washers, and nuts in Standard Service (Non-Corrosive Application) shall be galvanized steel in accordance with the requirements of Section 05500 - Miscellaneous Metalwork. Anchor bolts, washers, and nuts in Corrosive Service as defined in Section 05500 shall be stainless steel in accordance with that Section.

B. Materials in contact with potable water shall be listed as compliant with NSF Standard 61.

2.03 PUMP COMPONENTS – GENERAL

A. Flanges and Bolts: Suction and discharge flanges shall conform to ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800 or ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings dimensions. Bolts shall be in accordance with Section 05500.

B. Lubrication: Vertical pump shafts of clean water pumps shall be product water lubricated, unless otherwise indicated. Deep-well pumps and pumps with dry barrels shall have water- or oil-lubricated bearings and seals and enclosed line shafts. Pumps for sewage, sludge, and other process fluids shall be lubricated as indicated.

C. Handholes: Handholes on pump casings shall be shaped to follow the contours of the casing to avoid any obstructions in the water passage.

D. Drains: All gland seals, air valves, cooling water drains, and drains from variable speed drive equipment shall be piped to the nearest floor sink or drain, with galvanized steel pipe or copper tube, properly supported with brackets.

E. Grease Lubrication: For all vertical propeller, mixed-flow, and turbine pumps, other than deep well pumps, of bowl sizes 10-inches and larger, the CONTRACTOR shall provide a stainless steel tube attached to the column for grease lubrication of the bottom bearing.

F. Stuffing Boxes: Where stuffing boxes are indicated for the pump seal, they shall be of the best quality, using the manufacturer's suggested materials best suited for the specific application. For sewage, sludge, drainage, and liquids containing sediments, the seals shall be fresh-water flushed, using lantern rings. If fresh water is not available, the seal shall be flushed with product water cleaned by a solids separator as manufactured by John Crane Co., Lakos (Claude Laval Corp.), or equal.

1. Conventional Packing Gland Type Seal: Unless otherwise indicated, the packing material shall be interlaced Teflon braiding, containing 50 percent ultrafine graphite impregnation to satisfy the following. Acceptable ring materials are asbestos-free die-molded packing rings of braided graphite material free of PTFE, Chesterton 1400R, or equal for non-potable water service and braided PTFE material, Chesterton 1725 or equal that is listed under NSF Standard 61 for potable water service.

Shaft speeds	up to 2500 fpm
Temperature	up to 500 degrees F
pH range	0-14

2. Mechanical Seals (Conventional Non-Split Type): Mechanical seals shall be fresh water-flushed unless indicated otherwise; in which case product water cleaned by a solids separator as above shall be used. Mechanical seals shall be as manufactured by the following, or equal:

Sewage, Sludge, or Wastewater Pumps	Double seals	John Crane Type 88, Flowserve Type ISCPP, Chesterton Type GDS or 255
Water Pumps (hot and cold)	Single seals	John Crane Type 88SRS, Flowserve Type ISCPX, Chesterton Type UV, GSS, or 155

3. Mechanical Seals (Split Type): Split type mechanical seals shall be fresh water flushed unless indicated otherwise; in which case product

water cleaned by a solids separator as above shall be used. Mechanical seals shall be as manufactured by the following or equal

Sewage, Sludge, or Wastewater Pumps	Double seals	John Crane Type 3710, Flowserve Type PSS2, Chesterton Type 442
Abrasives, Grit, or Lime Slurry Pumps	Double seals	Split seals are not recommended.
Chemicals or Corrosive Liquid Pumps	Single seals	Split seals are not recommended because of leakage.
Water Pumps (hot and cold)	Single seals	John Crane Type 3710, Flowserve Type PSS II, Chesterton Type 442

4. Mechanical Seals (Tandem Type): Tandem type mechanical seals shall have an oil chamber between the seals. The seals shall be used with the rotating seal faces being carbon and the stationary seal faces to be ceramic. The lower seal shall be replaceable without disassembly of the seal chamber and without the use of special tools. Pump-out vanes shall be present of the back of the impeller to keep contaminants out of the seal area. Tandem Type Mechanical Seals shall be John Crane type 21, BF1C1.

G. Where indicated, a buffer fluid must be circulated a minimum 20 psi above discharge pressure, or as required by the manufacturer, in order to maintain reliable seal performance.

H. Mechanical seals for all services shall be equipped with nonclogging, flexible–mounted seats with elastomer secondary seals. Wetted metal parts shall be Type 316 stainless steel, Alloy 20, or Hastelloy B or C, whichever has the best corrosion resistance to the pumped fluid.

Dual cartridge seals shall be double balanced to allow for seal integrity in case of flush water pressure reversal. All single and double seals shall have springs in the non-wetted end of the seal.

I. Fresh water shall be delivered to the seals through appropriate size piping with plug valves, strainers, pressure regulators, electrically operated solenoid valves, and rotameters. Wiring shall comply with Division 16 and solenoid control shall comply with Division 17.

2.04 PUMP APPURTENANCES

A. Nameplates: Each pump shall be equipped with a stainless steel nameplate indicating serial numbers, rated head and flow, impeller size, pump speed, and manufacturer's name and model number.

B. Solenoid Valves: The pump manufacturer shall provide solenoid valves on the water or oil lubrication lines and on all cooling water lines if seal water flush is required. Solenoid valve electrical ratings shall be compatible with the motor control voltage.

C. Gauges

1. All pumps (except sample pumps, sump pumps, and hot water circulating pumps) shall be equipped with pressure gauges installed at pump discharge lines. Pump suction lines shall be provided with compound gauges. Gauges shall be located in a representative location, where not subject to shock or vibrations, in order to achieve true and accurate readings.
2. Where subject to shock or vibrations, the gauges shall be wall-mounted or attached to galvanized channel floor stands and connected by means of flexible connectors.

2.05 FACTORY TESTING

A. The following tests shall be conducted on each indicated pump system:

1. Pump Systems: All centrifugal pump systems with drives 10 hp up to and including150 hp shall be tested at the pump factory in accordance with the American National Standard for Centrifugal Pump Tests (ANSI/HI 1.6) acceptance Level "A" or the American National Standard for Vertical Pump Tests (ANSI/HI 2.6) as approved by ANSI and

published by the Hydraulic Institute. For sump pumps, acceptance shall be in accordance with Level "B" of ANSI/HI 1.6 unless indicated otherwise. For pumps with motors of 100 hp or less, the manufacturer's certified test motor shall be acceptable. Testing of prototype models will not be acceptable. The following minimum test results shall be submitted:

a. Hydrostatic test results
b. At maximum speed, a minimum of five hydraulic test readings between shutoff head and 25 percent beyond the maximum indicated capacity, recorded on data sheets as defined by the Hydraulic Institute.
   For variable speed driven pumps, each pump shall be tested between maximum and minimum speed at 100 rpm increments.
c. Pump curves showing head, flow, bhp, and efficiency requirements.
d. NPSH required test curve if required by the pump specification. Otherwise, a calculated NPSH required curve may be submitted.
e. Certification that the pump shaft horsepower demand did not exceed the rated motor horsepower of 1.0 service rating at any point on the curve.

2. Factory Witnessed Tests: All pumps, and motors, 150 hp and larger shall be factory-tested as complete assembled systems and may be witnessed by the OWNER and ENGINEER. The CONTRACTOR shall give the ENGINEER a minimum of 2 weeks notification prior to the test. All costs for OWNER and ENGINEER shall be borne by the CONTRACTOR and shall be included in the bid price. Such costs shall include travel and subsistence for two people excluding salaries. Test results shall be submitted to the ENGINEER. No equipment shall be shipped until the test data have been approved by the ENGINEER.
3. Acceptance: In the event of failure of any pump to meet any of the requirements, the CONTRACTOR shall make all necessary modifications, repairs, or replacements to conform to the requirements of the Contract Documents and the

pump shall be re-tested until found satisfactory.

PART 3 – EXECUTION

3.01 SERVICES OF MANUFACTURER

A. Inspection, Startup, and Field Adjustment: Where required by the individual pump Sections, an authorized service representative of the manufacturer shall visit the Site for the number of days indicated in those sections to witness the following and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.

1. Installation of the equipment
2. Inspection, checking, and adjusting the equipment
3. Startup and field testing for proper operation
4. Performing field adjustments to ensure that the equipment installation and operation comply with requirements

B. Instruction of the Owner's Personnel

1. Where required by the individual pump Sections, an authorized training representative of the manufacturer shall visit the Site for the number of days indicated in those Sections to instruct the OWNER'S personnel in the operation and maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment. Instruction shall be specific to the models of equipment provided.
2. The representative shall have at least 2 years experience in training. A resume for the representative shall be submitted.
3. Training shall be scheduled a minimum of 3 weeks in advance of the first session.
4. Proposed training material and a detailed outline of each lesson shall be submitted for review. Comments shall be incorporated into the material.
5. The training materials shall remain with the trainees.
6. The OWNER may videotape the training for later use with the OWNER'S personnel.

3.02 INSTALLATION

A. General: Pumping equipment shall be installed in accordance with the manufacturer's written recommendations.

B. Alignment: All equipment shall be field tested to verify proper alignment and freedom from binding, scraping, shaft runout, or other defects. Pump drive shafts shall be measured just prior to assembly to ensure correct alignment without forcing. Equipment shall be secure in position and neat in appearance.

C. Lubricants: The CONTRACTOR shall provide the necessary oil and grease for initial operation.

3.03 PROTECTIVE COATING

A. Materials and equipment shall be coated as required in Section 09905 – Painting and Protective Coatings.

3.04 FIELD TESTS

A. Each pump system shall be field tested after installation to demonstrate:

1. Satisfactory operation without excessive noise and vibration.
2. No material loss caused by cavitation.
3. No overheating of bearings.
4. Indicated head, flow, and efficiency at design point.

B. The following field testing shall be conducted:

1. Startup, check, and operate the pump system over its entire speed range. If the pump is driven by a variable speed drive, the pump and motor shall be tested at 100 RPM increments. If the pump is driven at constant speed, the pump and motor shall be tested at max RPM. Unless otherwise indicated, vibration shall be within the amplitude limits recommended by the Hydraulic Institute Standards at a minimum of four pumping conditions defined by the ENGINEER.
2. Obtain concurrent readings of motor voltage, amperage, pump suction head, and pump discharge

head for at least 4 pumping conditions at each pump rotational speed if variable speed at 100 RPM increment or at max RPM if constant speed. Check each power lead to the motor for proper current balance.

3. Determine bearing temperatures by contact type thermometer. A run time until bearing temperatures have stabilized shall precede this test, unless insufficient liquid volume is available.
4. Electrical and instrumentation tests shall conform to the requirements of the sections under which that equipment is specified.

C. Field testing will be witnessed by the ENGINEER. The CONTRACTOR shall furnish 3 days advance notice of field testing.

D. In the event any pumping system fails to meet the indicated requirements, the pump shall be modified or replaced and re-tested as above until it satisfies the requirements.

E. After each pumping system has satisfied the requirements, the CONTRACTOR shall certify in writing that it has been satisfactorily tested and that all final adjustments have been made. Certification shall include the date of the field tests, a listing of all persons present during the tests, and the test data.

F. The CONTRACTOR shall be responsible for all costs of field tests, including related services of the manufacturer's representative, except for power and water, which the OWNER will bear. If available, the OWNER'S operating personnel will provide assistance in field testing.

END OF SECTION

SECTION 11291

SLUICE GATES

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes furnishing all labor, materials, equipment and incidentals required, and installing and field testing the stainless steel flow control sluice gates and operators.

1.02 GENERAL

A. The equipment provided under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer unless exceptions are noted by the ENGINEER.

B. Gates and operators shall be supplied with all the necessary parts and accessories indicated on the drawings, specified or otherwise required for a complete, properly operating installation, and shall be the latest standard product of a manufacturer regularly engaged in the production of fabricated gates.

C. Gates supplied under this section shall be Series 20 stainless steel flow control sluice gates as manufactured by H. Fontaine Ltd.

1.03 QUALITY ASSURANCE

A. The manufacturer shall have experience in the production of substantially similar equipment, and shall show evidence of satisfactory operation in at least 50 installations. The manufacturer's shop welds, welding procedures and welders shall be qualified and certified in accordance with the requirement of the latest edition of ASME, Section IX.

B. Except as modified or supplemented herein, all gates and operators shall conform to the applicable requirements of AWWA C561, latest edition.

C. Gates shall be shop inspected for proper operation before shipping.

D. The manufacturer shall be ISO 9001: 2000 certified.

E. Leakage:

1. Sluice gates shall be substantially watertight under the design head conditions. Under the design seating head, the leakage shall not exceed 0.05 U.S. gallon per minute per foot (0.60 l/min per meter) of seating perimeter. Under the design unseating head, the leakage for heads of 20 feet (6m) or less shall not exceed 0.1 U.S. gallon per minute per foot (1.25 l/min per meter) of perimeter. For unseating heads greater than 20 feet (6m), the allowable leakage shall not exceed the rate per foot (meter) of perimeter specified by the following equations:

   Maximum allowable leakage:

   Gallons per minute per foot of perimeter:
   = 0.10 + [0.0025 x (unseating head in feet - 20)]

   Liters per minute per meter of perimeter:
   = 1.25 + [0.1025 x (unseating head in meters - 6.1)]

F. Design Head:

1. The sluice gates shall be designed to withstand the design head shown in the schedule.

G. Seal Performance Test:

1. The gate's sealing system shall have been tested through a cycle test in an abrasive environment and shall show that the leakage requirements are still obtained after 25,000 cycles with a minimum deterioration.

1.04 SUBMITTALS

A. The manufacturer shall submit for approval by the purchaser, drawings showing the principal dimensions, general construction and materials used in the gate and lift mechanism.

PART 2 – PRODUCTS

2.01 SLUICE GATES

A. General Design:

1. Gates shall be either self-contained or non self-contained of the rising stem, non-rising or telescopic stem configuration as indicated on the gate schedule.

B. Wall Thimble:

1. The wall thimble shall be stainless steel and supplied by the gate manufacturer. Refer to the gate schedule for type and applicable locations. Material thickness shall be according to the manufacturer's recommendations and be of sufficient resistance to handle the operating forces.

C. Frame:

1. The gate frame shall be constructed of structural members or formed plate welded to form a rigid one-piece frame. The frame shall be of the flange back design suitable for mounting on a concrete wall (CW), concrete wall with extra-wide flange (CWX), round manhole (RM), round manhole with extra-wide flange (RMX), a wall thimble (WT), or a standard flange (SF). The guide slot shall be made of UHMWPE (ultra high molecular weight polyethylene).

2. The frame configuration shall be of the flush-bottom type and shall allow the replacement of the top and side seals without removing the gate frame from the concrete or wall thimble.

D. Slide:

1. The slide shall consist of a flat plate reinforced with formed plates or structural members to limit its deflection to 1/720 of the gate's span under the design head.

E. Guides and Seals:

1. The guides shall be made of UHMWPE (ultra high molecular weight polyethylene) and shall be of such length as to retain and support at least two thirds (2/3) of the vertical height of the slide in the fully open position.

2. Side and top seals shall be made of UHMWPE (ultra high molecular weight polyethylene) of the self-adjusting type. A continuous compression cord shall ensure contact between the UHMWPE guide and the gate in all positions. The sealing system shall maintain efficient sealing in any position of the slide and allow the water to flow only in the opened part of the gate.

3. The bottom seal shall be made of resilient neoprene set into the bottom member of the frame and shall form a flush-bottom.

2.02 OPERATORS AND STEM

A. Stem and Couplings:

1. The operating stem shall be of stainless steel designed to transmit in compression at least 2 times the rated output of the operating manual mechanism with a 40 lbs (178 N) effort on the crank or handwheel.

2. The stem shall have a slenderness ratio (L/r) less than 200. The threaded portion of the stem shall have machined cut threads of the Acme type.

3. Where a hydraulic, pneumatic or electric operator is used, the stem design force shall not be less than 1.25 times the output thrust of the hydraulic or pneumatic cylinder with a pressure equal to the maximum working pressure of the supply, or 1.25 times the output thrust of the electric motor in the stalled condition.

   a. For stems in more than one piece and with a diameter of 1¾ inches (45 mm) and larger, the different sections shall be joined together by solid bronze couplings. Stems with a diameter smaller than 1¾ inches (45 mm) shall be pinned to an extension tube.

   b. The couplings shall be grooved and keyed and shall be of greater strength than the stem.

   c. Gates having a width greater than two times their height shall be provided with two lifting mechanisms connected by a tandem shaft.

B. Stem Guides:

1. Stem guides shall be fabricated from type 316L stainless steel. The guide shall be equipped with an UHMWPE bushing. Guides shall be adjustable and spaced in accordance with the manufacturer's recommendation. The L/r ratio shall not be greater than 200.

C. Stem Cover:

1. Rising stem gates shall be provided with a clear polycarbonate stem cover. The stem cover shall have a cap and condensation vents and a clear mylar position indicating tape. The tape shall be field applied to the stem cover after the gate has been installed and positioned.

D. Lifting Mechanism:

1. Manual operators of the types listed in the schedule shall be provided by the gate manufacturer.

2. All bearings and gears shall be totally enclosed in a weather tight housing. The pinion shaft of crank-operated mechanisms shall be constructed of stainless steel and supported by roller or needle bearings.

3. Each manual operator shall be designed to operate the gate under the maximum specified seating and unseating heads by using a maximum effort of 40 lbs (178 N) on the crank or handwheel, and shall be able to withstand, without damage, an effort of 80 lbs (356 N).

4. The crank shall be removable and fitted with a corrosion-resistant rotating handle. The maximum crank radius shall be 15 inches (381 mm) and the maximum handwheel diameter shall be 24 inches (610 mm).

E. Yoke:

1. Self-contained gates shall be provided with a yoke made of structural members or formed plates. The maximum deflection of the yoke shall be 1/360 of the gate's span.

2.03 MATERIALS

PART	MATERIAL
Frame, yoke, stem guides, slide, stem extension	Stainless steel Type 316L
Side seals, stem guide liner	Ultra high molecular weight polyethylene (UHMWPE) ASTM D-4020
Compression cord	Nitrile ASTM D2000 M6BG 708, A14, B14, E014, E034
Bottom seal	Neoprene ASTM D2000 Grade 2 BC 510
Threaded stem	Stainless steel Type 316
Fasteners	ASTM GR2 for type 316
Pedestal, handwheel and crank	Tenzaloy aluminum
Gasket (between frame and wall)	EPDM ASTM 1056
Stem cover	Polycarbonate ASTM D-3935
Lift nut, couplings	Manganese bronze ASTM B584 UNS-C86500

2.04 SCHEDULE

Gate Location	Anoxic Basin #1 & #2
Gate Identification	36″x36″ sluice gate w/FLGxFLGxFLG RND. Wall Thimble & B.F.
Gate Type	Open
Size Width x Height	36″x36″
Centerline of Wall Opening to Top of Tank	15′-3″
Invert Type	Chase
Head (Seating; Unseating)	Unseating
Mounting	Wall thimble

Gate Type: Open or self-contained

Mounting: CW - Mounted on a concrete wall
CWX - Mounted on a concrete wall in front of a pipe(specify type of pipe)
RM - Mounted on a round concrete wall
RMX - Mounted on a round concrete wall in front of a pipe(specify type of pipe)
WT - Mounted on a wall thimble
SF - Mounted on a standard flange

PART 3 – EXECUTION

3.01 INSTALLATION

A. Gates and appurtenances shall be handled and installed in accordance with the manufacturer's recommendations.

3.02 FIELD TESTS

A. Following the completion of each gate installation, the gates shall be operated through at least two complete open/close cycles. If an electric or hydraulic operator is used, limit switches shall be adjusted following the manufacturer's instructions.

B. Gates should be checked for leakage by the contractor (refer to the “Performance” section for approval criteria).

END OF SECTION

SECTION 11293

DOWNWARD-OPENING WEIR GATES

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes furnishing all labor, materials, equipment and incidentals required and installing and field testing the stainless steel downward opening weir gates and operators located at Aerobic Basin #1 and Aerobic Basin #2.

1.02 GENERAL

A. The equipment provided under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer unless exceptions are noted by the engineer.

B. Gates and operators shall be supplied with all the necessary parts and accessories indicated on the drawings, specified or otherwise required for a complete, properly operating installation and shall be the latest standard product of a manufacturer regularly engaged in the production of water control gates.

C. Weir gates supplied under this section shall be Series 40 stainless steel downward opening weir gates as manufactured by H. Fontaine Ltd.

1.03 QUALITY ASSURANCE

A. The manufacturer shall have experience in the production of substantially similar equipment, and shall show evidence of satisfactory operation in at least 50 installations. The manufacturer's shop welds, welding procedures and welders shall be qualified and certified in accordance with the requirement of the latest edition of ASME, Section IX.

B. Except as modified or supplemented herein, all gates and operators shall conform to the applicable requirements of AWWA C513, latest edition.

C. Weir gates shall be shop inspected for operation before shipping.

D. The manufacturer shall be ISO 9001: 2000 certified.

E. Leakage:

1. Weir gates shall be substantially watertight under the design head conditions. Leakage shall not exceed 0.05 U.S. gallon per minute per foot (0.60 l/min per meter) of seal periphery under the design seating head and 0.1 U.S. gallon per minute per foot (1.25 l/min per meter) of seal periphery for the design unseating head.

F. Design Head

1. Weir gates shall be designed to withstand the design head (maximum design head shall be taken as the height of the slide unless otherwise shown in the schedule).

G. Seal Performance Test

1. The weir gate's sealing system shall have been tested through a cycle test in an abrasive environment and shall show that the leakage requirements are still obtained after 25,000 cycles with a minimum deterioration.

1.04 SUBMITTALS

A. The manufacturer shall submit, for approval by the purchaser, drawings showing the principal dimensions, general construction and materials used in the gate and lift mechanism.

PART 2 – PRODUCTS

2.01 WEIR GATES

A. General Design

1. Weir gates shall be either self-contained or non self-contained, and of the rising stem or non-rising stem configuration, as indicated on the gate schedule.

B. Frame

1. The gate frame shall be constructed of structural members or formed plate welded to form a rigid one-piece frame. The frame shall be of the flange back design, suitable for mounting on a concrete wall (CW). The guide slot shall be made of UHMWPE (ultra high molecular weight polyethylene).

C. Slide

1. The slide shall consist of a flat plate reinforced with formed plates or structural members to limit its deflection to 1/720 of the gate's span under the design head.

D. Guides and Seals

1. The guides shall be made of UHMWPE (ultra high molecular weight polyethylene) and shall be of such length as to retain and support at least two thirds (2/3) of the vertical height of the slide in the fully open position.

2. The bottom and side seals shall be made of UHMWPE (ultra high molecular weight polyethylene) of the self-adjusting type. A continuous compression cord shall ensure contact between the UHMWPE guide and the gate in all positions. The sealing system shall maintain efficient sealing in any position of the slide and let the water flow only in the open part of the gate.

3. Seals shall maintain the specified leakage rate in both seating and unseating conditions.

2.02 OPERATORS AND STEM

A. Stem and Couplings

1. The operating stem shall be of stainless steel designed to transmit in compression at least two (2) times the rated output of the operating manual mechanism with a 40 lbs (178 N) effort on the crank or handwheel.

2. The stem shall have a slenderness ratio (L/r) less than 200. The threaded portion of the stem shall have machine cut threads of the Acme type.

3. Where a hydraulic, pneumatic or electric operator is used, the stem design force shall not be less than 1.25 times the output thrust of the hydraulic or pneumatic cylinder, with a pressure equal to the maximum working pressure of the supply or 1.25 times the output thrust of the electric motor in the stalled condition.

   a. For stems in more than one piece and with a diameter of 1-3/4 inches (45 mm) and larger, the different sections shall be joined together by solid bronze couplings. Stems with a diameter smaller than 1-3/4 inches, shall be pinned to an extension tube.

   b. The couplings shall be grooved and keyed and shall be of greater strength than the stem.

   c. Gates having width equal to or greater than two times their height shall be provided with two lifting mechanisms connected by a tandem shaft.

B. STEM GUIDES

1. Stem guides shall be fabricated from type 304L stainless steel. The guide shall be equipped with an UHMWPE bushing. Guides shall be adjustable and shall be spaced in accordance with the manufacturer's recommendation. The L/r ratio shall not be greater than 200.

C. STEM COVER

1. Rising stem gates shall be provided with a clear polycarbonate stem cover. The stem cover shall have a cap and condensation vents as well as a clear mylar position indicating tape. The tape shall be field applied to the stem cover after the gate has been installed and positioned.

D. LIFTING MECHANISM

1. Manual operators of the types listed in the schedule shall be provided by the gate manufacturer.

2. All bearings and gears shall be totally enclosed in a weather tight housing. The pinion shaft of crank-operated mechanisms shall be constructed of stainless steel and supported by roller or needle bearings.

3. Each manual operator shall be designed to operate the gate under the maximum specified seating and unseating heads by using a maximum effort of 40 lbs. (178 N) on the crank or handwheel, and shall be able to withstand, without damage, an effort of 80 lbs. (356 N).

4. The crank shall be removable and fitted with a corrosion resistant rotating handle. The maximum crank radius shall be 15 inches (381 mm) and the maximum handwheel diameter shall be 24 inches (610 mm).

E. YOKE

1. Self-contained gates shall be provided with a yoke made of structural members or formed plates. The maximum deflection shall be 1/360 of the gate's span.

2.03 MATERIALS

PART	**MATERIAL**
Frame, yoke, stem guides, slide, stem extension	Stainless steel ASTM A-240 type 304L
Guides, side and bottom seals, stem guide liner	Ultra high molecular weight polyethylene (UHMWPE) ASTM D-4020
Compression cord	Nitrile ASTM D2000 M6BG 708, A14, B14, E014, E034
Threaded stem	Stainless steel ASTM A-276 type 303
Fasteners	ASTM GR2 for type 316
Pedestal, handwheel and crank	Tenzaloy aluminum
Gasket (between frame and wall)	EPDM ASTM 1056
Stem cover	Polycarbonate ASTM D-3935
Lift nut, couplings	Manganese bronze ASTM B584 UNS-C86500

2.04 SCHEDULE

Gate Location	Aerobic Basin #1 & #2
Gate Identification	Weir Gate #1 & #2
Gate Type	Self-Contained
Size Width x Height	180″ x 36″
Operating Floor Elevation	N/A
Invert Elevation	N/A
Head (Seating; Unseating)	Seating
Mounting	CW

Gate Type: Open or self-contained

Mounting: CW - Mounted concrete wall

PART 3 – EXECUTION

3.01 INSTALLATION

A. Gates and appurtenances shall be handled and installed in accordance with the manufacturer's recommendations.

3.02 FIELD TESTS

A. Following the completion of each gate installation, the gates shall be operated through at least two complete open/close cycles. If an electric or hydraulic operator is used, limit switches shall be adjusted following the manufacturer's instructions.

B. Gates should be checked for leakage by the contractor (refer to the "Performance" section for approval criteria).

END OF SECTION

SECTION 11303

NON-CLOG SUBMERSIBLE SEWAGE PUMPS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope:

1. Furnish, install, and test submersible sewage pumps, motors, and related equipment necessary to complete work shown or specified for the lake gravity disk filter backwash pump station.

2. Equipment shall include pump(s), motor(s), pump base(s), guide rail system, access frames & covers, pre-fabricated fiberglass wet well and valve pit, electrical power, control system, and appurtenances. Provide all components of the pumping units by one manufacturer.

1.02 REFERENCES

A. Codes, Specifications, and Standards: Codes, specifications, and standards referred to by number of title shall form a part of this specification to the extent required by the references thereto.

1.03 SUBMITTALS

A. Submittals shall be as specified in the General Conditions and Section 01340 – Shop Drawings, Project Data and Samples.

B. Submit the following:

1. Manufacturer’s Certificate of Compliance certifying compliance with the referenced specifications and standards.

2. Shop drawings with performance data and physical characteristics.

3. Manufacturer’s installation instructions.

4. Manufacturer’s operation and maintenance material and manuals.

5. Certified copies of test reports.

1.04 QUALITY ASSURANCE

A. Have pumping unit manufacturer test each pump for mechanical and electrical correctness.

B. Perform field tests specified in this Section.

C. Certification of the wet well H-20 load rating must be supplied with submittals. The H-20 certification must be signed and sealed by an Engineer registered in the State of Florida. After the wet well has been installed, the ASTM certification number and serial tracking number must be visible.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Be responsible for the delivery, storage, and handling of products.

B. Load and unload all pumps, motors, fiberglass wet well and valve pit, and appurtenances by hoists or skidding. Do not drop products. Do not skid products on or against other products. Pad slings and hooks in such a manner as to prevent damage to products.

C. Package the pumping units furnished in such a manner as to provide ample protection from damage during handling, shipment, and outdoor storage at the lift station site. Cap all openings with dustproof closures and seal or tape all edges to provide a dust-tight closure.

D. Promptly remove damaged products from the job site. Replace damaged products with undamaged products.

1.06 WARRANTY

A. Provide warranty from the pump manufacturer warranting the complete units being supplied to the OWNER against defects in workmanship and material for a period of five (5) years or 10,000 hours under normal use, operation and service. Provide the warranty in printed form and submit with the normal drawings.

B. Provide a written 20-year warranty on the H-20 load rated fiberglass wet well.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. ITT Flygt Corporation, Barney's Pump, or equivalent.

2.02 NON-CLOG SUBMERSIBLE CENTRIFUGAL PUMPS, GUIDE RAIL BASE AND GUIDE RAIL DESIGN

A. The pump(s) shall be capable of handling raw unscreened sewage, storm water, and other similar solids-laden fluids without clogging. The pumps shall be installed in the H-20 FRP wet well utilizing a dual slide rail system. The discharge base and elbow shall be permanently installed in the wet well and connected to the discharge piping. In order to prevent binding or separation of the pump from the guide rail system, the pump(s) shall connect to the guide rail(s) base automatically and firmly, guided by the 316 stainless steel guide rail(s) extending from the top of the station to the discharge connection. Cable guide systems shall not be considered acceptable. Each pump shall be fitted with 15 feet of 316 stainless cable of adequate strength to permit raising the pump(s) for inspection. The working load of the lifting system shall be 50 percent greater than the pump unit weight. There shall be no need for personnel to enter the wet well to remove or reinstall the pump(s). Positive sealing of the pump to the discharge elbow shall be accomplished by metal to metal contact between the pump and discharge elbow. No portion of the pump shall bear directly on the floor of the sump. The pump with its appurtenances and cable shall be capable of continuous submergence to a depth of 65 feet.

2.03 PUMP CONSTRUCTION

A. Major pump components shall be of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of porosity or other irregularities. The lifting handle shall be of stainless steel. All exposed nuts and bolts shall be AISI type 316 stainless

steel construction. All exterior metal surfaces of the pump coming into contact with the pumped media (other than the stainless steel or brass components) shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish.

B. Sealing design for the pump/motor assembly shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where a watertight seal is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Sealing will be the result of controlled compression of rubber O-ring in two planes and O-ring contact of four sides without requiring a specific torque limit. Rectangular cross-sectioned gaskets requiring specific torque limits to achieve compression shall not be considered adequate or equal. No secondary sealing compounds, elliptical O-rings, grease, or other devices shall be used.

C. The pump volute shall be single piece gray cast iron, ASTM A48, Class 35B, non-concentric design with smooth passages large enough to pass any solids, which may enter the impeller. Minimum discharge size shall be as specified.

D. The impeller shall be of gray cast iron, Class 35B, dynamically balanced, double shrouded non-clogging design having a long throughlet without acute turns. The impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in wastewater. Whenever possible, a full vaned, not vortex, impeller shall be used for maximum hydraulic efficiency, thus reducing operating costs. The impeller shall be retained with an allen head bolt and shall be capable of passing a minimum 3-inch diameter solid.

E. A wear ring system shall be used to provide efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass ring insert that is drive fitted to the volute inlet.

F. The pump shaft and motor shaft shall be an integral unit. Each shaft shall be of ASTM A479 stainless steel material and adequately designed to meet the maximum torque required at any normal start-up condition or operating point in the system.

G. Each pump shall be equipped with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary tungsten carbide seal ring and one rotating tungsten carbide seal ring. The upper, secondary seal unit, located between the lubricant chamber and motor housing, shall contain one stationary tungsten carbide seal ring and one rotating seal ring made from tungsten carbide. Each seal interface shall be held in contact by its own spring system. The seals shall not require routine maintenance or adjustment, and shall not be dependent on the direction of rotation for proper sealing. Each pump shall be provided with a lubricant chamber for the shaft sealing system, which shall provide superior heat transfer and maximum seal cooling. The lubricant chamber shall be designed to prevent overfilling, and to provide lubricant expansion capacity. The drain and inspection plug shall have a positive anti-leak seal, and shall be easily accessible from the outside of the pump. The seal system shall be rely upon the pumped media for lubrication and shall not be damaged when the pump is run dry. Seal lubricant shall be FDA approved, nontoxic.

The following seal types shall not be considered acceptable or equal: seals requiring set screws, pins, or other mechanical locking devices to hold the seal in place; conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces; cartridge type systems, any system requiring a pressure differential to seat the seal and ensure sealing.

H. Each pump shaft shall rotate on permanently lubricated, greased bearings. The upper bearing shall be a single deep grooved ball bearing and the lower bearings shall be heavy-duty double row angular contact ball bearing. Bearings shall be of sufficient size and properly spaced to transfer all radial and axial loads to the pump housing and minimize shaft deflection. B-10 bearing life shall be a minimum of 50,000 hr. at BEP.

2.04 MOTOR(S)

A. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of no less than 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber containing the terminal board shall be hermetically sealed from the motor by an elastomer compression seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts

permanently affixed to a terminal board. The motor and the pump shall be produced by the same manufacturer.

B. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus 10%. The motor shall be designed for operation up to 40°C (104°F) ambient and with a temperature rise not to exceed 80°C. A performance chart shall be provided upon request showing curves for torque, current, power factor, input/output kW and efficiency. This chart shall also include data on starting and no-load characteristics.

C. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The motor and cable shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 65 feet or greater.

D. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut-off through run-out.

E. Motors are sufficiently cooled by the surrounding environment or pumped media. A water jacket is not required.

F. The cable entry design shall not require specific torque requirements to insure a watertight seal. The cable entry shall consist of a cylindrical elastomer grommet, flanked by stainless steel washers. A cable cap incorporating a strain relief shall mount to the cable entry boss compressing the grommet ID to the cable while the grommet OD seals against the bore of the cable entry. The junction chamber shall be equipped with a removable cover allowing for cable removal or voltage change without opening the motor. The junction chamber shall be sealed from the motor by means of a sealing gland or terminal board.

Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

2.05 PUMP STATION CONTROL PANEL AND COMPONENTS

A. General: This section specifies the electrical power system requirements for wastewater pump stations. These requirements apply to duplex pump panels. The manufacturer of the control panel shall provide data to indicate that the manufacturer has a minimum of 3 years experience in the fabrication of pump control panels.

B. Panel Construction: The duplex pump panel shall be assembled and built by a UL508A certified manufacturing facility. The enclosure shall be housed in a NEMA 4X, minimum 30”x30”x10” deep Type 316, 14 gauge stainless steel enclosure. Enclosure shall incorporate a three-point latch with two other fasteners and shall have provisions for padlocking the door and a dead front inner door unit for mounting controls. All exterior hardware and hinges shall be stainless steel.

There shall be permanently affixed to the interior side of the exterior enclosure door both a nameplate and a 10" x 12" pocket for log sheet storage. The nameplate shall contain the following information: voltage, phase, rated horsepower, speed, date manufactured, pump and control panel manufacturer's name, address and telephone number, pump data, including impeller data, discharge capacity (gpm) and head (ft.), kW input, and amps at the operating point and at least two other points on the pump curve.

The enclosure shall have external mounting feet to allow for mounting to unistrut channel. All hardware shall be stainless steel.

C. The following components shall be mounted through the enclosure:

1. 1 ea. Red Alarm Beacon (Light)
2. 1 ea. Alarm Horn
3. 1 ea. Generator Receptacle with weatherproof cover.
4. 1 ea. Alarm Silence Pushbutton

D. The back panel shall be fabricated from .125, 5025-H32 marine alloy aluminum. All components shall be mounted by machined stainless steel screws. The following components shall be mounted to the back panel:

1. 2 ea. Motor Contactors
2. 1 ea. Phase Monitor (Three Phase)
3. 1 ea. Control Transformer (480 Volt only)
4. 1 ea. Silence Relay
5. 1 ea. Model BOAC5AH Battery Back-Up with Smart Charger (per DEP)
6. 20 ea. Terminals for Field Connections
7. 3 ea. Grounding Lugs

E. The inner door shall be fabricated from .080, 5052-H32 marine alloy aluminum. The inner door shall have a continuous aluminum piano hinge. The following components shall be mounted through the inner door:

1. 1 ea. Main Circuit Breaker
2. 1 ea. Emergency Circuit Breaker
3. 1 ea. Mechanical Interlock for Emergency and Main Breakers
4. 2 ea. Short Circuit Protectors
5. 1 ea. Control Circuit Breaker
6. 1 ea. Hand-Off-Auto Selector Switches
7. 2 ea. Pump Run Pilot Lights
8. 1 ea. Power On Pilot Light
9. 2 ea. Elapse Time Meters (Non-Resetable)
10. 1 ea. GFI Duplex Convenience Outlet

F. Component Specifications:

1. All circuit breakers shall be molded thermal magnetic. The mechanical interlock shall prevent the normal and emergency main breakers being energized at the same time.

2. An emergency generator receptacle shall be supplied in accordance with DEP standards. The generator receptacle shall be adequately sized to meet the equipment operating conditions.

3. Neutral to be supplied for both 230V 3 Phase or 230V single phase power.

4. All motor short circuit protection devices must provide for under voltage release and Class 10 overload protection on all three phases. Visible trip indication, test, and reset capability must be provided without opening inner door.

5. Open frame, across the line, contactors shall be rated per IEC standards and properly sized per the motor requirements. Contactors shall provide for safe touch power and control terminals.

6. Lightning arrestor shall meet or exceed the requirements of ANSI/IEEE Std. C62.21-1984 Section 8.6.1 and 8.7.3 shall be supplied by electrician and mounted on the bottom side of the switch disconnect ahead of the pump control panel.

7. A phase monitor shall be supplied for three phase service.

8. A green pilot light shall be supplied for each motor. The pilot light shall illuminate each time the motor is called to run.

9. Each pump shall have an Elapse Time Meter to record the accumulated run time. The ETM shall be 2″ diameter, non-resettable, six digit, totally encapsulated unit.

10. A red pilot light shall be supplied for control power. The pilot light shall illuminate when the control power is available inside the control panel.

11. Relays shall be ice-cube plug-in type. Relay contacts shall be rated 10 amp minimum, DPDT.

12. Twenty (20) terminals shall be supplied for field connections. The terminals shall be rated 25 amps minimum.

13. Each motor over-temperature contact shall be connected to the terminal strip and shall open a contact to de-energize the appropriate motor upon a high temperature within the motor.

14. A 15 amp GFI duplex receptacle shall be supplied and mounted on the inner door.

15. Ground lugs shall be supplied and appropriately sized for each motor and for service entrance.

16. Nameplates for the inner door and back panel shall be of a graphic design, specifically depicting the intent for each device.

17. MISCELLANEOUS: All wiring on the back panel shall be contained within the wiring duct. All wiring between the inner door and the back panel shall be contained within a plastic spiral wrap. Each wire shall have a wire number at each end to correspond to the as-built drawing for field troubleshooting.

2.06 PUMP STATION CONTROL SYSTEM

A. All control components shall be mounted in the same enclosure as the power system components. 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. The control panel shall also provide electrical tracking provisions for any SCADA system.

B. A pump station control panel shall be provided for the lake gravity disk filter backwash pump station. The control panel shall respond to liquid level float switches to automatically start and stop pumps as well as sound an alarm upon high and low wet well levels. The control panel shall operate two (2) electrical submersible pumps at the power characteristics stipulated. The control function shall provide for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump shall automatically start to handle this increased flow. As the flow decreases, pumps shall be cut off at an 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.

2.07 ACCESS FRAMES AND COVERS

A. The wet well and valve pit shall be furnished with an access frame and cover. Equipment furnished shall include the necessary aluminum access frames, complete with hinged and slide bar equipped covers, 316 stainless steel upper guide rail brackets and 316 stainless steel level sensor cable holder. The frames shall be securely mounted above the pumps. Doors shall be of aluminum checkered plate. The access cover and frame with stainless steel hardware shall be sized in accordance with the pump manufacturer's requirements for proper pump spacing.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install the pre-fabricated lift station in strict accordance with the Drawings and manufacturer's written instructions.

B. Place concrete ballast material at the base of the wet well and valve pit, to the dimensions shown on the drawings.

3.02 TESTING

A. After installation, test each pump in accordance with manufacturer's instructions. Record test voltage and amperage measurements.

3.03 MANUFACTURER'S REPRESENTATIVE

A. Provide services of a qualified manufacturer's service representative to inspect equipment installation and to perform the required field tests.

3.04 CLEANING

A. Clean grease, oil or any other debris from the exterior surfaces of the pump and motor; make sure all passages are clear of obstruction and that impellers rotate freely.

END OF SECTION

SECTION 11312

LAKE GRAVITY DISK FILTERS

PART 1 GENERAL

1.01 DESCRIPTION

A. Furnish, install and test three (3) lake gravity disk filters.

B. The filters shall have all stainless steel media disks that operate in pairs. The filtration flow pattern shall be from inside the disks to outside the disks with filtrate leaving the filter by gravity. The filter shall be fed by gravity or by pumping.

C. The contractor shall furnish all labor, materials, equipment and incidentals required for installation of the filter assembly. The filter itself will be a completely self-contained unit including the drive assembly, bottom sediment discharge valve, and electrical junction box with emergency stop push button. The filter will not require field component assembly. In addition to the rear panel access via elevated platform shown on the drawings, the contractor shall provide a means to access the front panels either by additional platform construction or rolling platform ladder.

D. All motors, pumps, and bearings shall be designed for continuous duty and long operating life in a high humidity atmosphere. All electric motors and pumps shall be TEFC, 480 volt/60 hertz, 3 phase.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Division 13 – Instrumentation and Controls

B. Section 15062 – Ductile Iron Pipe and Fittings

C. Division 16 – Electrical

D. Section 16150 – Motors

E. Section 16483 – Variable Frequency Drives

1.03 QUALITY ASSURANCE

A. The equipment manufacturer shall have no less than twenty-five (25) installations of the same or similar applications.

B. All the equipment specified under this Section shall be furnished by a single manufacturer (the Disk Filter Equipment Manufacturer) fully experienced, reputable, and qualified in the manufacture of the equipment specified.

C. Available Manufacturers – Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work are limited to Nova Water Technologies, LLC, Tampa, Florida or Approved Equal. Contractor shall be responsible for all redesign work associated with Approved Equals.

D. All finish assembled equipment shall be factory wet-tested prior to delivery. Manufacturer shall provide a complete wet-testing report included within the final operations and maintenance manual. Wet testing report shall include recorded measurement of motor amp draws, wash pressure verification, testing of project specific control panel with project specific equipment, and photographs of finished assembled equipment during wet testing. Wet testing report shall have certification signature and date in which project equipment has been tested and is ready for delivery.

E. The equipment manufacturer shall furnish the services of a factory trained representative for a maximum of three (3) trips and four (4) days at the jobsite to inspect the Contractor’s equipment installation, supervise the initial operation of the equipment, instruct the plant operating personnel in proper operation and maintenance, and provide process assistance.

F. The equipment manufacturer shall reserve a minimum of one (1) day on site to work with the SCADA software programmer for verification of filter system operation and monitoring of signals by the SCADA system. This time will be schedule after all equipment is installed and operational and all field wiring completed.

G. The equipment manufacturer shall have a service center and parts warehouse within the state of Florida.

H. The equipment manufacturer shall provide on-site servicing of the installation once a month for the duration of the manufacturer's warranty. Field service reports summarizing monthly on-site servicing shall be written for project documentation. Field service reports shall be chronologically sorted and delivered to the Owner at the conclusion of warranty duration.

1.04 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples

B. Submit manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.

C. Shop Drawing Submittals shall include at least the following:

1. Certified shop and erection drawings showing all important details of construction, dimensions, anchor bolt locations, and field connections.

2. Certified shop drawings and cut sheets showing compliance with the performance requirements of this specification.

3. Descriptive literature, bulletins, and catalogs of the equipment, including lubrication points.

4. Installation, operation, and start-up procedures, including lubrication requirements.

5. Complete motor data

6. Total weight of the equipment including the weight of the single largest item, both empty and operating full of water.

7. A complete bill of materials for all equipment with the O&M manual. No samples will be required.

8. A list of spare parts that are supplied with the project.

1.05 DELIVERY, STORAGE AND HANDLING

A. After hydrostatic or other factory 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.

B. Each box or package shall be properly marked to show its net weight in addition to its contents.

C. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

D. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted.

E. The Contractor shall store and temporarily support equipment prior to installation in strict accordance with the Manufacturer's recommendations and instructions. Protect all exposed surfaces. Keep records of the storage parameters and the dates that storage procedures were performed. The Contractor shall be responsible for work, equipment, and materials until inspected, tested and finally accepted.

F. Store gear reducers and motors in buildings or trailers which have a concrete or wooden floor, a roof, and fully closed walls on all sides. Protect the equipment from being contaminated by dust, dirt, vibration and moisture.

G. Temporarily connect equipment with built in space heaters to a power source and keep heaters in operation. Rotate all shafts that have bearings on at least a monthly basis.

H. Fabricated assemblies shall be shipped in the largest sections permitted by carrier regulations and shall be properly match-marked for ease of field erection. The units shall be erected and lubricated in strict accordance with the instructions of the Manufacturer's field engineer.

1.06 OPERATION AND MAINTENANCE MANUALS

A. Submit operations and maintenance manuals for the equipment in compliance with the Contract documents, 30 days prior to shipment. Manuals shall include:

1. Name, address, and telephone number of the nearest competent service representative who can furnish parts and technical service.

2. Descriptive literature, including illustrations, covering the operational features of the equipment, specific for the particular installation, with all inapplicable information omitted or marked out.

3. Operating, maintenance and troubleshooting information.

4. Complete maintenance parts list.

5. Complete connection, interconnecting and assembly diagrams.

6. Approved Shop Drawings.

1.07 WARRANTY

A. Per General Condition Article 9, the Contractor shall provide a 3 year warranty from substantial completion. The equipment supplier shall warrant that its equipment shall be free from defects in material and workmanship; and that it will replace or repair, F.O.B. its factory, any part or parts returned to it which examination shall show to have failed under normal use and service by the user.

B. Warranties and guarantees by the suppliers of various components in lieu of single source responsibility by the manufacturer will not be accepted. The manufacturer shall be solely responsible for the warranty of the submersible pumps and all components.

PART 2 PRODUCTS

2.01 GENERAL

A. Each of three (3) disk filter shall be the Ultrascreen® Disk Filter Model UL1608CS as supplied by Nova Water Technologies, LLC. Tampa, Florida or approved equal. The unit shall be complete, factory tested and ready for operation. The filter will be a totally self-contained functional unit. Field wiring and field piping will be by the Contractor.

B. All materials used shall be new, high grade, with properties best suited for the working environment. All stainless steel shall be grade 304 minimum. All stainless steel filtration mesh shall be precision grade, 304L stainless steel, minimum.

2.02 PERFORMANCE AND DESIGN PARAMETERS

A. The 3 disk filters together shall be capable of filtering water from the reclaimed water storage ponds, and shall be able to filter the water at the following flow rates:

Average Daily Flow:	7.50 MGD
Peak Hourly Flow:	15.0 MGD
Average Daily Backwash Reject:	≤ 1% of the Average Daily Flow

B. The filters shall operate continuously, always presenting new filtering media surfaces to the incoming flow at all times. Backwash shall be initiated when the differential level indicator reaches a preset limit.

2.03 FILTER TANK

A. The filter tank shall be constructed of all AISI Type 304 stainless steel and shall have a minimum thickness of 4 mm.

B. The tank shall be completely covered with light weight covers that allow easy access for maintenance and inspection. Covers shall have two handles per section and be made from all Type 304 stainless steel. The Cover retaining frame shall be manufactured from Type 304 Stainless Steel. Non-metallic material for cover fabrication shall not be acceptable.

2.04 DRIVE ASSEMBLY

A. The drive assembly shall be of the Chain & Sprocket type for energy efficiency, equipped with a maximum 3.0 HP adjustable speed motor SEW MOVIMOT or equal. Speed control shall be accomplished by an integral VFD offering local or remote RS-485 communications.

B. The drive manufacturer shall be ISO 9001 certified. The motor shall be of the "energy efficient" type with a minimum service factor of 1.1, F class insulation, capable of operation with a temperature rise of minus 20

to plus 40 degrees Celsius and with an IP 55 or higher rated enclosure.

C. The drive shall have an adjustable carrier frequency to 16 kHz for quiet operation, and shall provide overload, overvoltage, and phase failure as protective functions.

D. The drive motor shall be inverter duty rated and be Totally Enclosed Fan Cooled (TEFC) with a pressed-steel fan guard.

2.05 CENTER AXLE ASSEMBLY

A. The center axle on which the disks are mounted shall be made of AISI 304 stainless steel. The axle assembly, including the disks, is to be designed so it can be removed from the tank. All internal hardware is to be AISI 304 stainless steel.

2.06 FILTER DISK ASSEMBLIES

A. Each disk frame shall be constructed entirely of AISI Type 304 stainless steel. Non-metallic material for disk frame fabrication shall not be acceptable.

B. The mesh panel mounting shall allow panel replacement from outside the filter by a single plant operator. The filtration mesh shall be a Type 304 Stainless Steel wire weave with nominal 25 micron apertures. The use of non-metallic filtration mesh shall not be approved.

C There shall be simple shoulder seals at the edges of each disk and the wall of the filtrate zone. These seals shall be made of industrial grade EPDM rubber for long life.

D Each disk shall have a minimum filtration area of 22 square feet and shall be able to support a layer of biological accumulation. This disk filter model shall have 16 disks and a total filtration area of 352 square feet.

E. The effluent outlet for the filtered water shall be 20-inches in diameter. The outlet shall connect to the plant through isolation valves supplied by the contractor.

2.07 BACKWASH ASSEMBLY

A. The backwash piping integral to the filter shall be constructed of 2-inch diameter 304L stainless steel pipe,

and shall include 14 flat-jet quick release nozzles per spray header. All hardware shall be 304 stainless steel. Each spray header shall deliver 16.2 gpm of spray water at 60 psi. Reclaimed water shall be used as spray water which shall be controlled by a slow-closing solenoid valve. The outlet from the wash water concentrate collection trough shall be 3-inches diameter. The total wash water volume shall be approximately 116.5 GPM per disk filter unit on an intermittent basis based on backwash frequency.

B. Actuated Valve

1. Each filter shall come equipped with one (1) electrically actuated, 3.0 inch diameter valve for draining accumulated solids from the bottom of the influent well. The Electric actuator assembly shall include an electric motor, reduction gearing, valve stem, drive nut/bushing, position limit switches, mechanical overload torque switches, ductile iron gear case and automatic declutchable hand wheel.

2. Motor speed reduction shall be by means of a gear train consisting of hardened steel spur gears and self-locking worm and worm gear sets. The worm shall be heat treated alloy steel and shall have rolled or ground worm thread surfaces. The worm gear material shall be bronze. Non-metallic gears in the power train shall not be acceptable.

3. All gearing and shafting shall be supported on anti-friction bearings. All thrust components shall be supported by use of tapered roller bearings.

4. The actuator shall be furnished with a hand wheel located in a 90 degree plane from the actuator output drive, and designed to produce the specified torque with a maximum rim pull requirement of 60 pounds. An external manual declutch lever shall be included to place the actuator in the manual mode. The lever shall not require more than a 10 pound force to engage even when the valve has been tightly seated. The lever shall be padlockable in either hand wheel or motor mode. Operation by the motor shall not cause the hand wheel to rotate, and manual operation of the hand wheel shall not cause the motor to rotate. The hand wheel shall operate in the counter-clockwise direction to open, and in the clockwise direction to close.

5. All gearing and bearings shall be grease lubricated and suitable for year-round service based on prevailing ambient temperature conditions.

6. Electric motors shall be specifically designed for valve actuator service, and shall be totally enclosed, nonventilated. The enclosure shall meet NEMA 4 (weatherproof) requirements as required by the project. The motor shall be capable of operation under maximum specified loads when voltage to the motor is +/- 10% of the nominal voltage. Motor shall have Class F insulation with thermal overload sensors imbedded in the motor windings.

7. Limit switches shall be geared to the drive mechanism and shall indicate actual valve position at all times, whether operation is by electric power or manual mode. Limit Switches shall be activated by a rotor type design. Contacts shall be silver and have a rating of 10 amps at 120VAC. A minimum of (3) N.O. and (3) N.C. contacts shall be present to prevent entrance of foreign matter or wire entanglement. Use of cams or screws to set switches, or designs requiring battery back-up methods to ensure position control in the event of a power failure are unacceptable.

8. The actuator shall include an adjustable torque switch to interrupt the motor power circuit when an obstruction is encountered in either direction of travel or when torque seating of valves is required for tight shut off. The torque switch shall have a calibrated dial for adjustment, and shall have means to ensure that the maximum actuator rating is not exceeded. Contacts shall be same construction and rating as limit switches. Mechanical torque springs for load control shall be field replaceable without need of actuator dismantling or removal of the worm assembly.

2.08 FILTER INLET AND EFFLUENT VALVES

A. Each disk filter inlet pipe and effluent pipe shall require isolation valves in the yard piping. These valves shall be supplied and installed by the Contractor as part of the plant yard piping

2.09 LEVEL SENSING DEVICE

A. A set of (5) conductivity probes shall be used to operate the filter while in "AUTO" mode. Four (4) of the probes shall control the start/stop of the filter gear drive and backwash pump cycles. The fifth probe shall be used as a high level (overflow) indicator. An overflow event shall energize a beacon light at the control panel and an audible alarm. A remote "dry" contact shall be available for alarm indication to plant SCADA.

2.10 CONTROLS

A. Each disk filter unit shall be supplied with a separate, local control panel in a NEMA 4X, Type 304 stainless steel enclosure. The control panel shall be UL listed and designed for outdoor use in corrosive environments in Florida. All operator components shall be mounted on a dead-front swing-out hinged inner door. Motor breakers and starters shall be NEMA type. The control panel shall include engraved, descriptive labels that are attached using permanent adhesive. The control panel shall be factory tested before installation on site. Field wiring shall be provided and installed by the Contractor. The control panel shall include, but not be limited to the following:

1. Circuit Breakers: main, control power, filter gear drive, backwash pump

2. Motor Starters: filter gear drive, backwash pump. Adjustable, solid state overloads are included.

3. Pilot Lights: "RUN", "OVERLOAD" and "FAIL" for gear drive and backwash pump; main power "ON"; "High Level Overflow", "Emergency Stop" depressed.

4. Pushbuttons: "Emergency Stop", "Alarm Silence", Motor Fail "RESET", Emergency Stop "RESET"

5. H-O-A selectors: filter gear drive, backwash pump, sludge discharge valve, plant wash water solenoid.

6. Elapsed Time Meters: filter gear drive and backwash pump

7. Dry Contacts for Plant SCADA: "OVERLOAD", "RUN", "FAIL" for filter gear drive and backwash pump, "HIGH LEVEL OVERFLOW" and "COMMON ALARM" for filter.

B. Each filter shall be supplied with an equipment mounted Emergency Stop/Junction box in a NEMA 4X, Type 304 stainless steel enclosure. The junction box shall be UL listed and designed for outdoor use in corrosive environments. The junction box shall include terminal blocks for all filter mounted equipment such that the installing contractor will only have to run field wiring to one centralized location. The junction box shall also include a NEMA 4X, 30mm, mushroom head, Emergency Stop button located on the outer door of the enclosure.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the Disk Filters to be sure all passages and filter meshes are clean and clear of obstructions and that the disks rotate freely. Examine the disk filter unit mounting surface, and make certain that bolts are properly located. Correct any irregularities prior to installation.

3.02 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the drawings. Installation shall include furnishing the required oil and grease for initial operation. See Section 01700 – Contractor Closeout.

B. The Contractor shall submit a certification from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.03 TESTING

A. After all disk filter units have been completely installed and working under the direction of the manufacturer, conduct in the presence of the Engineer tests necessary to indicate that disk filter operation conforms to these specifications. Field test shall include all three (3) disk filter units under this section. Supply all reclaimed water, labor, equipment and incidentals required to complete the field tests.

B. If the disk filter unit performance does not meet these specifications, corrective measures shall be taken, or the disk filter units shall be removed and replaced with disk filters which satisfy the conditions specified.

C. Motors: The Contractor shall megger each motor winding before energizing the motor and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor.

D. The Contractor shall check all motors for correct clearance and alignment and for correct lubrication in accordance with the manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

3.04 TOOLS AND SPARE PARTS

A. One set of all special tools for the disk filter units required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys. See Section 01700 – Contract Closeout.

END OF SECTON

SECTION 11348

CHEMICAL FEED SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Contractor shall furnish all labor, materials, equipment and appurtenances required to furnish, install, test and place into satisfactory operation two sodium hypochlorite feed systems as shown on the Drawings and as specified herein. This section includes, but is not limited to:

1) Chemical feed pumps/motors
2) Skid mounted piping, valves, and accessories

B. All electrical, mechanical, metal, painting and instrumentation work included herein shall conform to the applicable requirements of this project.

C. It is the intent of these Specifications that the Contractor is to provide a complete and workable system whether or not any specific component is shown or specified.

1.02 QUALITY ASSURANCE

A. Single Source

1) All major components of the system, i.e. metering pumps, motors, variable frequency drives, and chemical injector/diffuser assembly (see drawing details), whether or not shown or specified herein, shall be supplied to the Contractor by the chemical feed system supplier for single source system responsibility.

B. Manufacturer’s Qualifications

1) Each component manufacturer shall have at least five (5) years experience in furnishing equipment of similar capacity and service capability to the equipment described herein. As part of their submittal package, the system supplier shall submit the following:

a. Evidence that the supplier’s equipment of similar capacity and service capability has been in successful operation for at least five (5) years in at least ten (10) separate skid-mounted installations in the state of Florida. Referenced installations must be for the same chemicals

required in this specification and have been in satisfactory operation for a minimum of two years.

b. Available Pump Manufacturers: Subject to compliance with requirements, provide from the following:

(1) Prominent Sigma 2 Series 16090 PVT- Duplex Skid
(2) Prominent Gamma L Series 0708 w/degassing ends– Simplex Skid

c. Available Skid Manufacturers: Subject to compliance with requirements, provide from the following:

(1) Prominent
(2) Approved Equal

C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1) Standards of American Water Works Association (AWWA)
2) American National Standards Institute, ANSI
3) American Society for Testing and Materials, ASTM
4) American Welding Society
5) Anti-Friction Bearing Manufacturers Association (AFBMA)
6) American Gear Manufacturers' Association (AGMA)
7) Institute of Electrical and Electronic Engineers, IEEE
8) Instrument Society of America, ISA
9) Joint Industrial Council, JIC
10) National Electric Manufacturer's Association, NEMA
11) National Electrical Code, NEC
12) OSHA, Safety standards concerning personnel, protection when operating machinery, and the handling of dangerous chemicals.

1.03 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings in accordance with Section 01340 for approval the following:

1) Manufacturer/Supplier's literature, illustrations, Specifications and bill of materials for each component of the system. Data shall include a complete description in sufficient detail to permit comparison with the technical Specifications.
2) Engineering data including: dimensions (including anchor bolt layout), materials, size, weight, performance data showing, flow rate, discharge head, turndown, stroke rate, motor horsepower and speed.

3) Data sheets on chemical compatibility of the wet end materials being furnished for each chemical.
4) Drawings showing fabrication, assembly, installation and wiring diagrams. Wiring diagrams shall consist of, at a minimum, of control schematics, including coordination with other electrical control devices operating in conjunction with the sodium hypochlorite feed system and shall conform to JIC Standards.
5) Motor Tests and Data: For each motor, furnish a motor data sheet for the provided motor listing the following minimum data:

   a. Efficiency at 1/2, 3/4, and full load.
   b. Base, minimum and maximum speeds.
   c. Armature volts, amps.
   d. Field volts, minimum and maximum field amps.
   e. Motor type and frame size.
   f. Bearing type and lubrication medium.
   g. Insulation and enclosure type

6) Pump Data: For each pump furnish a performance certification indicating: head, capacity, efficiency and horsepower.
7) Shop Tests: Submit shop test reports in accordance with the requirements of Part 3.3.
8) Field Tests: Submit field test reports in accordance with the requirements of Part 3.4.
9) A list of any and all parameters, ratings or other characteristics where the proposed chemical feed system deviates from the requirements set forth in these Specifications.
10) Affidavits of compliance with referenced standards and codes.
11) Manufacturer/supplier's standards for chemical feed system.
12) Drawing Approval: Shop drawings shall be approved by the Owner’s Project Representative prior to manufacturing. Approval of drawings by the Owner’s Project Representative shall not release the Contractor of responsibility of compliance with these specifications. All proposed changes to these Specifications shall be stated in writing.
13) References
   a. Submit to Owner’s Project Representative a list of 10 previous similar use site installations in accordance with Part 1.2B.
   b. Submit to the Owner’s Project Representative supporting information of ISO 9001 certification.

B. Operation and Maintenance Data - Submit copies of complete Operation and Maintenance manuals in accordance with Section 01730 and the requirements as described below:
   1) Required Operation Data:

a. Complete, detailed operating instructions for each piece of equipment.
b. Explanations for all safety considerations relating to operations.

2) Required Maintenance Data:
a. Maintenance data shall include all information and instructions required by plant personnel to keep equipment properly cleaned, lubricated and adjusted so that it functions economically throughout its full design life.
b. Explanation with illustrations as necessary for each maintenance task.
c. Recommended schedule of maintenance tasks.
d. Lubrication charts and tables of alternate lubricants.
e. Troubleshooting instructions.
f. List of maintenance tools and equipment.
g. Name, address and phone number of manufacturer and manufacturer's local service representative.

1.04 WARRANTY

A. Prior to acceptance of the chemical feed system, provide written warranty from the system supplier that includes the following statements:

1) System supplier has inspected the installation during and after completion and the chemical feed system is free from faults and defects and is in conformance with the Contract Documents.
2) The system supplier shall provide a two (2) year warranty from the date of final acceptance for the metering pumps and one (1) year for the skid material/construction, and skid-mounted equipment, piping and valves.
3) During the warranty period, the manufacturer shall provide the services of a trained technician to make all adjustments, repairs and replace all defective equipment at no cost to the Owner.
4) The system supplier shall include all costs incurred by the manufacturer, including travel and expenses, under the terms of the warranty.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All equipment and materials shall be inspected against approved Shop Drawings at time of delivery. All surfaces shall be smooth, free of voids and porosity, without dry spots, crazes or unreinforced areas. If damaged, notify Owner and manufacturer at once. Equipment and materials damaged or not meeting requirements of the approved Shop Drawings shall be immediately returned to the system manufacturer for replacement or repair.

B. Equipment and materials shall be stored in a dry location and protected from the elements according to the system manufacturer's instructions.
C. Equipment and materials shall be handled in an approved manner according to the system manufacturer's instructions. Equipment that is damaged will not be acceptable. Protect all bolt threads, etc. from damage and corrosion.

PART 2 – PRODUCTS

2.01 SERVICE CONDITIONS

A. The chemical feed system supplier shall furnish diaphragm chemical metering pump skids, with all pumps, controls, fittings, appurtenances, specialty items and all supports and anchors required for complete and operating pumping systems.

B. All parts and mechanisms shall be amply proportioned for all stresses that may occur during fabrication, shipping, erection, and intermittent or continuous operation. All units shall be constructed such that dismantling and repairing can be accomplished without difficulty.

2.02 PERFORMANCE

A. The pumping units shall operate without vibration or excessive noise over the operating speed range

B. Pumping system vibration shall not exceed the acceptable field vibration limits given in the standards of the Hydraulic Institute.

C. All wetted surfaces of the diaphragm chemical metering pumps and appurtenances shall be suitable for continuous exposure to the chemical being pumped as outlined in the Pump Schedule.

D. Pumping units shall perform according to the following parameters:

1) The pumping units shall be able to perform continuously in the temperature range of 32 to 104 F.
2) The pumping units shall have disc style diaphragms. No tube diaphragms will be allowed.
3) Pumps shall include variable speed control via microprocessor controller with AC drive from a remote 4-20 mA signal with a minimum turndown of 20:1 unless otherwise specified.

2.03 DETAILS OF CONSTRUCTION

A. Pumps shall be positive displacement diaphragm type that is mechanically or solenoid actuated. Hydraulically actuated diaphragm pumps shall not be acceptable. This specification addresses skid mounted chemical metering pump systems complete with the skid assembly containing chemical metering pumps, all necessary piping, valves, fittings, supports, electrical controls, and accessories as specified herein. The metering pump skid shall contain the following items:

1) Skid with drip lip
2) Metering pumps w/auto-degassing liquid ends
3) TEFC pump motors- Sigma Series
4) Calibration columns
5) Pulsation dampeners
6) Pressure gauges with diaphragm seals
7) Vented ball valves
8) Pressure relief valves
9) Backpressure valve
10) Wye strainer
11) Remote mounted control panel
12) Controls
13) Flushing inlet and outlet for each pump
14) All piping, valves, gaskets, supports, hardware, wiring, junction boxes, and accessories necessary for a fully functioning skid. Piping shall be terminated within 2 inches from the edge of skid. Electrical cables shall terminate in the control panel.

B. Pumps shall be specially designed, constructed and installed for the service intended and shall comply with the conditions listed in the schedule at the end of this Section. The Vendor shall submit compatibility data from the manufacturer being supplied to confirm the materials of construction.

C. Metering Pump Construction:
1) The liquid end shall be constructed of materials compatible with the chemical to be pumped as listed in the Pump Schedule.
2) The liquid end shall be physically separated from the drive unit by air gap and back plate with weep hole. The diaphragm shall have a steel core in nylon-reinforced EPDM with PTFE-faced for the fluid contact surface.

D. The skid mounting of the metering pumps shall conform to the following requirements:
1) Each chemical feed system shall be completely assembled, mounted, calibrated, tested, and delivered to the site on a single skid. Components to be mounted on the skid shall include the items

listed in Part 2.3 A- metering pumps, calibration column, piping, valves, piping accessories (pulsation dampeners, pressure relief, strainers, etc.), and wiring integral to the skid. The chemical feed system supplier shall be responsible for providing all equipment, valves and piping within the skid boundary.

2) The skids shall be constructed of fusion welded polypropylene sheets or thermally welded PVC with adequate supports for all equipment and piping. The skids shall be provided with a flushing inlet and outlet for each pump. Fork lift truck cut outs and anchor bolt holes shall also be provided.
3) All components of the skid mounted system (pumps, piping and controls) shall be tested at the manufacturer's facility prior to shipment.

E. Calibration Chamber: Provide one, clear plastic calibration chamber with vent for use in calibrating the metering pumps. The chamber shall be sized to give adequate capacity for a minimum 30 second draw down test. The scale shall give direct readings in GPH without the need for calculations. The calibration chamber shall be piped and valved so that each pump shall be able to utilize the calibration chamber without interfering with the operation of the other pumps. The top of the chamber shall have a threaded fitting to allow for piping to a common vent.

F. Pulsation Dampeners:

1) Pulsation dampeners shall be of the single diaphragm design, capable of arresting water hammer in the pump discharge lines created by the metering pumps. Pulsation dampener shall dampen pulsations a minimum of 95 percent.
2) Pulsation dampeners shall be provided with valves, gauges and fittings necessary for maintaining required air pressure in the air chamber.
3) Materials of construction of diaphragm and body shall be corrosion resistant to the chemical fluid pumped.
4) Provide one dampener on the discharge side of each metering pump.
5) Each pulsation dampener shall include an integral pressure gauge.
6) Size: Pulsation dampeners shall be sized appropriately for each pump to remove a minimum of 95% of the pulsations. The manufacturer shall provide calculations to verify sizing if requested by the Engineer.

G. Diaphragm Protected Pressure Gauges

1) 2-1/2″ liquid filled pressure gauges with isolators shall be provided for indication of system pressure in the discharge piping of each metering pump. Industrial quality all 316 Stainless Steel gauges shall be utilized. The isolators shall have housings compatible with chemicals as listed under Service Conditions and Table 11348-1 with a Teflon diaphragm and suitable liquid fill. The process connection shall feature a SS reinforcement ring not in contact with the chemical. A fabricated PVC bracket shall be provided for each pressure gauge to secure the isolator and prevent lateral movement of the pressure gauge.

H. Pressure Relief Valve: Valves with body and seat of PVC or polypropylene, suitable for use and with a teflon diaphragm. Valves field adjustable with initial setting set at factory.

I. Piping, Valves, and Appurtenances:

1) Skid pipe shall be Schedule 80 PVC with Socket or flanged ends. Cement shall be as recommended by the pipe manufacturer for the service outlined in this Section.
2) Vented, true-union ball valves shall be utilized. Isolation valves shall be provided at all equipment connections. Seals shall be compatible with the chemical being pumped.
3) Both pumps on each skid shall share a common suction and discharge manifold.
4) The discharge manifold shall have one outlet for the proposed injection point. The contractor shall connect the piping from the proposed injection point to the new duplex skid.

J. Duplex Controls:

1) Each skid shall be supplied with its own control panel suitable for remote mounting.
2) Each pump shall have its own circuit breaker mounted in the control panel.
3) A common terminal strip shall be utilized for electrical connections at the control panel. Terminals shall be provided for a single control panel 120 volt, single phase power input.
4) All wiring on the skid shall be performed prior to shipping and shall terminate in a NEMA 4X junction box located on the skid. Terminals shall be provided in the junction box for all connections between the remote control panel and the junction box.
5) Each pump shall be provided with the following controls:

a. Local HOA switch
b. Start/Stop discrete input to skid
c. Electronic motor speed controller capable of accepting remote 4 to 20 mA signals for automatic feed rate adjustments.
d. Stroke length control: Manually adjustable from 0-100%.
e. Alarm discrete output from skid

6) In addition to local start/stop, stroke and speed control, the pump shall include a selector switch to determine local operation or remote control. The pump shall be capable of accepting a remote start command from a discrete, dry contact input in addition to a 4-20 mA dc for speed control. Additional monitoring signals shall include a pump in remote control mode, pump run status, pump fail and a 4-20 mA dc signal for speed feedback.

K. Simplex Controls:

1) A non-metallic NEMA 4X Terminal Junction Box (TJB) shall be provided and include a pre-wired power connection for the metering pump power cord and terminals for all signal cables. The metering pump cables shall be pre-wired to the TJB by the metering panel manufacturer. The TJB shall include the following:

a. Terminals for 120VAC power with heavy duty surge protection
b. Local-Off-Remote selector switch with a dry contact connection available for remote indication of Remote status.
c. Terminal connections for a dry contact remote RUN command
d. Terminal connection for a dry contact indication of pump fault.
e. Terminal connection for a dry contact indication of pump run status.

L. Name Plates:

1) Each pump and motor shall be furnished with a suitable nameplate securely mounted to the body of the equipment.
2) As a minimum, the nameplate for the pumps shall include the following:
a. Complete equipment model number.
b. Manufacturer's name and address.
c. Serial number
d. Rated maximum flow capacity
e. Maximum discharge head
f. Horsepower

g. Speed
h. Armature voltage
i. Armature amps
j. Field voltage
k. Field amps
l. Power and service factors.

2.05 MAINTENANCE

A. Spare Parts

1) Provide spare parts to the OWNER for each chemical metering skid upon delivery of the pump skid. Spare parts shall include all parts required for two (2) years of normal maintenance of all components of each chemical metering system and any pertinent parts recommended by the pump manufacturer. All parts shall be in one box labeled with the Skid ID Information.

B. Provide all special tools required for normal maintenance. Tools shall be packaged in a lockable steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended.

C. Provide to the Owner a list of all spare and replacement parts with individual prices and location where they are available. Prices shall remain in effect for a period of not less than one year after start-up and final acceptance.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The chemical feed systems shall be installed in accordance with manufacturer's instructions and recommendations in locations shown the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the shop drawings. Anchor bolts shall be set in accordance with the shop drawings.

B. All fitting connections shall be installed with flexible type connections as per the Manufacturer's recommendations.

C. Make all pipe connections to and from pump skids as shown on the Drawings.

D. A manufacturer's representative for the equipment specified herein shall be present at the jobsite for 12-hrs of installation assistance, inspection and

confirmation of the correctness of the installation, testing, startup, and operation and maintenance training.

3.02 FIELD PAINTING

A. Field painting is included in Section 09900.
B. Meter pumps shall not be field painted.

3.03 SHOP TESTING

A. To insure quality and unit responsibility, the pump skids must be assembled and tested by the skid manufacturer at his facility and be a standard and regularly marketed product of that manufacturer. The skid manufacturer must have a physical plant, technical and design staff, and fabricating personnel to complete the work specified. Skids assembled by an integrator or contractor shall not be acceptable.

B. Shop Tests:

1) Tests shall be conducted on the actual pumps, control panels, and skids being provided for the project. All pumps shall be tested.
2) Each skid system must be tested prior to shipment. The test can be performed with water and not with chemical. The system shall be operated throughout the entire operating range of the pumps, in all automatic and manual modes.
3) Manufacturer shall make temporary electrical connections between the control panel and the pump skid to perform the tests.
4) All piping shall be hydrostatically tested to a pressure of 150 psi without leakage.
5) Provide certified factory tests indicating that the tests took place and documenting the results.

3.04 FIELD TESTING

A. Working under the direction of the manufacturer’s representatives, conduct in the presence of the Engineer such test as are necessary to indicate that each item of equipment conforms to this Section.

B. If the performance of any item of equipment does not meet the specified requirements, take corrective measures or remove the unit and replace with one which satisfies the conditions specified. A two-hour operating period of each item of equipment will be required before acceptance. During this two-hour operating period, supply all power and water necessary.
C. All chemical feed pumps shall be field calibrated in the presence of the Engineer to demonstrate pumps meet rated

capacities, and three sets of test data shall be provided.

TABLE 11348-1
CHEMICAL METERING PUMP SCHEDULE

NWRF Phase 1 Improvements		
	Duplex	Simplex
Location	Indoors-Dewatering Building	Indoors-Dewatering Building
# Pumps	2	1
Chemical	9-15% NaOCl	9-15% NaOCl
Type Pump	Positive Displacement Mechanically Actuated Diaphragm	Positive Displacement Mechanically Actuated Diaphragm
Max. Horsepower	0.5	N/A
Controls	Local Control Panel w/ HOA switch Start/Stop discrete input 4-20 ma input Alarm discrete output	Local Control Panel w/ HOA switch Start/Stop discrete input 4-20 ma input Alarm discrete output
Stroke Length Control	Manual	Manual
Stroke Rate Control	4-20 mA	Manual
Design Max. Capacity-GPH	21	1
Max. Pressure-psi	145	101
Piping Material	SCH 80 PVC	SCH 80 PVC
Type Valves	Type 21 Ball Valve	Type 21 Ball Valve
Skid Piping Outputs	1	1

END OF SECTION

SECTION 11386

HORIZONTAL AXIAL FLOW PROPELLER PUMP

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Provide and install four (4) Horizontal Axial Flow Propeller Pumps, each designed for a maximum capacity of 8,200 GPM at 10.50 feet of total dynamic head. Each pump shall be provided with a suction / discharge elbow, packing box, mechanical seal, propeller, sweep liner, pump shaft, shaft sleeve, shaft coupling, bearing frame, oil seals, base plate, cleanout, 2-speed electric motor and back pull-out assembly. Each pump will be installed outdoors between two existing anoxic/aeration basins replacing an existing pump.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 11100 – Pumps General

B. Section 13300 – Controls and Instrumentation.

C. Division 16 – Electrical

1.03 REFERENCES

A. National Electrical Code

B. ANSI/NEPA

C. Underwriters Laboratory

D. Hydraulic Institute Standards

E. ASTM – American Society for Testing and Materials

F. AISI – American Iron and Steel Institute

1.04 QUALITY ASSURANCE

A. Pumps shall be the product of a manufacturer with a minimum of five years experience in the design and building of such pumping equipment. All workmanship and materials throughout shall be of the highest quality.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work are limited to the following:

1. Lawrence Pumps, Inc.
2. Friatec
3. or approved equal

C. Provide nameplate identifying the manufacturer’s name, model number, rating/capacity, and electrical equipment.

D. Electrical work shall conform to the latest NEC, State, local and power company standards.

E. All electrical equipment shall be UL approved and labeled.

1.05 SUBMITTALS

A. Obtain shop drawings showing dimensions. Incorporate in piping drawings. Verify dimensions and make necessary adjustments in installations.

B. Submit manufacturer’s Certificate of Compliance certifying compliance with the referenced specifications and standards.

C. Submit certified copies of reports of factory tests specified in this section and required by referenced standards. Include performance data and physical characteristics.

D. Submit dimension data, manufacturer’s parts list, operation and maintenance literature and instructions as part of Record information in accordance with Section 01730.

E. Submit product data in accordance with Section 01340:

1. Indicate pump type, capacity and power requirements.

2. Submit certified pump curves showing pump performance characteristics with duty point plotted. Include NPSH curve.

3. Submit pump layout with dimensions including base plate and discharge piping.

F. Submit manufacturer's instructions for delivery, storage, assembly, installation, start-up, operation adjusting and finishing.

G. Submit electrical control wiring diagrams.

H. Submit 3 copies of the Service Representative's Report of Field Tests.

1.06 DELIVERY, STORAGE AND HANDLING

A. Pump and motor shall be coupled together and tested at the factory. Separate delivery of pump and motor for assembly on Site will not be permitted.

B. After factory 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.

C. Each box or package shall be properly marked to show its net weight in addition to its contents.

D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

E. Finished surfaces of all exposed pump openings shall e protected by wooden blanks, strongly built and securely bolted.

F. Accept equipment on Site in original factory packaging; inspect for damage.

1.07 SOURCE QUALITY CONTROL

A. Provide certified field performance test curves for the specified conditions based upon most recent tests of a similar pump.

1.08 WARRANTY

A. Warranties and guarantees by the suppliers of various components in lieu of a single source responsibility by the manufacturer will not be accepted. The manufacturer shall be solely responsible for the warranty of the Horizontal Axial Flow Propeller Pumps and all components.

B The pump manufacturer shall warrant the units to the Owner in writing against defects in workmanship and material covering parts and labor for a period of three

(3) years from date of substantial completion per Article 9 of the General Conditions.

C. In the event a component fails to perform as specified or is proven defective in service during the warrantee period, the manufacturer shall provide and install a replacement part without cost to the Owner.

D. The Warranty shall be in published form and apply to all similar units.

PART 2 PRODUCTS

2.01 HORIZONTAL AXIAL FLOW PROPELLER PUMPS

A. **General**

The 4 Horizontal Axial Flow Propeller Pumps shall be identical units from one manufacturer except for their pump suction pipe location, two of which are on the right side and two of which are on the left side of their pump drive shafts.

Each pump shall have a 2-speed electric motor suitable for operation at 880/705 RPM. Each pump shall be mounted on an existing concrete pad that may have to be adjusted to a different height and length in order to best match existing suction and discharge piping. The existing suction and discharge piping locations may have to be adjusted in order to match with the proposed pump.

Each Pump shall be installed with its motor drive shaft and pump drive shaft in a horizontal alignment. Each pump shall be similar to a 'top suction' type horizontal axial flow propeller pump with its vertical pump suction pipe at an angle of 90 degrees to its drive shaft. For this application the pump suction pipe will be in a horizontal position at an angle of 90 degrees to its drive shaft. The pump discharge pipe will have its centerline at the same location as the centerline of the drive shaft. The wastewater discharge will be along the centerline of the drive shaft in a direction directly opposite the electric motor (see the construction plans).

Each pump shall be driven by a 2-speed electric motor using a direct-drive connection. Each pump shall be provided with a non-clogging impeller designed for pumping activated sludge with a suspended solids

concentration of 3,000 to 5,000 mg/l. The Orientation of each pump is shown on the Mechanical Construction drawings.

B. **Design Performance Data** (Each Pump)

Description	High Speed	Low Speed
Speed – RPM	880	705
Capacity – GPM	8,400	6,700
Total Dynamic Head, Feet	10.0	6.4
Horsepower	31	16

C. **Other Design Data** (Each Pump)

Number of Pumps	4
Pump Size	16 x 16 – 16
Propeller Diameter– Inches	15.12
Electric Motor Characteristics	460v/3Phase/60Hertz
Maximum Motor Speed– RPM	900
Maximum Number of Starts Per Hour	4
Pump Suction pipe Diameter– Inches	16
Pump Discharge Pipe Diameter– Inches	16
Maximum Allowable Solid Size– Inches	4
Coupling:	Thomas or equivalent

D. The manufacturer shall design the proposed pump motors for full load continuous operation.

E. All mating surfaces of the major castings requiring a watertight seal shall be machined and fitted with Buna-N-rings.

F. Each pump casting shall be free from porosity voids and other casting quality defects. The internal surface of the casing shall be smooth to the touch and free from all sharp edges.

G. Pump propellers shall be smooth, finished throughout, and shall be free from sharp edges. Each propeller shall be statically and dynamically balanced after assembly to the drive shaft.

H. Drive shafts shall be supported by single row outer and inner bearings for radial and axial thrust. All shafts shall be dynamically balanced and amply sized to minimize shaft deflection. Submit certified bearing life calculations to provide a minimum B10 of 50,000 hours at the design pumping capacity.

I. The mechanical seal shall be provided with a solid silicon carbide seal face material on both the stationary and rotating components.

J. Each pump shall be furnished with a 2-speed squirrel-cage, induction motor that is totally enclosed, fan cooled (TEFC). Each motor shall be furnished with moisture resistant, Class F insulation, NEMB design, 1.15 service factor, designed for continuous duty, non-overloading throughout the entire pumping range of operation without using the motor service factor. Each motor shall be capable of sustaining 4 starts per hour at a minimum ambient temperature of 40^{o}C. Each motor shall be capable of uninterrupted operation with a 10% voltage drop.

K. Each pump shall be provided with a Back Pull-Out Assembly which enables the propeller, shaft, mechanical seal, bearings, and housing to be pulled out of the casing as one unit for inspection, maintenance and repairs.

L. Each pump shall be provided with a 6-inch hand-hole in its casing in order to inspect the propeller and remove solids that get stuck.

M. **Materials of Construction**

1. Ductile iron, ASTM A395
   Elbow, packing box, back cover, gland plate, shoulder-ring, shaft slinger, radial bearing cover, shoulder-ring.

2. Close-grained cast iron, ASTM A48, CL30
   Thrust bearing cover, bearing housing, bearing frame.

3. Hardened carbon steel, ASTM A532, HC-250
   Elbow sweep liner, propeller cap, propeller.

4. Hardened carbon steel, AISI 1045
   Pump Shaft.

5. 316 Stainless Steel, ASTM A276
   Shaft sleeve.

6. Carbon steel, ASTM A108GR12L14
   Base-plate, frame foot.

7. Bronze, ASTM 584, C83600

Radial Bearing, thrust bearing.

8. AISI 304 Stainless Steel
Shaft sleeve screw, bearing locknut and washer, propeller nut, miscellaneous nuts, bolts, washers.

9. Buna-N
Radial bearing cover seal, thrust bearing cover seal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install pumps as specified in accordance with the Drawings, in accordance with the pump manufacturer's written instructions, and as specified in this Section.

B. Align pumps and motors in accordance with the manufacturer's written instructions. Lubricate pumps and motors in accordance with the manufacturer's written instructions.

C. Adjust existing concrete pump support pads as required to fit the pumps to existing piping.

3.02 TESTING

A. Test pumps and motors after pumping units are installed.

B. Perform field tests in the presence of pump manufacturer's field representative.

C. Test pumping units in accordance with pump manufacturer's written instructions.

3.03 PAINTING

A. The exterior surfaces of the proposed pumps shall receive a primer coat of paint in the manufacturer's shop as specified in Section 09900.

B. The Contractor shall apply an exterior coat of finish paint to all exterior surfaces of the pumps as specified in Section 09900. Stainless steel items shall not be painted.

3.04 CLEANING

A. Clean grease, oil, or any other debris from exterior surfaces of equipment.

3.05 MANUFACTURER'S REPRESENTATIVE

A. The representative shall be present for the function test of the IR Pumps. The representative shall also provide operation and maintenance instructions to members of the wastewater treatment plant's operating staff. The General Contractor shall include the cost of the manufacturer's representative in his bid. The representative shall be on the plant site for a minimum of two 8-hour days (16 hours minimum) in two different trips.

END OF SECTION

SECTION 13300

INSTRUMENTATION AND CONTROLS, GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 THE REQUIREMENT:

A. The Contractor shall provide, through the services of a single Control System Integrator (CSI), all components and system installation services, as well as all required and specified ancillary services, whether reflected in the Contract Documents or not, in connection with the Instrumentation and Control System (ICS) as specified herein for a complete and operable system. The system shall include all materials, labor, tools, fees and documentation required to furnish, install, test and place into operation, a complete and operable ICS whether or not shown and/or specified within this section, related ICS specification sections, and subsections within equipment specifications. The system shall include all measuring elements, signal converters, transmitters, specialty cables, control panels, digital hardware and software, remote telemetry units (RTU), signal and data transmission systems, interconnecting wiring and such accessories as shown, specified and/or required to provide the functions indicated, whether specifically mentioned or not.

B. The requirements provided within this section shall be applied to all of the Instrumentation and Controls specifications, Sections 13300 through 13330, as well as additional specifications sections as referenced. The ICS shall be provided as a single and complete system as specified herein and as specified within the following ICS specifications:

1. Section 13310 - Instrumentation and Controls, Field Equipment
2. Section 13320 - Instrumentation and Controls, Control Enclosures
3. Section 13325 – Instrumentation and Controls, Plant Drain Pump Station Pump Control Panel
4. Section 13330 - Instrumentation and Controls, SCADA Hardware
5. Section 13340 – Existing Telemetry System Modifications

C. For the purposes of these specifications the Control System Integrator shall be referred to as the CSI. Where references are made to the SCADA System Programmer or the SSP, it shall be understood that CSI will not be providing that work under this Contract. Although the SSP will provide programming

services outside of this Contract, that in no way relieves the CSI from providing all materials, labor, documentation, etc., including coordination, programming, startup, and testing services as necessary to ensure the complete system is fully capable of providing all specified functions, whether provided by the CSI or programmed by the SSP. Additional clarifications of responsibilities are provided herein and within related ICS specifications, as it pertains to the relationship between the CSI and the SSP.

D. The Contractor shall be ultimately responsible for installation of the ICS. However, the CSI will include installation within the scope of the subcontract to provide for furnishing and installation of the complete system as specified. The CSI shall also coordinate this work with the Contractor to ensure that the proper type, size and number of wires with their conduits are provided and installed. This coordination will also ensure that proper electrical power circuits are provided for all components and systems.

E. The Contractor’s responsibilities, as distinct from the CSI’s responsibilities, shall be to provide all additional materials and work necessary to supplement the materials and work provided by the CSI, thereby satisfying all requirements that are within ICS specification sections.

F. The Contractor shall coordinate structural work, penetrations, painting, etc., as required for installation of a complete ICS. In-line or integrally mounted items (such as flow elements, level sensors, etc.) shall be installed under the supervision of the CSI.

G. The Contractor shall be responsible for coordinating interfaces between ICS equipment provided under the ICS specification sections and the equipment provided under other sections of the specifications. The Contractor shall verify and coordinate space requirements, process equipment power supply and voltage, process equipment control power supply and voltage, compatibility of control signals, details of equipment installation and interconnection. Coordination shall include distribution of approved shop drawings to all vendors, subcontractors, etc., involved in the control interface. Likewise, the Contractor shall ensure that instrumentation and control devices provided under other sections of the specifications are compatible and of the same quality and characteristics as similar devices specified under the ICS specification sections.

H. The CSI will not be responsible for providing PLC and HMI control programming and logic. These services will be provided under a separate contract.

1.02 SCOPE:

A. The scope listed within this subsection pertains to major items of supply. Refer to the complete Contract Documents for all requirements. For additional clarification of scope refer to related specification sections.

B. This project shall provide for the expansion and upgrade of the Manatee County North Water Reclamation Facility. This project will include and provide additions, upgrades and modifications to the in-plant SCADA System and existing ICS. The ICS shall monitor and control the Aeration/Anoxic Basins, Internal Recycle Pumps, Plant Drain Pump Station, new Lake Filter System and Lake Outfall and Return Pumping System, and all other systems, facilities and components as shown on the Drawings and Technical Specifications.

C. Monitoring and control shall be through PLC control panels communicating over a fiber optic Ethernet network or wireless communications system to the Human-Machine Interface (HMI) operator interfaces located in the control room. Network communications shall consist of fiber cables, patch panels, patch cables (fiber and hard-wired), fiber optic switches, etc. as required and specified to provide a complete system.

D. Modifications will be required in existing PLC control panels SP-1(Headworks Building), SP-2 (Clarifiers), SP-3 (Sludge Dewatering Building) and SP-4 (Electrical Building No. 1) to accommodate the new Input/Output requirements.

E. A new Plant Drain Pump Station Pump Control Panel will be required as part of the rehabilitation of the pump station.

F. A new SCADA PLC panel (SP-8) will be provided at the Lake Filter area to accommodate the I/O requirements for the equipment in this area.

G. To allow for ICS control of the new golf course lake discharge valves, the existing Data Flow Systems (DFS) RTU at the Effluent Pump Back Pump Station No. 2 will be modified to support the new capability.

H. Modifications will be required in the Control Building and console to connect the existing DFS telemetry system to the in-plant SCADA system over the Ethernet SCADA network.

I. The following additional major items of supply shall be provided:

1. Furnish and install instrumentation as specified.
2. Furnish TVSS for instrumentation and control panels as specified.
3. Furnish and install new equipment to provide all specified SCADA Input/Output signals and functions.
4. Furnish and install all Control Panels as scheduled (Lake Filter system control panels are provided by the manufacturer under this project).
5. Provide, install and configure all SCADA software packages specified and as needed to complete the requirements noted herein.
6. Interface with control panels provided by other equipment suppliers under this contract.
7. Spare parts as described herein.
8. Implementation and testing of the complete system, including testing with the SSP.
9. Training of Owner personnel.
10. Operations and Maintenance Manuals.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

A. Division 11 - Equipment

1. Refer to individual product specifications within specification sections for additional requirements specific to those devices. Instrumentation and control equipment supplied as part of packaged systems shall be integrated into the ICS as specified.

2. Where Division 11 equipment suppliers are providing instrumentation and control equipment for which there is no specification within their respective equipment specification, they shall provide equipment in accordance with the ICS specifications. This

equipment shall be compatible and of the same quality and characteristics as similar devices specified under the ICS specifications. If possible the same make and/or model supplied under the ICS specifications shall be provided.

3. PLC and HMI programming performed by Division 11 equipment suppliers shall be coordinated with the CSI to provide supervisory control and monitoring of control panels provided under Division 11 via network communications.

B. Division 16 - Electrical

1. Where electrical subcomponents are to be provided as part of ICS equipment, but for which there is no specification, provide in accordance with Division 16 - Electrical. These subcomponents shall be compatible and of the same quality and characteristics as similar devices specified under Division 16 - Electrical. If possible the same make and/or model supplied under Division 16 shall be provided.

2. The following work shall be provided under Division 16 - Electrical:

   a) Conduit, raceways and installation of wire and cable for all instrumentation and control system signal wiring, grounding systems, special cables and network cables except as noted.

   b) Instrumentation and control system signal field wire.

   c) Final wire preparation and termination of field wires to ICS equipment as directed by the CSI.

   d) Grounding systems for all ICS equipment.

   e) Mounting of ICS electrical enclosures (i.e. control panels, TVSS boxes, electronic instrumentation, etc.) with exclusion of final measuring elements of instrumentation (i.e. flow tubes, sensors in process piping, etc.) which shall be as coordinated by the Contractor.

3. The CSI shall provide all termination information for the ICS equipment, to support equipment terminations provided under Division 16. This information shall be provided within ten (10) days of ICS equipment arrival onsite or as required by the project schedule. The information shall be in the form of drawings

and termination lists, showing complete termination information (to/from panels, terminal numbers, terminal block locations, signal types, voltages, etc.).

1.04 CODES AND STANDARDS:

A. The ICS shall comply with the National Electric Code, National Electric Safety Code, OSHA and with all applicable federal, state, county, municipal and electrical utility codes and regulations, as well as the Contract Documents. In the event of any conflict between these codes, regulations and Contract Documents, the most restrictive shall apply.

B. The Instrumentation and Control System shall comply with the following codes and standards as well as any others within the specifications and drawings. In the event of any conflict between these codes, regulations, standards and Contract Documents, the most restrictive shall apply.

1. Applicable state, county and municipal code requirements.

2. Applicable standards of the National Fire Protection Association (NFPA)

a) National Electrical Code (NEC).

3. Applicable standards of the Underwriter's Laboratories, Inc. (U.L.)

a) UL 508 Industrial Control Equipment

b) UL 508A Industrial Control Panels

c) UL 698 Industrial Control Equipment for Use in Hazardous Locations

4. Applicable standards of the Institute of Electrical and Electronics Engineers (IEEE)

5. Applicable standards of the National Electrical Manufacturers Association (NEMA)

a) NEMA 250 Enclosures for Electrical Equipment (1000 V Maximum)

b) NEMA ICS 1 Industrial Control and Systems: General Requirements

c) NEMA ICS 6 Enclosures for Industrial Control and Systems

6. Applicable standards of the International Society of Automation (ISA)

a) S5.1 Instrumentation Symbols and Identification

b) S5.4 Instrument Loop Diagrams

c) S20 Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves

d) TR20.00.01 Specification Forms for Process Measurement and Control Instruments

1.05 SUBMITTALS:

A. All shop drawings shall be in accordance with Section 01340 – Shop Drawings, Project Data and Samples. In addition to the requirements set forth in Section 01340 – Shop Drawings, Project Data and Samples, the following additional submittal requirements included herein shall apply.

B. Every submittal shall have a separate section entitled "Requested Deviations from ICS Specifications" which shall clearly define and explain all requested deviations and exceptions of the Instrumentation and Control System to this Specification. Only those deviations requests listed in this section will be reviewed by the Engineer.

C. After all changes or corrections resulting from the Engineer's review of the system supplier's drawings have been made, panels may be built and instrumentation devices may be supplied in accordance with the approved drawings. One set of 'As Shipped' prints shall be included in the panels when shipped from the system supplier's wiring and assembly shop.

D. The following major list of submittals shall be provided as a minimum. Major submittals are generally listed in the order they are to be provided. Refer to related ICS specification sections and equipment subsections for additional submittals and submittal requirements.

1. Preliminary Design Review/Project Plan
2. Process Field Instrumentation
3. SCADA System Control Panel Modifications
4. SCADA System Hardware and Software
5. Preliminary Operation and Maintenance Manuals
6. Training
7. Testing Submittal
8. Tools, Supplies and Spare Parts
9. Site Installation/Startup Plan
10. Final Operation and Maintenance Manuals

E. Preliminary Design Review/Project Plan Submittal

1. The Project Plan shall provide an overview of the proposed system including system architecture diagrams, the approach to work, the proposed work schedule indicating milestones and potential meetings, project personnel and organization, details of factory testing and field testing, details of training programs, and a paragraph by paragraph review of the specifications indicating any proposed deviations. The schedule shall illustrate all major project milestones including the following:

   a) Schedule for all subsequent project submittals.

   b) Tentative dates for all project design review meetings.

   c) Schedule of manufacture and staging of all instrumentation and control system equipment.

   d) Schedule for all testing.

   e) Schedule for shipment of all instrumentation and control system equipment and peripheral devices.

   f) Schedule for equipment start up.

   g) Schedule for all training.

2. The Project Plan submittal will be followed by an ICS project kickoff meeting which will be a discussion of the Project Plan Submittal concerns and issues. This meeting will be scheduled a minimum of two weeks following delivery of the submittal. No other submittals will be allowed prior to acceptance of the Project Plan.

F. Process Field Instrumentation Submittal

1. This submittal shall provide complete documentation of all field instruments and other instrument and control equipment not specified to be submitted elsewhere.

   a) Provide data sheets for each component listing all model numbers, optional and ancillary devices that are being provided.

      The data sheets shall be provided with an index and proper identification and cross referencing. They shall include but not be limited to the following information:

1) Plant Equipment Number and ISA tag number per the Loop Diagrams.

2) Product (item) name used herein and on the Contract Drawings.

3) Manufacturer's complete model number.

4) Location of the device.

5) Input - output characteristics.

6) Range, size and graduations.

7) Physical size with dimensions, enclosure NEMA classification and mounting details.

8) Materials of construction of all components.

9) Instrument or control device sizing calculations where applicable.

10) Certified calibration data on all flow metering devices.

b) Provide equipment specification sheets which shall fully describe the device including the intended function, how it operates and its physical environmental and performance characteristics. Each data sheet shall have appropriate cross references to loop or equipment identification tags. As a minimum the specification sheets shall include the following:

1) Dimension, rigid clearances.

2) Mounting or installation details.

3) Connection.

4) Electrical power or air requirements.

5) Materials of construction.

6) Environmental characteristics.

7) Performance characteristics.

c) The submittal shall also contain all planning information, site preparation instructions, grounding and bonding procedures, cabling diagrams, plug identifications, safety precautions or guards and equipment layouts in order to enable the Contractor to proceed with the detailed site preparation for all equipment.

G. SCADA System Control Panel Modifications Submittal

1. This submittal shall provide complete documentation of the proposed hardware (control panels, PLCs, peripherals, etc.) including:

   a) A complete system block diagram(s) showing in schematic form, the interconnections between major hardware components such as: control centers, panels, power supplies, consoles, computer and peripheral devices, telemetry equipment, local digital processors and like equipment. The block diagram shall reflect the total integration of all digital devices in the system and shall reflect any man/machine interface locations. All components shall be clearly identified with appropriate cross references to the location of each.

      The diagram shall reference all interconnecting cabling requirements for digital components of the system including any data communication links.

   b) Data sheets for each hardware component, listing all model numbers, optional, auxiliary and ancillary devices that are being provided.

      The data sheets shall be provided with an index and proper identification and cross referencing. They shall include but not be limited to the following information:

      1) Equipment Number and ISA tag number per the Loop Diagrams (as applicable).
      2) Product (item) name used herein and on the Contract Drawings.
      3) Manufacturer's complete model number.
      4) Location of the device.
      5) Input - output characteristics.
      6) Range, size and graduations.
      7) Physical size with dimensions, enclosure NEMA classification and mounting details.
      8) Materials of construction of all components.
      9) Power supply device sizing calculations where applicable.

   c) Equipment specification sheets shall fully describe the device, the intended

function, how it operates and its physical environmental and performance characteristics. Each data sheet shall have appropriate cross references to loop or equipment identification tags. As a minimum the specification sheets shall include the following:

1) Dimensions and working clearances.
2) Mounting or installation details.
3) Connection diagrams.
4) Electrical power requirements (volts, amps).
5) Materials of construction.
6) Environmental characteristics.
7) Performance characteristics.

d) Provide detailed loop diagrams on a single 11-in x 17-in or 8.5-In x 11-in sheet for each monitoring or control loop. The loop diagram shall show all analog, digital and discrete components of the loop, including all relays, switches, dropping resistors, etc. which are being provided for proper operation. Loop numbers used shall correspond to the loop numbers indicated in the Contract Documents. The format shall be the International Society of Automation, Standard for Instrument Loop Diagrams, ISA-S5.4 plus the following requirements:

1) On each diagram, present a tabular summary of (1) the output capability of the transmitting instrument, (2) the input impedance of each receiving instrument, (3) an estimate of the loop wiring impedance based on wire sizes and approximate length used, (4) the total loop impedance, (5) reserve output capacity.
2) Show all interconnecting wiring between equipment, panels, terminal junction boxes and field mounted components. The diagrams shall show all components and panel terminal board identification numbers and all wire numbers. This diagram shall include all intermediate terminations between field elements and panels (e.g. terminal junction boxes). The diagrams shall be coordinated with the electrical contractor and shall

bear his mark showing this has been done.

3) Show location of all devices.

4) Show instrument description including type, manufacturer, model number, range, set points and operation (e.g. fail open, open on energization, normally closed, etc.) as applicable.

5) Show all instrument loop power or instrument air requirements back to termination on terminal block or bulkhead, fuse block (including fuse size), etc., as applicable.

e) Provide detailed drawings covering control panel consoles and/or enclosures which shall include:

1) Cabinet assembly and layout drawings to scale. These shall include both front, rear (where applicable) and interior layouts.

2) Material, fabrication and painting specifications.

3) Color selection samples for selection by the Engineer.

4) Where graphic display panels are required, submit detailed layout to scale, including symbols and line widths, as well as color selection samples and details of fabrication. Half-scale layout will be acceptable.

5) Panel wiring diagrams showing all power connections to equipment within and on the panel, combined panel power draw requirements (volts, amps), breaker sizes, fuse sizes and grounding. This wiring diagram shall be in ladder format and shall reference the appropriate loop drawing for continuations or details where required. Show all wire numbers and terminal block designations.

f) The SCADA submittal shall also contain all planning information, site preparation instructions, grounding and bonding procedures, cabling diagrams, plug identifications, safety precautions or guards, and equipment layouts in order to enable the Contractor to proceed with the detailed site preparation for all equipment.

H. SCADA System Hardware and Software Submittal

1. Software submittals shall include the following as a minimum:

   a) Bill of materials with hardware components, software names, vendors and complete listings of included software modules.

   b) Standard manufacturer's literature describing the products.

   c) Description of function of software in ICS System.

   d) Software features, limitations and constraints of software.

   e) Minimum system (processor and memory) requirements.

2. Submit information on the following software, where applicable:

   a) Operator Interface (SCADA or HMI) software, including all add-in software provided to perform specific functions (alarm dialers, schedulers, backup creation software, etc.).

   b) Control software (block oriented and/or ladder logic).

   c) Office-type products, such as spreadsheets, word processors, etc.

   d) Database management software.

   e) Communications software, including all applicable local and wide area network software.

   f) Programmable logic controller programming software.

   g) Software configuration, including:

      1) Graphic display organization.

      2) Database configuration for real-time, historical, etc. databases.

      3) Trends.

      4) System security.

      5) Formats for all reports, including all required calculations.

      6) Intercommunications between software products required to implement system functions.

7) Equipment backup configuration and requirements.

I. Training Submittals

1. Training Plan Submittal: The training plan shall include:

a) Definitions of each course with necessary pre-requisites.

b) Specific course attendance.

c) Schedule of training courses including dates, duration and locations of each class.

d) Résumés of the instructors who will actually conduct the training.

J. Testing Submittals

1. Three levels of system testing shall be required: Unwitnessed Factory Testing, Operational Readiness Testing and Performance Acceptance Testing.

2. Test plans shall be submitted only after all hardware submittals have been approved by the Owner and/or Engineer.

3. The test plan shall demonstrate that the CSI has designed and configured a system that meets the design specifications. The documents for the test plan shall be structured so that the Owner understands what the inputs are, what the predicted outputs should be, and what the actual outputs are. The test plan should have sign-off and date block for the CSI, the Contractor and the Owner.

4. The complete test plan should include but not be limited to the following:

a) Test assumptions and methods

b) Test Equipment List

c) Test Personnel Staffing and Qualifications

d) Test Schedule with time allotted for each task

e) System hardware and software summary.

f) Communications test to the various PLCs for Discrete and Analog I/O data transfer.

g) One hundred percent (100%) I/O point test including all spare points based upon the previously submitted System I/O list.

h) Functional and Control strategy tests.

5. Test Procedures: Submit the procedures proposed to be followed during the test. Procedures shall include test descriptions, forms and checklists to be used to control and document the required tests. Testing may not be started until all Testing Submittals have been approved.

6. Test Documentation: Submit a copy of the signed off test procedures upon completion of each required test.

K. Tools, Supplies and Spare Parts Lists Submittal

1. This submittal shall include a list of all required and recommended spares. The following information shall be provided in table format:

a) Specification Section

b) Tagname

c) Description

d) Quantity

e) Manufacturer

f) Model, part, order number

g) Local distributor and manufacturer contact information. Contact information shall include address, phone number and website.

L. Operation and Maintenance Manuals

1. Prior to installation of any equipment onsite, preliminary O&M manuals shall have been submitted and approved. No installation of equipment shall be permitted without the Contractor maintaining an updated version of these preliminary O&M manuals onsite for the Owner’s and Engineer’s use.

2. After all field changes or corrections made during installation and field check out have been completed, all system supplier documentation, including drawings, shall be revised to reflect the “as installed, corrected and accepted" condition of the system and final record copies of O&M manuals for the system shall be provided to the Owner and Engineer for approval.

3. Final system documentation shall be provided in 3-hole type binders of archival quality (e.g. slant D or elliptical binding, vinyl

with metal hinge or extra heavy weight vinyl, etc.) with a binding no larger than 3". Materials shall be printed on 8.5" x 11" or 11" x 17" tear resistant paper or ring reinforced paper where tear resistant is not available. Drawings shall be either folded to fit within an 8.5" x 11" binder or in an 11" x 17" 3-hole binder. Each binder shall include fifteen percent (15%) spare space for the addition of future material. Tear resistant paper shall be Xerox Never Tear or equal.

4. Where electronic documentation is available, either by purchase through the manufacture or via Internet download, it shall be organized and provided on CD. All CAD drawings and word processing documents prepared by the CSI or one of their subcontractors shall be organized and provided on CD. Electronic documentation formats shall be Adobe PDF, AutoCAD, Microsoft Office documents, HTML, or as approved by the Engineer or Owner.

5. All electronic media (i.e. software, electronic documentation, configuration files/reports, device backups, etc.) shall be provided with two (2) backup copies, each organized into a separate binder. Media storage binders shall include but not be limited to the following:

   a) Table of contents

   b) Archival media holders (e.g. CD, DVD, floppy, tape disk, etc.)

   c) Support contacts (i.e. company, phone, internet link, etc.)

   d) Software system requirements and installation instructions

6. Laminated water/tear resistant copies of all applicable instrumentation and control system drawings shall be supplied in drawing pocket of each control enclosure after "as installed, corrected, and accepted" revisions have been made to the enclosure.

7. Operation and Maintenance manuals shall include but not be limited to the following:

   a) Manufacturer standard O&M manuals for all equipment and software furnished.

   b) Custom O&M information describing the specific configuration of equipment and software, and the operation and maintenance requirements for this particular project.

c) The manuals shall contain all illustrations, detailed drawings, wiring diagrams and instructions necessary for installing, operating and maintaining the equipment.

d) All modifications to manufacturer standard equipment and/or components shall be clearly identified and shown on the drawings and schematics. All information contained therein shall apply specifically to the equipment furnished and shall only include instructions that are applicable.

e) A functional description of the entire system, with references to drawings and instructions.

f) A complete "as built" set of all approved shop drawings, which shall reflect all work required to achieve final system acceptance.

g) A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.

h) Full specifications on each item.

i) Detailed service, maintenance and operation instructions for each item supplied.

j) Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.

k) Complete parts lists with stock numbers and name, address and telephone number of the local supplier.

l) References to manufacturers' standard literature where applicable.

m) Warning notes shall be located throughout the manual where such notes are required to prevent accidents or inadvertent misuse of equipment.

n) The operating instructions shall clearly describe the step by step procedures that must be followed to implement all phases of all operating modes. The instructions shall be in terms understandable and usable by operating personnel and maintenance crews and shall be useful in the training of such personnel.

o) The maintenance instructions shall describe the detailed preventive and corrective

procedures required, including environmental requirements during equipment storage and system operation, to keep the System in good operating condition. All hardware maintenance documentation shall make reference to appropriate diagnostics, where applicable, and all necessary wiring diagrams, component drawings and PCB schematic drawings shall be included.

1.06 MEETINGS:

A. The Contractor shall be required to give the Owner, the Engineer and their representatives, at least three (3) weeks notice prior to any scheduled meetings. The notice may be shortened with Owner's and Engineer's consent.

B. Preliminary Design Review Meeting: A preliminary design review meeting shall be conducted by the Contractor for the Owner and Engineer, to ensure design compliance, installation strategies and proper coordination between responsible subcontractors related to the ICS. The Contractor shall be responsible for arranging the on-site meeting no later than sixty (60) days after notice to proceed. The Contractor shall arrange for detailed meeting minutes to be recorded, approved and distributed to meeting attendees. Two (2) weeks prior to the meeting the Contractor shall submit the following for approval:

1. A proposed list of meeting attendees including organization and phone number.
2. A proposed meeting agenda.
3. A list of personnel to be involved in the project including their responsibilities, qualifications and phone numbers.
4. An overall system description.
5. An overall system block diagram.
6. A description of all numbering, lettering, color and format conventions that will be used including examples of loop drawings, interconnection diagrams, schematic diagrams, documentation table of contents, etc.
7. A project schedule and implementation plan that coordinates the ICS installation with the installation of the entire site project.

C. Preliminary Site Testing Meeting: A preliminary site testing meeting shall be conducted by the Contractor for the Owner and Engineer, to ensure site readiness, testing strategies and proper coordination between parties related or involved in

testing the ICS. The Contractor shall be responsible for arranging the on-site meeting after the Site Testing Plan has been approved and no earlier than three (3) weeks prior to testing. The Engineer must be satisfied that the site is ready and that the testing will be performed to their satisfaction prior to any documented ICS testing being performed. The Contractor shall arrange for detailed meeting minutes to be recorded, approved and distributed to meeting attendees. Additional meetings may be required at the discretion of the Owner and Engineer to resolve specific action items not addressed in the preliminary site testing meeting. Two (2) weeks prior to the meeting the Contractor shall submit the following for approval:

1. A proposed list of meeting attendees including organization and phone number.
2. A proposed meeting agenda.
3. A list of personnel to be involved in the testing including their responsibilities, qualifications and phone numbers.
4. A list of tasks requiring Owner, Engineer or outside party involvement in testing.
5. A testing schedule that coordinates the ICS testing with the operability of the specific equipment being tested.

D. Additional meetings may be required at the discretion of the Owner and Engineer, to resolve specific action items not addressed in the preliminary design review or preliminary site testing meeting.

1.07 CONTROL SYSTEM INTEGRATOR:

A. The Control System Integrator shall be regularly engaged in the detailed design, fabrication, installation and startup of instrumentation and control systems for water and wastewater treatment facilities in the state of Florida. Any CSI that has been subject to litigation or the assessment of liquidated damages for nonperformance on any project within the last five (5) calendar years shall not be acceptable.

B. Where specific manufacturers and/or models of major hardware or software products (PLC, software, network equipment, wireless equipment, etc.) are specified to be used on this project, the CSI shall have completed at least one (1) project using that specified hardware or software. As used herein, the term “completed” shall mean that a project has been brought to final completion and final payment has been made.

C. Control System Integrators shall meet the following minimum qualifications:

1. A minimum of seven (7) years experience with at least five (5) years in water / wastewater projects
2. References for three (3) completed projects of like size and application to the project specified herein
3. Project bonding capacity of two million dollars ($2,000,000)
4. UL 508 certified control panel manufacturing shop
5. On staff licensed professional engineer registered in the state of Florida, if required to perform engineering services as specified to implement this project.

D. The listing of acceptable Control System Integrators in this specification in no way relieves the Control System Integrator from meeting the qualifications specified herein. Acceptable Control System Integrators shall be as follows:

1. Revere Control Systems: 2240 Rocky Ridge Road, Birmingham, AL, 35216; (205) 824-0004; www.reverecontrol.com
2. Curry Controls Company: 1019 Pipkin Road, Lakeland, FL 33811, (863) 646-5781; www.currycontrols.com
3. Commerce Controls: 9216 Hollyridge Place, Tampa, Fl 33637, (941) 301-9991; www.commercecontrols.com
4. DCR Engineering: 502 CR 640 E.; Mulberry, FL 33860, (863) 428-8080; www.dcreng.com
5. Rocha Controls: 5025 Rio Vista Ave; Tampa, Florida 33634; (813) 628-5584; www.rochacontrols.com
6. Commerce Controls: 9216 Hollyridge Pl., Tampa, FL 33637, 941-301-9991; www.commercecontrols.com

E. The Owner shall have the right of access to the CSI's facilities and the facilities of their equipment suppliers to inspect materials and parts, to witness inspections, tests and work in progress, and to examine applicable design documents, records and certifications during any stage of design, fabrication and tests. The CSI and their equipment suppliers shall furnish office space, supplies and services required for these surveillance activities.

1.08 QUALITY ASSURANCE:

A. The listing of specific products in this specification in no way relieves the Contractor of furnishing equipment which shall meet the performance and quality criteria specified herein.

B. All equipment and materials shall be new and the products of reputable recognized suppliers having adequate experience in the manufacture of these particular items.

C. For uniformity, only one (1) manufacturer will be accepted for each type of product.

D. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses that may occur during fabrication, transportation and erection as well as during continuous or intermittent operation. Equipment shall be adequately stayed, braced and anchored and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details.

E. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, which shall be of sturdy and durable construction and be suitable for long, trouble free service.

F. Electronic equipment shall be suitable for the specified environmental conditions.

G. Optional or substituted equipment or both requiring changes in details or dimensions required to maintain all structural, mechanical, electrical, control, operating, maintenance or design features incorporated in these specifications and drawings, shall be made at no additional cost to the Owner. In the event that the changes are necessary, calculations and drawings showing the proposed revisions shall be submitted for approval. The Contractor shall coordinate all changes with other affected trades and contracts and pay all additional charges incurred.

1.09 DEFINITIONS AND ABREVIATIONS:

A. The following definitions and abbreviations are used throughout the specifications and drawings when referring to instrumentation and control equipment, functions, and service. Definitions and abbreviations are not listed for those used in common industry practice except where to provide explicit

meaning. Refer to ISA, IEEE, and other industry standard references for those not listed herein.

CSI .....Control System Integrator
ICS .....Instrumentation and Control System
OIT .....Operator Interface Terminal
HMI .....Human-Machine Interface
OWS .....Operator WorkStation
PID .....Proportional-Integral-Derivative Control
SCADA ....Supervisory Control and Data Acquisition
SSP .....SCADA System Programmer
TVSS .....Transient Voltage Surge Suppression
RTU .....Remote Telemetry Unit
PLC .....Programmable Logic Controller

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. All materials, equipment and devices shall, as a minimum, meet the requirements of UL, where UL Standards are established for those items, and the requirements of NFPA-70. All items shall have the U.L. seal where possible and all control panels shall be U.L. labeled. All items shall be new unless specified or indicated otherwise.

B. Properly store, adequately protect and carefully handle equipment and materials to prevent damage before and during installation. Handle, store and protect equipment and materials in accordance with the manufacturer's recommendations. Replace all damaged or defective items.

C. All equipment shall be the latest and proven design. Specifications and drawings call attention to certain features, but do not purport to cover all details entering into design of the instrumentation system. The completed system shall be compatible with functions required and the equipment furnished by the Contractor.

D. All electrical components of the system shall operate on 120 volt, single phase, 60 Hz power source, except as otherwise noted in the Specifications. Drawings and Specifications indicate the energy sources that will be provided. Any other devices necessary to obtain proper operation of the instrumentation and control system from these energy sources shall be furnished with the system.

E. All necessary fuses or switches required by the instrumentation manufacturer for his equipment shall be provided with the equipment. All instruments requiring internal power supply shall have internal on-off switches.

F. The mechanical, process and electrical drawings indicate the approximate locations of field instruments, control panels, systems and equipment as well as field mounted equipment provided by others. The instrumentation subcontractor shall examine the mechanical, process and electrical drawings to determine actual size and locations of process connections and wiring requirements for instrumentation and controls furnished under this Contract. The CSI shall inspect all equipment, panels, instrumentation, controls and appurtenances either existing or furnished under other Divisions of the Specifications to determine all requirements to interface same with the ICS. The Contractor shall coordinate the completion of any required modifications with the associated supplier of the item furnished.

G. Instrumentation equipment and enclosures shall be suitable for ambient conditions specified. All system elements shall operate properly in the presence of telephone lines, power lines and electrical equipment.

H. Inside control rooms and climate-controlled electrical rooms, the temperature will normally be 20 to 25 °C; relative humidity forty to eighty percent (40% - 80%) without condensation and the air will be essentially free of corrosive contaminants and moisture. Appropriate air filtering shall be provided to meet environmental conditions (i.e., for dust).

I. Other indoor areas may not be air conditioned/heated; temperatures may range between 0 and 40 °C with relative humidity between forty and ninety-five percent (40% – 95%).

J. Field equipment, including instrumentation and panels, may be subjected to wind, rain, lightning, and corrosives in the environment, with ambient temperatures from -20 to 40 °C and relative humidity from ten to one hundred percent (10% - 100%). All supports, brackets and interconnecting hardware shall be aluminum, 316 stainless steel, or as shown on the installation detail drawings.

2.02 TOOLS, SUPPLIES, AND SPARE PARTS:

A. Provide special tools, other than those normally found in an electronic technician's toolbox, required

to test, diagnose, calibrate, install, wire, connect, disconnect, assemble and disassemble any digital equipment, instrument, panel, rack, cabinet or console mounted equipment for service and maintenance (i.e. connector pin insertion and removal tools, wire crimping tool, special wrenches, special instrument calibrators, indicator lamp insertion and removal tools, etc.).

B. Provide tools and test equipment together with items such as instruction manuals, carrying/storage cases, unit battery charger where applicable, special tools, calibration fixtures, cord extenders, patch cords and test leads, which are not specified but are necessary for checking field operation of equipment supplied under this Section.

C. The CSI shall provide supplies as needed or as required by the Owner during the specified warranty period. All fuses consumed during installation, testing, startup, the system availability demonstration, and the warranty period shall be replaced by the Contractor.

D. Provide spare parts for items of ICS equipment as recommended by the manufacturer and in accordance with the Contract Documents.

E. Furnish all spares in moisture-proof boxes designed to provide ample protection for their contents. Label all boxes to clearly identify contents and purpose.

F. Refer to individual product specifications for additional requirements specific to those devices.

2.03 SIGNAL TRANSMISSION:

A. The Contractor shall be responsible for providing a signal transmission system free from electrical interference that would be detrimental to the proper functioning of the ICS equipment.

B. The Contractor shall be responsible for coordinating signal types and transmission requirements between the various parties providing equipment under this Contract. This shall include, but not be limited to, distribution of appropriate shop drawings among the equipment suppliers, the electrical subcontractor, the HVAC subcontractor and the CSI.

C. The CSI shall provide 24 VDC power supplies for signals and instruments where applicable and as required inside control panels, etc. Where two-wire instruments transmit directly to the instrumentation and control system, the CSI shall provide power supplies at the PLC-equipped control panels for those

instruments. Where four-wire instruments with on-board loop power supplies transmit directly to the instrumentation and control system, the CSI shall provide necessary signal isolators or shall otherwise isolate the input from the ICS loop power supply. Similar provisions shall be made when a third element such as a recorder, indicator or single loop controller with integral loop power supply is included in the loop.

D. Analog signal transmission between electric or electronic instruments, controllers, and all equipment and control devices shall be individually isolated, linear 4-20 mA and shall operate at 24 VDC. Signal output from all transmitters and controllers shall be current regulated and shall not be affected by changes in load resistance within the unit's rating. All cable shields shall be grounded at one end only, at the control panel, with terminals bonded to the panel ground bus. Analog signal isolation and/or conversion shall be provided where necessary to interface with instrumentation, equipment controls, panels and appurtenances.

E. Non-standard analog transmission systems such as pulse duration, pulse rate and voltage regulated shall not be permitted except where specifically noted in the Contract Documents. Where transmitters with non-standard outputs do occur, their outputs shall be converted to an isolated, linear, 4-20 mA signal prior to transmission to other devices.

F. All discrete inputs to equipment and PLC's, from field devices, starters, panels, etc., shall be dry contacts in the field device or equipment, powered from the PLCs, unless specified otherwise. Sensing power (wetting voltage) supplied by the PLC shall be 24 VDC.

G. All discrete outputs from local control panels and Instrumentation and Control System PLCs to field devices, starters, panels, etc., shall be 120 VAC / 28 VDC 5A dry contacts. Output contacts may be powered from the field equipment or powered from 24 VDC / 120 VAC sourced from PLCs cabinet power system, as required to interface with field equipment. Outputs to solenoid valves, horns, and strobe lights shall be 120 VAC, powered from the PLC or control panel unless specified or shown otherwise.

H. Discrete signals between starters, panels, etc. where 120 VAC is utilized shall be clearly identified in the starter, panel, etc. as being powered from a different power supply, than other starter/panel components. Where applicable, warning signs shall be affixed inside the starter, panel, etc., stating that the panel is energized from multiple sources. Output

contacts in the starter, panel, etc. which are powered from other locations shall be provided with special tags and/or color coding. Disconnecting terminal strips shall be provided for such contacts. The above requirements shall apply to all starters and panels, regardless of supplier.

2.04 NAMEPLATES:

A. All items of equipment listed in the instrument schedule, control panels and all items of digital hardware shall be identified with nameplates. Each nameplate shall be located so that it is readable from the normal observation position and is clearly associated with the device or devices it identifies. Nameplates shall be positioned so that removal of the device for maintenance and repair shall not disturb the nameplate. Nameplates shall include the equipment identification number and description. Abbreviations of the description shall be subject to the Engineer's approval.

B. Control panel nameplates shall be made of 1/16-inch thick machine engraved laminated phenolic plastic having white numbers and letters not less than 3/16-inch high on a black background.

C. Field mounted nameplates shall be engraved 316 stainless steel, 22 gauge minimum thickness.

D. Nameplates shall be attached to metal equipment by stainless steel screws and to other surfaces by an epoxy based adhesive that is resistant to oil and moisture. In cases where the label cannot be attached by the above methods, it shall be drilled and attached to the associated device by means of stainless steel wire.

PART 3 EXECUTION

3.01 INSTALLATION:

A. The CSI shall provide the Contractor a periodic written report detailing progress of startup. This report shall include specific tabulations of devices on which startup has been completed.

B. Equipment shall be located so that it is accessible for operation and maintenance. The CSI shall examine the Contract Drawings and Shop Drawings for various items of equipment in order to determine the best arrangement for the work as a whole, and shall supervise the installation of ICS equipment.

C. Instrumentation and Control System equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment,

transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field, all information relevant to the placing of process control work, and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

D. The CSI shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the CSI shall be required to ship his material in sections sized to permit passing through restricted areas in the building. The CSI shall also investigate, and make any field modifications to, the allocated space for each cabinet, enclosure and panel, to assure proper space and access (front, rear, side).

E. Two (2) complete sets of approved shop drawings shall be kept at the job site during all on-site construction. Both sets shall be identically marked up to reflect any modifications made during field installation or startup. All markings shall be verified and initialed by the Engineer or his designated representative. Following completion of installation and the operational readiness test, one (1) set of the marked up drawings shall be provided to the Engineer, the other retained by the CSI for incorporation of the mark-ups into final as-built documentation.

F. All work shall be in strict accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, the CSI shall bear full responsibility for such violations and assume all costs arising there from.

G. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.

H. The Contractor shall take steps to keep electrical and control enclosures clean and free of contaminants throughout installation. Cleaning after installation only is not acceptable. Under no circumstances are electrical and control enclosures to be cleaned using compressed air to blow out dust, causing contaminants to be forced into sensitive electronics.

I. Provisions shall be made to completely capture filings (metal, etc.) when drilling into enclosures, to prevent contamination of electrical equipment.

J. Upon completion of the instrumentation and control work, the Contractor shall thoroughly clean all soiled surfaces of installed equipment and materials and remove all surplus materials, rubbish and debris that has accumulated during the construction work. The entire area shall be left neat, clean and acceptable to the Owner.

3.02 WIRING AND GROUNDING:

A. The following wiring practice guidelines shall be used in order to minimize ground loops, to minimize electromagnetic interference/radio frequency interference (EMI/RFI) to this equipment, and to provide maximum practical immunity from damage resulting from lightning-induced transients.

B. Common wires or conductors shall not be utilized (either within panels or external to panels or for grounding of field devices) for signal shield or signal grounding, and for safety grounds.

C. Exposed wire lengths extending from within shielded signal cables shall be minimized to reduce pick-up of EMI/RFI by signal circuits. Exposed lengths of less than one inch are preferred, and a maximum exposed length of two inches may be permitted where necessary. No splicing of signal wires is permitted.

D. All signal wiring shall be shielded, both within panels and external to panels. Unless otherwise specified, all signal wiring shall be No. 16 AWG stranded tinned two-conductor twisted pair, with one hundred percent (100%) coverage aluminized Mylar or aluminized polyester shield and tinned copper drain wire.

E. Signal wiring within outdoor or indoor field device enclosures shall conform to the same requirements as panel wiring.

F. The shield on each process instrumentation cable shall be continuous from source to destination, and grounded at one end only. In general, grounding of signal cable shields shall be done at the control panel end. The signal cable for no signal shall share a common cable shield grounding wire with the signal cable shield for any other signal, and shall not share a common grounding wire with any other circuit. The length of no signal cable shield grounding wire shall not exceed two (2) inches, with less than one (1) inch maximum length preferred.

G. All outdoor instruments and all outdoor enclosures shall be grounded using the practice defined in Section 800.40 of the National Electric Code.

3.03 TESTING, GENERAL REQUIREMENTS:

A. The CSI shall test all equipment hardware and software at the factory prior to shipment. Unless otherwise specified in the individual specification sections, all equipment provided by the CSI shall be tested at the factory as a single fully integrated system.

B. As a minimum, testing shall include the following:

1. Operational Readiness Testing (ORT).
2. System Acceptance Testing (SAT).

C. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and, upon the system's or subsystem's producing the correct result (effect), the specific test requirement will have been satisfied.

D. All tests shall be conducted in accordance with prior Engineer approved procedures, forms and checklists. Each specific test to be performed shall be described and a space provided after it for sign off by the appropriate party after its satisfactory completion.

E. Copies of these sign off test procedures, forms and checklists will constitute the required test documentation.

F. Provide all special testing materials and equipment. Wherever possible, perform tests using actual process variables, equipment and data. Where it is not practical to test with real process variables, equipment and data, provide suitable means of simulation. Define these simulations techniques in the test procedures.

G. The Contractor shall require the CSI to coordinate all of his testing with all affected Subcontractors and the Owner.

H. The Engineer reserves the right to test or retest all specified functions whether or not explicitly stated in the prior approved test procedures.

I. The Engineer's decision shall be final regarding the acceptability and completeness of all testing.

J. The CSI shall furnish the services of technicians, all special calibration and test equipment, and labor to perform the field tests.

3.04 OPERATIONAL READINESS TESTING (ORT):

A. The entire system shall be certified (inspected, calibrated, tested and documented) that it is ready for operation. Each specified function shall be verified on a paragraph by paragraph and loop by loop basis.

B. The Engineer, or his designated representative(s), reserves the right to witness any test, inspection, calibration or startup activity. Acceptance by the Engineer of any plan, report or documentation relating to any testing or commissioning activity specified herein, shall not relieve the Contractor of his responsibility for meeting all specified requirements.

C. The CSI shall provide the services of factory trained technicians, tools and equipment to field calibrate, test, inspect and adjust each instrument to its specified performance requirement in accordance with manufacturer's specifications and instructions. Any instrument which fails to meet any contract requirements, or any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the Engineer, at no cost to the Owner. The Contractor shall bear all costs and provide all personnel, equipment and materials necessary to implement all installation tests and inspection activities for equipment specified herein.

D. Each instrument shall be calibrated at zero, twenty-five, fifty, seventy-five and one hundred percent (0%, 25%, 50%, 75% and 100%) of span using test instruments to simulate inputs and read outputs. Test instruments shall be rated to an accuracy of at least five (5) times greater than the specified accuracy of the instrument being calibrated. Where applicable, such test instruments shall have accuracies as set forth by the National Institute for Standards and Technology (NIST).

E. The CSI shall provide a written calibration sheet to the Engineer for each instrument, certifying that it has been calibrated to its published specified accuracy. The Contractor shall submit proposed calibration sheets for various types of instruments for Engineer approval prior to the start of calibration. This sheet shall include but not be limited to date, instrument tag numbers, calibration data for the various procedures described herein, name of person performing the calibration, a listing of the published specified accuracy, permissible tolerance at each point of calibration, calibration reading as finally adjusted within tolerance, defect

noted, corrective action required and corrections made.

F. If doubt exists as to the correct method for calibrating or checking the calibration of an instrument, the manufacturer's printed recommendations shall be used as an acceptable standard, subject to the approval of the Engineer.

G. Upon completion of calibration, devices calibrated hereunder shall not be subjected to sudden movements, accelerations or shocks, and shall be installed in permanent protected positions not subject to moisture, dirt and excessive temperature variations. Caution shall be exercised to prevent such devices from being subjected to over-voltage, incorrect voltages, overpressure or incorrect air. Damaged equipment shall be replaced and recalibrated at no cost to the Owner.

H. After completion of instrumentation installation and calibration, the CSI shall perform a loop check. The Contractor shall submit final loop test results with all instruments listed in the loop. Loop test results shall be signed by all representatives involved for each loop test.

I. Loop/Component Inspections and Tests: The entire system shall be checked for proper installation, calibrated and adjusted on a loop by loop and component by component basis to ensure that it is in conformance with related submittals and the Contract Documents.

1. The Loop/Component Inspections and Tests shall be implemented using Engineer approved forms and check lists.

2. The Contractor shall require the CSI to maintain the Loop Status Reports and Components Calibration sheets at the job-site and make them available to the Engineer/Owner at any time.

3. These inspections and tests do not require witnessing. However, the Engineer will review and initial all Loop Status Sheets and Component Calibration Sheets and spot check their entries periodically and upon completion of the Operational Readiness Tests. Any deficiencies found shall be corrected.

3.05 SYSTEM ACCEPTANCE TEST (SAT):

A. Successful completion of the operational readiness test, as determined by the Engineer, shall be the

basis for starting the witnessed system acceptance test. The Engineer shall approve the ORT test results and the Engineer and Owner shall be given two (2) weeks notice prior to the start of the System Acceptance Test.

B. The system acceptance test shall repeat loop and functional testing done during the operational readiness test in order to demonstrate to the Owner and Engineer that the system has been started up, is operating, and is in compliance with these Specifications. Each specified function shall be demonstrated on a paragraph by paragraph and loop by loop basis.

C. The following documentation shall be made available to the Engineer during the test:

1. All Contract Drawings and Specifications, addenda, and change orders.
2. Master copy of the test procedure.
3. One (1) copy of all O&M Manuals shall be made available to the Engineer at the job-site both before and during testing.

D. Any malfunction during the tests shall be analyzed and corrections made by the CSI. The Engineer and/or Owner will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.

E. After all functions have been tested and all corrections made, the system shall operate continuously for fifteen (15) days without failure before this test will be considered successful.

F. The total availability of the system shall be greater than ninety-nine and one-half percent (99.5%) during this test period. Availability shall be defined as "Avail. = (Total Time-Down Time,) / Total Time x 100%". Down times due to power outages or other factors outside the normal protection devices or back-up power supplies provided, shall not contribute to the availability test times above.

3.06 TRAINING:

A. The CSI shall provide project specific classroom training at the Owner’s site or designated location. Training shall be provided for the operation and maintenance of all equipment provided, as well as site specific installation configuration training for the system as a whole.

B. Each student shall be provided with training materials. All training materials shall be provided

in hardcopy as well as on a training CD, with all materials in Microsoft Office or Adobe PDF file format. When a large volume of training materials is to be provided (i.e. software documentation, etc.), only electronic copies need to be provided per Engineer's approval. When providing training materials as electronic copies only, the CSI must ensure that the training attendees will be able to use computers during the training to access information, whether provided by the Owner or not. All training CD's shall be updated with final configurations and resubmitted for approval. Final CD media shall be archival quality.

C. Scheduling for the training sessions shall be specified by, and at the convenience of, the Owner. The CSI shall coordinate the scheduling, and shall provide written notice of available training dates, with a minimum of two (2) weeks prior notice. Candidates for training will be selected by the Owner.

D. Operator training shall be provided to familiarize operators with the system as a whole and to instruct on the function and operation of each component of the system. Training shall consist of the day-to-day operation of the system and all other operator site specific functions for this project. Instruction shall include a site walkdown of installed equipment. Two (2) courses lasting a minimum of two (2) days, with six (6) hours of instruction per day, shall be provided by the CSI.

E. Maintenance training shall be provided to maintenance personnel so that each component may be maintained without the assistance of outside organizations. The training shall be extensive so that after training, personnel shall be able to identify component malfunctions and repair components to the board replacement level. One (1) course lasting a minimum of three (3) days with six (6) hours of instruction per day shall be provided by the CSI.

F. Under the scope of this project, the CSI will not be responsible for providing PLC and HMI control programming and logic. Specific training should therefore include, but not be limited to the following: system architecture and interconnection; wiring; fiber optic systems, including maintenance and repair; field panels and equipment; radio systems; and field instrumentation and PLC hardware, including maintenance and troubleshooting.

G. Refer to related specification sections for additional training requirements.

3.8 WARRANTY:

A. During this warranty period, the CSI shall provide, at no additional cost to the Owner, the services of a trained, competent, field service engineer who shall arrive on site within thirty-six (36) hours of notification by the Owner or Engineer, to repair and/or replace any faulty device or equipment supplied by the system supplier as part of this Instrumentation and Control System.

B. All preventive and corrective activities shall be documented with service reports, which shall identify the equipment being serviced, state the condition of the equipment, describe all work performed, and list materials used. A copy of all service reports shall be delivered to the Owner on or before the next business day.

C. The CSI shall be capable of providing, after the warranty period for this system expires, a renewable service contract as specified in Section 01740 – Warranties and Bonds, whereby a trained, competent field service engineer shall arrive on site within thirty-six (36) hours of notification by the Owner. Information relative to charges for such service and availability of service shall be submitted to the Owner and the Engineer.

D. Components shall be furnished to the manufacturer's standard for service intended, unless otherwise indicated in the Specifications or on the Contract Drawings.

END OF SECTION

SECTION 13310

INSTRUMENTATION AND CONTROLS, FIELD EQUIPMENT

PART 1 - GENERAL

1.01 THE REQUIREMENT:

A. The Contractor shall furnish, test, install and place in satisfactory operation all equipment required to provide a complete and operable Instrumentation and Control System (ICS) as specified herein and as shown on the Contract Drawings, even if each needed item is not specifically specified or shown.

B. The Control System Integrator (CSI) shall provide full onsite supervision of all equipment provided under this section, where installation is provided by others.

C. Field equipment (i.e. primary elements, measuring devices, transmitters, field controllers, chart recorders, indicators, and other instrumentation and accessories) shall be provided with all components necessary for a fully functional device whether specifically mentioned in these specifications or not. This shall include, as applicable or recommended by the manufacturer: sample conditioning, sensors, sensor holder and mounting brackets, transmitter, all required cables, calibration equipment, chemicals, reagents and spare parts.

D. Specialty cables between sensors/probes and their electronics/transmitters shall be furnished with each instrument. Special cables include any type of cable not specified in Division 16 – Electrical.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. In addition to the requirements specified in this section, the requirements of specification Section 13300 - Instrumentation and Controls, General Requirements, and the sections referenced therein shall be applied.

1.03 SUBMITTALS:

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples and as specified in Section 13300 - Instrumentation and Controls, General Requirements. In addition, the following specific submittals items shall be provided:

1. An ISA specification sheet for each instrument furnished and/or calibrated shall be submitted with the field equipment submittals. The ISA data sheet shall be in accordance with ISA Standards ISA S20 "Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves" and ISA TR20.00.01 "Specification Forms for Process Measurement and Control Instruments".

2. The CSI and the field equipment manufacturer shall review the proposed installation and configuration of all field equipment, prior to submittal for approval, and shall identify any condition which shall require corrective measures. The following as a minimum shall be reviewed for the installation configuration of each instrument:

   a. Listed features
   b. Material of construction
   c. Consideration of process fluid
   d. Environmental conditions
   e. Installation location
   f. Process connections
   g. Ability to perform maintenance

3. Submit in writing in the field equipment submittal, that each piece of equipment is suitable for the proposed installation. Any proposed deviations shall be reviewed by the Engineer prior to execution.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. Unless otherwise specified, instruments shall be provided with enclosures to suit the specified environmental conditions. Field-mounted devices shall be rugged and mounted on walls, equipment racks, or pipe stanchions. Where the field equipment's integral enclosure for a specified instrument is not available with the specified environmental rating, the field equipment shall be provided in a control enclosure as specified in Specification Section 13320 - Instrumentation and Controls, Control Enclosures.

B. Where separate elements and transmitters are required, they shall be fully matched, and unless otherwise noted or shown on the Contract Drawings, installed adjacent or near to the sensor, in a readily accessible location. Special cables that are required for interconnection

between sensors or probes and transmitters shall be furnished with the instrumentation devices by the associated equipment manufacturer. Special cables shall be of the required length for the equipment locations and conduit routing paths shown on the Contract Drawings. No splicing of cables will be accepted.

C. Electronic equipment shall utilize printed circuitry and shall be coated (tropicalized) to prevent contamination by dust, moisture and fungus. Ambient conditions shall be -15 to 50° C and twenty to ninety-five percent (20% - 95%) relative humidity, unless otherwise specified. Field mounted equipment and system components shall be designed for installation in dusty, humid and corrosive service conditions.

D. All non-loop-powered instruments and equipment shall be designed to operate on a 60 Hz alternating current power source at a nominal 120 VAC, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

E. All analog transmitter and controller outputs shall be isolated, 4-20 mA into a load of 0-750 ohms minimum, unless specifically noted otherwise.

F. Process taps for primary sensors shall be sized to suit each individual installation and the requirements of the instrument served. It is the Contractor's responsibility to ensure that the location, supports, orientation and dimensions of the connections and taps for instrumentation furnished under this Division are such as to provide the proper bracing, the required accuracy of measurement, protection of the sensor from accidental damage, and accessibility for maintenance while the plant is in operation. Isolation valves shall be provided at all process taps.

G. All instrumentation exposed to sunlight shall be provided with sunshields constructed from 316 stainless steel or epoxy coated aluminum. Sunshields shall be designed to withstand regional wind and ice loads. Sunshield design shall be submitted for approval.

H. All outdoor external sample/process piping, including valves and appurtenances, shall be insulated with weather-proof insulation, and heat-taped to prevent freezing. Heat taping shall be thermostatically controlled and self-regulating, and shall adjust its heat output to the temperature of the lines.

2.02 TOOLS, SUPPLIES AND SPARE PARTS:

A. Tools, supplies and spare parts shall be provided as specified in Section 13300 - Instrumentation and Controls, General Requirements, and as specified for each equipment item. In addition, the following items shall be provided:

1. One (1) remote handheld configuration device for communication with all "smart" equipment furnished under this Contract shall be provided. The device shall be capable of performing configuration, test, and format functions from anywhere on the 4-20 mA signal loop for a particular transmitter or by direct connection. For HART communications, the configuration device shall be Rosemount 375 or approved equal as manufactured by Endress & Hauser, or ABB. Provide at least one (1) spare fuse for the device.

2. All instruments shall be supplied with one (1) year's worth of supplies, including chemicals and reagents, for the calibration, operation and maintenance of the device.

2.03 ACCESSORIES:

A. Instrument tubing shall be 1/4 x 0.065-inch seamless, annealed, ASTM A-269 Type 316L stainless steel with Type 316 - 37° stainless steel flared fittings, or Swagelock or Parker-CPI flareless fittings.

B. Diaphragm seals shall be provided to systems as shown on the Contract Drawings, as specified herein and/or for isolation of pressure gauges, switches and transmitters attached to systems containing chemical solutions or corrosive fluids. As a minimum, seals shall be of all 316 stainless steel construction. Diaphragms shall be 316L stainless steel for operating pressures at or above 15 psi, and elastomers for operating pressures below 15 psi. Diaphragm material shall be non-reactive with the process fluid. Refer to the Instrument Schedules for specific materials requirements. Seal shall have fill connection, 1/4-inch NPT valve flush port and capable of disassembly without loss of filler fluid. Where specified, diaphragm seals shall comply with the above requirements, and shall be provided with 316 stainless steel factory filled capillaries. Seals shall be Helicoid Type 100 HA, Mansfield & Green, Ashcroft, or equal.

C. Isolating ring seals shall be provided for sensing elements measuring pressure in solids bearing fluids.

D. For heavy solids/slurry applications, wherever the associated pressure instrument is used for control purposes, or where shown on the Contract Drawings, the sensor body shall be full line size wafer design, with 316 stainless steel housing and assembly flanges, and

Buna N flexible cylinder lining for in-line mounting. The wafer shall have through bolt holes or centerline gauge for positive alignment with the associated flanged piping. The captive liquid chamber and associated instrument(s) shall be furnished with threaded drain tap and plug. Isolating ring seals shall be RED Valve Series 40, Ronningen-Petter Iso-Ring, Moyno RKL Series W, or equal.

E. For all other solids bearing fluids, pressure shall be sensed via a 1/2" diameter spool-type isolating ring seal, mounted on a 1/2" pipe nipple at 90 degrees from the process piping. An isolation ball valve shall be provided between the process piping and the ring seal, and a cleanout ball valve shall be provided between the ring seal and the atmosphere. The pressure instrument shall be back or side mounted to the ring seal such that the gauge or readout may be viewed normally. Isolating ring seals for normal solids service shall be Red Valve Series 42, Ronningen-Petter Iso-Spool, or equal.

F. Isolation valves shall be 1/2-inch diameter ball valves with 316 stainless steel body, 316 stainless steel ball.

2.04 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS):

A. TVSS shall be supplied for all field equipment power, signal, and communications wires that have any portion extending outside of a building. Refer to Specification Section 13320 - Instrumentation and Controls, Control Enclosures for requirements.

2.05 PRESSURE GAUGES:

A. General: Unless otherwise noted or specified, pressure and vacuum gauges shall conform to the following:

B. Mounting Type: Gauges shall be of the stem-mounting type unless noted otherwise.

C. Construction: Gauges shall be of the bourdon tube or bellows type with 270 degrees clockwise pointer travel. Dials shall be white face with black numerals. Dial size shall be 4-1/2 inches. Connections for all gauges shall be male 1/2 NPT with square wrench flats. Wetted parts shall be corrosion-resistant to the process fluid shown and unless otherwise specified shall be the manufacturer's best quality standard. The case shall be filled with glycerin and shall be black phenolic. Accuracy shall be ±0.5 percent of span.

D. Chemical Seal: Where specified or shown in the drawings, the gauge, with optional locking device, shall be furnished with a diaphragm seal. The diaphragm seal shall have a 316 stainless steel (minimum) top and bottom housing and a 316 stainless steel diaphragm welded to the top housing. When the

process fluid or pressure is not compatible with 316 stainless steel, the manufacturer shall provide a diaphragm seal compatible with the process fluid. The process connection shall be a 3/4-inch threaded connection with a flushing connection. The fill fluid shall be glycerin. A locking device shall be included from the factory on all fluid-filled instruments to prevent inadvertent loosening or removal from the seal.

E. Where no seal is specified the gauge will be supplied with a pressure limiting snubber to protect against surges and pulsations.

F. Manufacturers: The gauges shall be as manufactured by Ashcroft, McDaniels, U.S. Gauge or equal. The diaphragm seals shall be field serviceable for oil filling and as manufactured by Ashcroft, Mansfield and Green, FIT, Ametek or equal.

2.06 GAGE PRESSURE TRANSMITTERS

A. Gauge pressure transmitters shall be of the capacitance type, with a process isolated diaphragm with silicone oil fill, microprocessor based "smart" electronics, and a field adjustable 30:1 input range.
B. Span and zero shall be continuously adjustable externally over the entire range. Span and zero adjustments shall be capable of being disabled internally.
C. Transmitters shall be NEMA 4X weatherproof and corrosion resistant construction with low copper aluminum body and 316 stainless steel process wetted parts.
D. Accuracy, including nonlinearity, hysteresis, and repeatability errors shall be plus or minus 0.10 percent of calibrated span, zero based. The maximum zero elevation and maximum zero suppression shall be adjustable to anywhere within sensor limits.
E. Output shall be linear isolated 4-20mA 24 VDC. Power supply shall be 24 VDC, two wire design.
F. Each transmitter shall be furnished with a 4 digit LCD indicator capable of displaying engineering units and/or milliamps, and mounting hardware as required.
G. Overload capacity shall be rated at a minimum of 25 MPa. Environmental limits shall be 40 to 85 °C at zero to one hundred percent (0-100%) relative humidity.
H. Each transmitter shall have a stainless steel tag with calibration data, attached to body.
I. The capacitance pressure sensor shall be mechanically, electrically and thermally isolated from the process and the environment, shall include an integral temperature compensation sensor, and shall provide a digital signal to the transmitter's electronics for further processing.
J. Factory set correction coefficients shall be stored in the sensor's non volatile memory for correction and

linearization of the sensor output in the electronics section.

K. The electronics section shall correct the digital signal from the sensor, and convert it into a 4-20 mA analog signal for transmission to receiving devices.

L. The electronics section shall contain configuration parameters and diagnostic data in non volatile EEPROM memory, and shall be capable of communicating, via a digital signal superimposed on the 4-20 mA output signal, with a remote interface device. Output signal damping shall be provided, with an adjustable time constant of 0-36 seconds.

M. Where scheduled, gauge pressure indicating transmitters shall be calibrated in feet of liquid for liquid level service. Refer to the Contract Drawings for installations and applications.

2.07 LEVEL SWITCHES (SUSPENDED FLOAT):

A. Level Switches (Suspended Float): Float switches shall be of the non-mercury displacement type, encapsulated in polyurethane or vinyl floats.

B. The units shall be waterproof, shockproof, explosion-proof and equipped with sufficient submersible cable to extend to the control panel or junction box without splicing. Any required weights shall be provided.

C. Switches shall be suspended in the wetwell on a suitable rack or rail of stainless steel construction.

D. Suspended type float switches shall be Anchor Scientific model GSI40N0 or approved equal.

2.08 LEVEL/FLOW TRANSMITTER, ULTRASONIC TYPE:

A. Ultrasonic transmitters shall be provided for measurement of tank and wetwell levels or for flow measurement based on level over a weir or flume. Equipment shall be provided with features and accessories as described herein, suitable for the application.

B. Ultrasonic level/flow transmitters shall meet the following specifications as a minimum:

1. NEMA 4X enclosure
2. 120VAC, 60Hz input power
3. Process display with keypad for menu driven configuration
4. One (1) 4-20 mA output
5. One (1) alarm relay output
6. Non-volatile memory
7. Accuracy: 0.25 %

C. The CSI shall provide all mounting hardware and coordinate the details of the installation so that the instruments are installed in keeping with the best

standard and recommended practices of the manufacturer and conforming to the requirements set forth by the Engineer.

D. Level/flow transmitters shall be fully programmable and configurable using a keypad. The final 'As-Built' documentation shall be provided with a tabulation of the Programming Parameters used in each level/flow transmitter so that the initial calibration can be reproduced if a spare transmitter is installed.

E. Level/flow transmitters shall be provided with optional integral analog signal isolators, as part of the transmitter assembly. All conduit connections shall be sealed to prevent damage or corrosion due to vapors or wetness.

F. Ultrasonic Level/Flow Transmitters shall be Milltronics Hydroranger 200 with Echomax XPS-15 sensors. Refer to the Instrumentation Schedule Attachment for flange mounting requirements. Transmitters shall be installed using the appropriate transducer, suitable for the range of the installation. The cable provided with the transducer shall be ordered with sufficient length to provide installation without splicing the cable at any point.

G. The CSI shall provide mounting hardware components and appropriate mounting assistance to install and secure the transducers in a manner in keeping with the recommendations of the manufacturer of the equipment and in keeping with the general details provided in the drawings. All hardware shall be fabricated from corrosion resistant materials and shall utilize stainless steel hardware. The mounting system shall be secure and permanent and shall allow easy access to the sensor for servicing. All cables shall be installed in suitable rigid conduit with only short lengths of flexible conduit allowed to complete the installation.

H. In cases where the transducer is used to monitor a covered wetwell, the transducer shall be installed using a hinged protective enclosure. The enclosure shall be a special corrosion resistant instrument enclosure made of polyurethane, and stainless steel hardware. Enclosures shall be model C-6, as provided by O'Brien Corp, St. Louis, Missouri. The case shall be secured to the slab using heavy anchors over an appropriately sized hole cored through the slab. The enclosure shall also have a hole in the bottom to match the hole in the slab so that the transducer can be easily installed from above. The transducer shall be installed on a heavy aluminum plate which would lie in the bottom of the enclosure and allow the transducer to extend into the cored hole.

I. In cases where the transducer is used to monitor a water storage tank or other type of location, the CSI shall provide a mounting design and mounting hardware to provide an installation which is appropriate for the operation of the device and easily maintained. For storage tanks, the transducer shall be mounted above the tank or a suitable bracket extending out far enough from the tank sides to receive a strong signal over the entire level range without reflections off the tank sides. The transmitter shall be mounted outside of the wall at a convenient ground-level working height.

J. In cases where the transducer is used on a chemical storage tank, the CSI shall provide a flange mounted arrangement to match the connection point on the storage tank. Flange sizes and type will be coordinated with that equipment supplier.

K. In cases where the transducer is used in a highly turbulent area, the sensor shall be flange mounted to a stilling well to minimize incorrect responses to wave action in the liquid. The stilling well shall be a six (6) inch PVC pipe which shall extend the entire depth of the measured range and to below the normal low liquid level. The stilling well shall have holes drilled periodically along the length sufficient to allow adequate response to changes in liquid level. The stilling well shall be supported in a manner which produces a rigid installation minimizing the movement due to the turbulent liquid.

L. Spare parts: Provide one (1) spare Ultrasonic Level/Flow Transmitter and one (1) spare transducer of each type used (supplied with the longest cable utilized in the project).

2.08 ULTRASONIC FLOWMETERS (TRANSIT TIME):

A. Ultrasonic Flowmeters shall consist of a dual strap-on flowmeter sensor assembly with remote signal converter/transmitter that is capable of converting and transmitting the signal from the sensors.

B. The transmitter shall utilize the characterized principles of acoustical wave travel in a water pipeline with measurements being the difference in time for signals transmitted both upstream and downstream into the flow.

C. The flowmeter accuracy shall be ≤±0.5% of reading from 2-100% meter capacity. Flow range sensitivity shall be up to 0.01 feet/sec.

D. The flow system shall include but not be limited to the following:

1. Submersible, non-intrusive encapsulated clamp-on dual-sensors with manufacturer supplied sensor cable of sufficient length as to not require splicing.
2. SST clamps and mounting hardware
3. The cables for interconnecting the flow tube to the transmitter shall be furnished by the manufacturer and of sufficient length as to not require splicing.
4. NEMA 4X / IP65 transmitter enclosure
5. 120VAC, 60Hz input power
6. Backlit 2-line, 40 character alphanumeric process LCD display with tactile keypad for menu driven configuration
7. One (1) 4-20 mA output
8. Up to four (4) alarm relay outputs
9. Provide with configuration and operational tuning software

E. Ultrasonic Transit Time Flowmeters shall be Thermo Scientific DCT 6088.

2.09 CHLORINE ANALYZER (TOTAL RESIDUAL)

A. The online total residual chlorine analyzer shall measure concentrations of total chlorine residual in water in the range 0-5 ppm with an accuracy ≤±5% of reading. The analyzer's accuracy shall not be affected by pH changes between 6-9.5 pH. The analyzer shall have a response time ≤2.5 minutes. The analyzer shall include but not be limited to the following:

1. Non-corrosive NEMA 4X enclosure
2. 120VAC 60Hz input power
3. Process display with keypad for menu driven configuration
4. One (1) 4-20ma output
5. Two (2) user-selectable alarm relay outputs
6. Flow Controller
7. Sample conditioning kit
8. One (1) year supply of maintenance/operating parts and chemicals

B. The analyzer shall be mounted within a NEMA 4X enclosure with full door window kit for protection of the equipment.

C. Total Residual Chlorine Analyzers shall be Hach CL17

2.10 CHECK VALVE LIMIT SWITCH

A. General – Check valve limit switches shall be added to the existing Internal Recycle Pump check valves for providing indication of positive flow on each pump.

B. The switch shall operate off a stem extending into the valve interior and operated as the check mechanism opens. The stem will operate a micro limit switch to provide a dry contact indication rated for up to 6-ampere maximum load at 120 VAC, 60 Hertz.

C. The switch package shall be housed in a NEMA 4 enclosure with an electrical conduit connection.

D. The switch assembly shall be as manufactured by the check valve supplier and shall be compatible with the existing check valve.

2.11 SUNSHIELDS:

A. All outdoor mounted transmitters shall be provided with a 316 stainless steel sunshield. Sunshields are to be sized so that the sunshield will extend a minimum of three (3) inches beyond the transmitter enclosure on all sides.

B. The sunshield shall be sized to include protection for the transmitter and the surge arresting device.

C. All sunshield and instrument mounting hardware shall be 316 stainless steel.

PART 3 - EXECUTION

3.01 REQUIREMENTS:

A. In addition to the requirements specified in this section, refer to Section 13300 - Instrumentation and Controls, General Requirements.

END OF SECTION

North Water Reclamation Facility
Manatee County, Florida

Instrumentation Schedule

TAG	DESCRIPTION	SERVICE	RANGE
AE/AIT-810	Total Chlorine Residual Analyzer	Distribution Pump Discharge Chlorine Residual	0-5 ppm
FE/FIT-709	Transit Time Ultrasonic Flow Transmitter	Lake Storage Return Flow	0-12,000 GPM
FE/FIT-710	Transit Time Ultrasonic Flow Transmitter	Effluent Flow to Lake Storage	0-12,000 GPM
FE/FIT-1015	Transit Time Ultrasonic Flow Transmitter	Plant Drain Pump Station Flow	0-3,500 GPM
LE/LIT-1002	Ultrasonic Level Transmitter (6-inch Flange)	Plant Drain Pump Station Wetwell Level	0-15 Feet
LSHH-750	Non-Mercury Float Level Switch	Backwash Pump Station High Alarm Level	
LSMH-750	Non-Mercury Float Level Switch	Backwash Pump Station Lag Start Level	
LSML-750	Non-Mercury Float Level Switch	Backwash Pump Station Lead Start Level	
LSL-750	Non-Mercury Float Level Switch	Backwash Pump Station Low Cutoff Level	
LSLL-750	Non-Mercury Float Level Switch	Backwash Pump Station Low Low Alarm Level	
LSHH-1001	Non-Mercury Float Level Switch	Plant Drain Pump Station High Alarm Level	
LSMH-1001	Non-Mercury Float Level Switch	Plant Drain Pump Station Lag 1 Start Level	
LSML-1001	Non-Mercury Float Level Switch	Plant Drain Pump Station Lead Start Level	
LSL-1001	Non-Mercury Float Level Switch	Plant Drain Pump Station Low Cutoff Level	
LSLL-1001	Non-Mercury Float Level Switch	Plant Drain Pump Station High Alarm Level	
PE/PI-316	Pressure Gauge with Diaphragm Seal	Internal Recycle Pump No. 1 Discharge Pressure	0-100 PSI
PE/PI-317	Pressure Gauge with Diaphragm Seal	Internal Recycle Pump No. 2 Discharge Pressure	0-100 PSI
PE/PI-326	Pressure Gauge with Diaphragm Seal	Internal Recycle Pump No. 3 Discharge Pressure	0-100 PSI
PE/PI-327	Pressure Gauge with Diaphragm Seal	Internal Recycle Pump No. 4 Discharge Pressure	0-100 PSI
PE/PI-751	Pressure Gauge with Diaphragm Seal	Backwash Pump No. 1 Discharge Pressure	0-100 PSI
PE/PI-752	Pressure Gauge with Diaphragm Seal	Backwash Pump No. 2 Discharge Pressure	0-100 PSI
PE/PI-1011	Pressure Gauge with Diaphragm Seal	Plant Drain Pump No. 4 Discharge Pressure	0-100 PSI
PE/PI-1012	Pressure Gauge with Diaphragm Seal	Plant Drain Pump No. 5 Discharge Pressure	0-100 PSI
PE/PI-1013	Pressure Gauge with Diaphragm Seal	Plant Drain Pump No. 6 Discharge Pressure	0-100 PSI
PIT-713	Pressure Transmitter	Mars Discharge to Lake	0-200 PSI
PIT-717	Pressure Transmitter	Effluent Discharge to Storage	0-200 PSI
ZSC-316	Check Valve Limit Switch	Internal Recycle Pump No. 1 No Flow Switch	
ZSC-317	Check Valve Limit Switch	Internal Recycle Pump No. 2 No Flow Switch	
ZSC-326	Check Valve Limit Switch	Internal Recycle Pump No. 3 No Flow Switch	
ZSC-327	Check Valve Limit Switch	Internal Recycle Pump No. 4 No Flow Switch	

SECTION 13320

INSTRUMENTATION AND CONTROLS, CONTROL ENCLOSURES

PART 1 GENERAL

1.01 THE REQUIREMENT:

A. The Contractor shall furnish, test, install and place in satisfactory operation all control enclosures (i.e. field panels, control panels, cabinets, consoles, boxes, etc.) required to provide a complete and operable Instrumentation and Control System (ICS) as specified herein and as shown on the Contract Drawings, even if each needed item is not specifically specified or shown.

B. The Contractor shall also be responsible to provide modifications to existing control panels as described herein or as indicated in the PLC Input/Output Schedule Attachment. Modifications to existing control panels shall also conform to the requirements of these specifications.

C. All components and all necessary accessories (e.g. mounting hardware, conditioning equipment, TVSS, fuses, circuit breakers, terminals, ground bars, relays, contactors, starters, indicators, control operators, power supplies, signal conditioning, connectors, digital hardware, etc.) that may be required to complete the system, shall be provided.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. In addition to the requirements specified in this section, the requirements of specification Section 13300 - Instrumentation and Controls, General Requirements and the sections referenced therein shall be applied.

B. Instrumentation and Controls Schedules. Refer to Instrumentation Schedule and PLC Input/Output Schedule Attachments for a listing of major equipment, enclosure construction and signal monitoring requirements.

1.03 SUBMITTALS:

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples and as specified in Section 13300 - Instrumentation and Controls, General Requirements. In addition, the following specific submittals items shall be provided:

1. Cabinet sizing in relation to heat dissipation and cooling/heating system sizing calculations shall be submitted for all cabinets containing PLCs, UPSs, VFDs, SCRs and, at the request of the Engineer, for all cabinets containing sensitive electronic equipment or chemicals.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS:

A. Either manufacturer-standard or custom enclosures may be furnished, subject to the requirements of the Contract Documents and favorable review by the Engineer.

B. All enclosures shall fit within the allocated space as shown on the Drawings. The Contractor shall examine plans and/or field inspect new and existing structures as required to determine installation requirements and shall coordinate the installation of all enclosures with the Owner and all affected contractors. The Contractor shall be responsible for all costs associated with installation of enclosures, including repair of damage to structures (incidental, accidental or unavoidable).

C. A minimum estimated size is shown on the Drawings. The Contractor shall furnish enclosures of the size and quantity required to house the manufacturers' equipment supplied and all other electrical components installed in the enclosure. In addition, provide useful space and power supply capacity as spare for future expandability to a minimum of one (1) item per item type installed or twenty percent (20%) of quantity of each type item installed, whichever yields the greater spare space.

D. Enclosures (cabinets, panels, boxes, etc.) shall be formed or welded construction, reinforced with Unistrut, Powerstrut or equal to facilitate mounting of internal components or equipment. Sufficient access plates and doors shall be provided to facilitate maintenance and testing of the supplier's equipment. Doors shall be removable. Enclosures with any dimension thirty-six (36) inches or greater shall be provided with removable lifting lugs designed to facilitate safe moving and lifting of the panel during installation. No screws or bolts shall protrude through from the interior enclosure.

E. All steel enclosures shall be free from dirt, grease and burrs, and shall be treated with a phosphatizing metal conditioner (phosphate conversion coating) before painting. All surfaces shall be filled, sanded, and

finish coated by spraying a 1-2 mil epoxy prime coat and smooth, level, high grade textured finish between flat and semi-gloss shine. The colors shall be selected by the Owner from a minimum of six (6) color samples provided. All stainless steel enclosures shall be polished to a No. 4 finish.

F. Enclosures shall be prefabricated cabinets and panels by Hoffman, Rittal or Vynckier. The Contractor may optionally provide enclosures custom fabricated by a reputable panel fabrication shop acceptable to the Engineer.

G. Each panel shall incorporate a removable back panel on which control components shall be mounted. Back panels shall be secured to the enclosures with collar studs. All components shall be of the highest industrial quality and securely mounted to the removable back panels with screw and lock washers. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.

H. All enclosures with any dimension twenty-four (24) inches or larger shall be provided with drawing pockets for as-built panel drawings. One (1) laminated copy of the appropriate panel as-built drawings shall be furnished and left in the pocket of each panel.

I. All metallic enclosures with door mounted equipment shall have the door grounded by means of flexible ground strap.

J. The enclosure and all interior and exterior equipment shall be identified with nameplates. The equipment shall be mounted such that service can occur without removal of other equipment. Panel mounted equipment shall be flush or semi-flush mounted with flat black escutcheons. All equipment shall be accessible such that adjustments can be made while the equipment is in service and operating. All enclosures shall fit within the allocated space as shown on the Contract Drawings.

K. Enclosures shall provide mounting for UPS, power supplies, control equipment, input / output subsystems, panel mounted equipment and appurtenances. Ample space shall be provided between equipment to facilitate servicing and cooling. Enclosures shall be sized to adequately dissipate heat generated by equipment mounted inside the panel. Louvered openings fitted with dust filters near the bottom and top of the cabinet shall be provided for NEMA 12 enclosures. If required, cabinets shall be provided with filtered fans, heat exchangers or air conditioners. Only closed loop cooling systems shall be provided for NEMA 4X cabinets. Cooling systems

shall be by the cabinet fabricator, McLean Midwest, Noren Products, or approved equal.

L. Enclosures shall be provided with a main circuit breaker and a circuit breaker on each individual branch circuit distributed from the panel. Main breaker and branch breaker sizes shall be coordinated such that an overload in a branch circuit will trip only the branch breaker but not the main breaker. Circuit breakers shall be provided for the following internal branch circuits distributed within the panel:

1. Receptacles and power strips
2. Lighting
3. UPS
4. HVAC equipment

M. Enclosures shall be provided with 120 volt duplex receptacles for service equipment and fluorescent service lights. Loads not requiring transient voltage surge suppression (i.e. receptacles, lighting, HVAC, branch circuits to remote equipment, etc.) shall be connected ahead of the enclosure TVSS device.

N. Locate equipment, devices, hardware, power supplies, instrumentation and controls, electrical equipment and wiring to be installed inside the enclosures and/or as facial features on the enclosures, so that connections can be easily made and so that there is ample room for servicing each item. Every component in and on the enclosures shall be able to be removed individually without affecting the other components and without the need to move other components. Support and restrain all internally, as well as panel mounted components to prevent any movement.

O. All cabinets and/or enclosures shall be NEMA rated for the environment in which it is to be installed and as noted in the Drawings.

P. Materials and equipment used shall be U.L. approved wherever such approved equipment and materials are available.

Q. Control panels shall be built in accordance with UL508A Industrial Control Panels and NEC Article 409 Industrial Control Panels. Control panels for areas classified as Hazardous shall be built in accordance with UL698 Industrial Control Equipment for Use in Hazardous Locations. Control panels shall be UL508A and/or UL698 labeled and marked as defined in NEC 409.110 with the following:

1. Manufacturer’s name and contact information (i.e. address, phone, website, email, etc.).
2. Supply voltage, phase, frequency and full-load current.
3. Short-circuit current rating of the industrial panel based on one of the following:
   a. Short-circuit current rating of a listed and labeled assembly
   b. Short-circuit current rating established utilizing an approved method
4. Electrical wiring diagram numbers or the index sheet to the electrical wiring diagrams.
5. The enclosure type number (i.e. NEMA 1A, 3R, 12, 4X, 7, 9, etc.)
6. If the industrial control panel is intended as service equipment, it shall be marked to identify it as being suitable for use as service equipment.

2.2 TOOLS, SUPPLIES, AND SPARE PARTS:

A. Tools, supplies, and spare parts shall be provided as specified in Section 13300 - Instrumentation and Controls, General Requirements and as specified for each equipment item. In addition, the following items shall be provided:

1. One (1) of each type of panel mounted equipment (i.e., indicators, signal converters, etc.) provided under this Contract. This does not include large LCD display electronic operator interface devices.
2. Three (3) of each type of interposing relay provided under this Contract.
3. Five (5) of each type of power TVSS device used
4. Ten (10) of each type of signal TVSS device used
5. Two (2) of each type of communication TVSS device used.
6. Three (3) pints of each type or color of touchup paint for the control enclosures provided under this Contract.

2.3 OUTDOOR ENCLOSURES:

A. All outdoor enclosures shall be rated NEMA 4X, constructed of 316 stainless steel with a white powder epoxy coating finish unless specified otherwise. Outdoor enclosures shall have a hinged and gasketed door. Door latches shall be all stainless steel, fast operating clamp assemblies (quick release), which do not require bolts or screws to secure. Gaskets shall be polyurethane.

B. Outdoor panels shall be fitted with pad-lockable latch kits.

C. Outdoor enclosures with internal digital electronics, exterior indicators or exterior indicator lights shall have external sun shields or sun shades, constructed of the same materials as the associated enclosure, unless otherwise specified.

D. Outdoor enclosures shall be designed for ambient conditions of -15 to 50°C and twenty to ninety-five percent (20% - 95%) relative humidity, unless otherwise specified. Outdoor enclosures shall be provided with thermostatically controlled space heaters to provide condensation protection.

2.4 INDOOR ENCLOSURES:

A. Indoor enclosures located in the same area (i.e. room, etc.) as open process tanks, open process channels, closed process piping or process equipment containing wet liquids or possible airborne powders, shall be rated NEMA 4X, constructed of 316 stainless steel, fiberglass, fiberglass reinforced polyester, or polycarbonate, unless specified otherwise. Enclosures shall have a hinged and gasketed door. Door latches shall be all stainless steel, fast operating clamp assemblies (quick release) which do not require bolts or screws to secure. Gaskets shall be polyurethane.

B. Indoor enclosures located in a dry area (i.e. electrical room, etc.) shall be NEMA 12 steel, unless specified otherwise. Enclosures shall have a hinged and gasketed door. Door latches shall be three (3) point door latches with handle for all enclosures with a dimension of twenty-four (24) inches or larger, or otherwise shall be fast operating clamp assemblies which do not require bolts or screws to secure. Gaskets shall be polyurethane.

C. Indoor enclosures in a non-air conditioned space shall be designed for ambient conditions of 0 to 40°C and twenty to ninety-five percent (20% - 95%) relative humidity, unless otherwise specified. Indoor enclosures in an air conditioned space shall be designed for

ambient conditions of 20 to 30°C and twenty to eighty-five percent (20% - 85%) relative humidity, unless otherwise specified.

2.5 PLC, RTU AND OTHER DIGITAL EQUIPMENT ENCLOSURES:

A. Enclosures shall be prefabricated cabinets and panels by Hoffman, Rittal, or Vynckier. The Contractor may optionally provide enclosures custom fabricated by a reputable panel fabrication shop acceptable to the Engineer.

B. Enclosures shall be sized to provide a minimum of fifteen percent (15%) spare sub-panel mounting space for future equipment.

C. A minimum of ten percent (10%) spare terminals for each type of wiring (power, signal, DC control, AC control, etc.) shall be mounted within each control panel.

D. Outdoor enclosures shall be provided with thermal insulation and thermostatically controlled space heaters to provide condensation protection.

E. Enclosures with any dimension greater than thirty-six (36) inches which contain a programmable logic controller (PLC) shall be provided with a folding laptop programmer shelf on the inside of the door.

F. NEMA 12 enclosures shall be provided with filtered louvered openings at the top and bottom of the cabinet, if required for heat dissipation.

G. Enclosures shall be provided with copper ground bars for terminating cable shields.

H. The temperature inside each enclosure containing digital hardware (i.e. cabinet, panel or console) shall be continuously monitored, and shall generate an alarm to the nearest PLC if the temperature rises to an adjustable, preset high temperature.

2.6 TERMINALS:

A. Wiring which enters or leaves the enclosure shall be terminated to large lug type terminal strips, designed to accommodate minimum 16 AWG wiring, and permanently numbered consistent with the component schematic. These wiring termination strips shall be located with ample room to allow field wiring to be terminated in a neat and workmanlike manner.

B. Terminal blocks shall be assembled on non-current carrying galvanized steel DIN mounting rails, securely

bolted to the cabinet sub-panel. Terminals shall be of the screw down pressure plate type as manufactured by Phoenix Contact, Wieland, Square D, or equal. Power terminal blocks shall be single tier with a minimum rating of 600 volts, 30 amps. Signal terminal blocks shall be single tier with a minimum rating of 600 volts, 20 amps.

C. Fused terminal blocks or miniature thermal circuit breaker terminal blocks shall be supplied for protection and isolation of enclosed equipment, or as specified in the Contract documents. Blown fuse indicators shall be provided and/or tripped breaker status shall be clearly visible. Fused or miniature thermal circuit breaker terminal blocks shall be provided for, but not limited to each of the following:

1. Each piece of equipment provided with a power supply (integral, internal or external) with the exception of devices with internal fusing plugged into a receptacle.

2. Each PLC module requiring external power

D. Terminals shall be marked with a black waterproof, permanent, continuous marking strip. One side of each terminal shall be reserved exclusively for field incoming conductors. Common connections and jumpers required for internal wiring shall not be made on the field side of the terminal.

2.7 WIRING:

A. All wiring shall be bundled and run open or enclosed in vented plastic wireway, as required. All conductors run open shall be bundled and bound with nylon cable ties, at regular intervals, with intervals not to exceed twelve (12) inches. Adequately support and restrain all wiring runs to prevent sagging or other movement. Care shall be taken to separate communication, network, electronic signal, AC discrete signal, DC discrete signal and power wiring. Wiring to equipment mounted on doors or where movement of the equipment will take place shall be installed in nylon spiral wrapping sheaths.

B. Wires shall be color coded as follows:

1. Equipment Ground - GREEN
2. 120 VAC Power Distribution - BLACK
3. 120 VAC Power Neutral - WHITE
4. 120 VAC Control (Internally Powered) - RED
5. 120 VAC Control (Externally Powered) - YELLOW

6. 24 VAC Control - ORANGE
7. DC Power (+) - RED
8. DC Power (-) - BLACK
9. DC Control - BLUE
10. Analog Signal (+) - BLACK
11. Analog Signal (-) - WHITE

C. All wiring shall comply with accepted standard instrumentation and electrical practices. Field wiring for power, control and signal wires shall comply with Division 16 of the specifications. For each pair of parallel terminal blocks, the field wiring shall be between the blocks.

D. Internal panel wiring shall be as follows:

1. AC power wiring: 14 AWG minimum, stranded copper conductors, THHN/THHW wire rated for 600 volts and 90 °C. For wiring carrying more than 15 amps, use sizes required by NEC.

2. AC control and DC power and control wiring: 16 AWG minimum, stranded copper conductors, THHN/THHW wire rated for 600 volts and 90 °C.

3. Instrument signal wiring: 18 AWG stranded conductors, tinned copper, twisted pair or triad, overall one hundred percent (100%) aluminum foil shield with 20 AWG stranded drain wire, plenum rated 300V 60°C FEP insulated wire with FEP jacket, equal to Belden 88760.

4. All stranded wire shall have a minimum of sixteen (16) strands, except for drain wires.

2.8 IDENTIFICATION:

A. Provide a laminated black nameplate with beveled edges and 1/2-inch white letters to identify each console, panel or cabinet on the front of the enclosure.

B. Provide laminated, beveled edge, plastic legend plates and nameplates, with 1/4-inch letters, for each front panel mounted device as shown on the Drawings. Legend plates and nameplates shall be the size as shown on the Drawings. Color shall be black lettering on white background except caution/warning nameplates which shall be white lettering on a red background. Attach front panel nameplates with both a permanent adhesive and stainless steel machine screws into tapped holes.

C. Tag all interior instruments and other components with engraved, laminated plastic nameplates with 1/8-inch, minimum, lettering. Legends shall be consistent with wiring and layout drawings. Nameplates shall be attached with permanent adhesive to the panel, near the device or on the device itself or as otherwise approved by the Engineer.

D. Number and label each wire in the systems. Every unique wiring node shall have its own individual unique number. Numbers shall be shown on all submitted drawings. All wires shall be labeled at each termination and junction of the wire and at 30-inch intervals along the wire. All multi-conductor cables shall be labeled at each end and at 30-inch intervals with CBL-XXX and also label each conductor at both ends. Labeling shall be self laminating white/transparent self extinguishing vinyl strips (Brady DAT 7 292 or equal) with clear heat shrink tubing over the markers. Length shall be sufficient to provide at least two and one-half (2 1/2) wraps. All labels shall be machine-printed with wire and/or cable numbers.

2.9 ACCESSORIES:

A. Control operators such as pushbuttons (PB), selector switches (SS), and pilot lights (PL) shall be Allen Bradley 800H, Square D Company Type SK or equal. Control operators shall be 30.5 mm, round, heavy-duty, oil tight NEMA 4X corrosion resistant.

B. Pushbuttons and selector switches shall be non-illuminated, spring release type. Pushbuttons shall include a full guard. Panic stop/alarm pushbuttons shall be red mushroom type with manual-pull release. Pilot lights shall be of the proper control voltage, LED type (indoor) and lamp type (outdoor).

C. Control operators shall have legend plates as specified herein, indicated on the Contract Drawings, or otherwise directed by the Engineer. Legend plates shall be plastic, white field (background) with black lettering. Engraved nameplates shall be securely fastened above each control operator. If adequate space is not available, the nameplate shall be mounted below the operator.

D. Control operators for all equipment shall be as specified herein and of the same type and manufacturer unless otherwise specified or indicated on the Contract Drawings. Modifications to existing panels using control operators and indicators of the same type and manufacturer shall be allowed with Engineer’s approval.

E. Where required to interface between motor control centers, equipment controls, and control panels, interposing relays and associated control wiring circuitry shall be furnished and installed to provide the monitoring and/or control functions specified herein. Interposing relays shall be miniature type with DPDT contacts rated a minimum 10 amp @ 120 VAC, push-to-test button, and status indicator. Relay coils shall be 120/240 VAC or 24 VDC as required. Relays shall be as manufactured by Idec, Square D, Omron, Allen-Bradley or approved equal.

2.10 POWER SUPPLIES:

A. Power supplies shall be enclosed and sized per the guidelines of UL508 and UL508A. Power supplies shall be Phoenix Contact, Model Quint-PS-X, or approved equal.

B. External PLC power supplies provided for loop and/or PLC power shall be redundant and alarm to the PLC upon failure.

2.11 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS):

A. Transient voltage surge suppressors shall be provided at the following minimum locations:

1. At any connections between AC power and electrical and electronic equipment, including panels, assemblies and field mounted instruments.

2. At both ends of all analog signal circuits that have any portion of the circuit extending outside of a protecting building.

3. At both ends of all copper-based communications cables that extend outside of a building.

4. At all specified spare analog inputs and outputs in PLCs and RTUs.

B. These protective devices shall be external to and installed in addition to any protective devices built into the equipment. Power and signal protection shall be installed either in a NEMA 4X enclosure or in the enclosure that houses the equipment to be protected.

C. All surge arrestors shall be mounted and wired per the manufacturer’s recommendations including local grounding for surge energy dissipation. For surge suppressors use No. 8 cable for ground connection or install suppressor directly on ground bus using grounding screw. Provide 1-inch wide by 1/8-inch thick copper ground bus as a minimum.

D. Panel-mounted power circuit protectors shall be provided in all enclosures powered by 120 VAC. The protector shall be a 3-stage hybrid, solid-state power line protector with noise filtering, common mode and normal mode suppression and nanosecond reaction time. The unit shall include a replaceable fuse to remove the load (protected equipment) from the line if the unit is either overloaded or the internal protection fails. TVSS devices shall be EDCO HSP-121BT-1RU or approved equal.

E. Panel-mounted signal circuit protectors shall be made for mounting on a terminal block rail. Each TVSS shall include a moveable grounding link to allow each signal cable shield to be individually grounded to the panel via the mounting rail through the TVSS for that cable without the use of any additional grounding wire or to be isolated from ground at the TVSS. Each mounting rail shall be grounded to the panel by the use of rail mounting screws at approximately one-foot intervals. Protection shall be from line to line and from each line to ground. Protection shall also be from shield to ground where the shield is not grounded at the protector. Each TVSS shall have the ability to protect against surge currents greater than 10,000 amperes. Each TVSS shall add no more than 22 ohms per signal wire to the total signal loop resistance of the analog signal loop in which it is installed. TVSSs shall not introduce error-producing ground loop currents into the instrumentation signal circuits. TVSS devices shall be EDCO DRS-036, Phoenix Contact or approved equal.

F. Signal circuit TVSS for 2-wire field instruments shall be a conduit connected/pipe nipple type and shall have characteristics equal to the panel mounted devices. Units shall be mounted to a transmitter conduit entry point where available. When not available or practical, then these devices shall be mounted in NEMA 4X enclosures located at the field devices. TVSS devices shall be EDCO SS65-036, Phoenix Contact or approved equal.

G. Signal circuit TVSS for 4-wire field instruments shall be a separate enclosure unit capable of providing protection on both the power and signal side. The unit shall contain the characteristics of the line power protector and signal circuit protectors discussed above. Units shall be enclosed in a manufacturer assembled NEMA 4X polycarbonate enclosure with a clear polycarbonate cover. TVSS devices shall be EDCO SLAC-12036, Phoenix Contact or approved equal.

H. TVSS devices antenna cable signal protection shall be an in-line panel mount type unit rated for 50 Ohms and with

dc blocking. Unit shall be rated for the appropriate frequency range and have an insertion loss of 0.1 dB. TVSS device shall be a Polyphaser IS-50 series or approved equal.

I. TVSS device specifications and ratings for signal or communications types not defined herein shall be as specified elsewhere or of a type recommended by the manufacturer of the device being protected. TVSS devices shall be Phoenix Contact, EDCO, Polyphaser or Innovative Technology.

PART 3 EXECUTION

3.01 REQUIREMENTS:

A. In addition to the requirements specified in this section, refer to Section 13300 - Instrumentation and Controls, General Requirements.

B. Floor mounted enclosures shall be installed on 1/4-inch thick rubber type pads. These pads shall completely cover the area of the base that is against the floor.

C. Keep enclosures clean at all times. Keep enclosure doors closed except when actually working in the enclosure. Protect all equipment during installation, including hole punching for conduit connection. Remove all filings and thread cuttings from enclosures. Careful attention must be paid to provide installations which are both functional and aesthetically acceptable.

D. All conduits used in conjunction with control panels or instrumentation of any kind shall be sealed using a suitable duct-sealing compound to minimize the possible damage caused by vapors or wetness. It shall be the responsibility of the CSI to verify that this is accomplished early in the project, so that corrosion damage does not occur during the time of construction.

E. The Contractor shall provide the Engineer a periodic written report detailing construction progress. This report shall include specific tabulations of equipment on which construction/installation has been completed.

F. Equipment shall be located so that it is accessible for operation and maintenance. The CSI shall examine the Contract Drawings and Shop Drawings for various items of equipment in order to determine the best arrangement for the work as a whole and shall supervise the installation of all equipment.

G. All UPS units shall be mounted on raised platforms so as to not rest on the panel bottom.

3.02 WIRING AND GROUNDING:

A. The following wiring practice guidelines shall be used in order to minimize ground loops, minimize the effects of electromagnetic interference/radio frequency interference (EMI/RFI) and to provide maximum practical immunity from damage resulting from lightning-induced transients.

B. Common wires or conductors shall not be utilized (either within panels or external to panels, or for grounding of field devices) for signal shielding, signal grounding, or safety grounds.

C. Exposed wire lengths extending from within shielded signal cables shall be minimized to reduce pick-up of EMI/RFI by signal circuits. Exposed lengths of less than one inch is preferred with a maximum exposed length of two inches only permitted where necessary. No splicing of signal wires shall be permitted.

D. All signal wiring shall be shielded, both within panels and external to panels. Unless otherwise specified, all signal wiring shall be No. 16 AWG stranded tinned two-conductor twisted pair with 100 percent coverage of aluminized Mylar or aluminized polyester shield and tinned copper drain wire.

E. The shield on each process instrumentation cable shall be continuous from source to destination, and grounded at one end only. In general, grounding of signal cable shields shall be done at the control panel end. No signal cable shall share a common cable shield grounding wire with any other signal cable or other circuit. The exposed length of cable shield grounding wires shall not exceed two inches prior to termination with less than one-inch maximum length preferred.

F. All outdoor instruments and all outdoor enclosures shall be grounded using the practice defined in Section 800.40 of the National Electric Code.

END OF SECTION

SECTION 13325

INSTRUMENTATION AND CONTROLS, PUMP CONTROL PANEL

PART 1 GENERAL

1.01 THE REQUIREMENT:

A. The Contractor shall furnish, test, install and place in satisfactory operation a new triplex pump control panel for the Plant Drain Pump Station. The control panel shall be mounted adjacent to the wetwell.

B. All components and all necessary accessories (e.g. mounting hardware, conditioning equipment, TVSS, fuses, circuit breakers, terminals, ground bars, relays, contactors, starters, indicators, control operators, power supplies, signal conditioning, connectors, digital hardware, etc.) that may be required to complete the system, shall be provided.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. In addition to the requirements specified in this section, the Control Panel shall comply with the requirement for control panels as included herein and as defined in Section 13320 – Instrumentation and Control, Control Enclosures and as shown on the Contract Drawings.

B. Motor starter and circuit breaker components shall comply with the requirements defined under Division 16 – Electrical.

C. Instrumentation and Controls Schedules. Refer to Instrumentation Schedule and PLC Input/Output Schedule Attachments for a listing of major equipment, enclosure construction and signal monitoring requirements.

1.03 SUBMITTALS:

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples and as specified in Section 13300 - Instrumentation and Controls, General Requirements. In addition, the following specific submittals items shall be provided:

1. Cabinet sizing in relation to heat dissipation and cooling/heating system sizing calculations shall be submitted for all cabinets containing PLCs, UPSs, VFDs, SCRs and, at the request of the Engineer, for all cabinets containing sensitive electronic equipment or chemicals.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS:

A. Construction: The electrical control equipment shall be mounted within a NEMA Type 4X, powder epoxy coated white, dead front enclosure with 3-point latch, constructed of not less than 14-gauge 316 stainless steel.

B. The enclosure shall be dead front equipped with a door and shall incorporate a removable back panel on which control components shall be mounted. The back panel shall be secured to the enclosure with collar studs.

C. The panel shall be mounted on 3-inch Type 304 stainless steel pipe supports, with stainless steel Unistrut channels attached with stainless steel fasteners as shown on the Drawings. The support posts shall be anchored in concrete adjacent to the lift station wetwell. Sufficient space shall be provided for mounting of the associated wetwell level transmitter and surge arrestor.

D. No fittings shall enter from the back or sides of the control panel. All conduits shall enter the bottom of the panel and shall be threaded conduit hubs.

E. The minimum panel size shall be 30" x 30" x 8". All panels shall be equipped with main and emergency circuit breakers (Min. 100 amp). All power conductors from the main breaker to the emergency and pump breakers shall be connected via a power distribution block.

F. Controls shall be rated for 480 volts, 3-phase, 60 Hz, equipped with individual pump breakers, across-the-line magnetic starters, 3-phase overload protection, a lightning arrestor on the incoming power source mounted on the exterior and wired to the load side of the safety switch, a three pump alternator, an overload reset, HAND-OFF-AUTO pump operation selector switches, a 120 VAC control circuit transformer, 120 VAC interposing relays and a terminal board with connections for external signal connections.

G. Five (5) liquid level switches shall be installed and equipped with a continuous length of flexible 600 volt, type S.O. cable to make all connections inside the control panel (NO SPLICES SHALL BE PERMITTED).

H. The station shall have a flashing type red alarm beacon mounted on top of control panel, one adjustable audible

alarm with a silence switch, and one emergency generator receptacle of the appropriate type listed below with a safety catch between the main and emergency circuit breakers to prevent electrical backfeed. All test switches will be of the momentary contact type. All neutral wiring shall be connected via a neutral assembly (Square D #SN12-125 or equal).

I. Generator Receptacles: 0-200 amp, 460 volt - Russell Stoll JRSB2034ER or approved equal.

J. Components:

1. All motor branch circuit breakers, motor starter and control relays shall be of the highest industrial quality, securely fastened to the removable back panels with screws and lock washers. The back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.

2. A magnetic air circuit breaker, Type KA as manufactured by Square D Company or approved equal, shall be furnished for each pump motor. The circuit breaker trip shall be adjustable and adequately sized to meet the pump motor and station operating conditions.

3. A mechanical disconnect mechanism shall be installed on each circuit breaker to provide a means of disconnecting power to each pump motor.

4. An open frame, across-the-line, NEMA rated, magnetic starter, Class 8536, as manufactured by Square D, or approved equal, shall be furnished for each pump motor, sized as shown on the plans. The motor starter shall be equipped to provide under-voltage release and overload protection on all three (3) phases using three overload relays of the melting alloy type. The motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position. No starter smaller than NEMA size 1 shall be used. Overload reset pushbuttons shall be located on the exterior of the control compartment doors. Provide each starter with the status signals wired to the terminal strip for motor run (N.O.) and auxiliary overload relay (N.O.)

5. Control relays shall be miniature plug-in type with contacts rated at 300 VAC, 10 amperes, non-inductive.

6. Provide surge protection as shown on the drawings.

K. Operating Controls and Instruments:

1. All operating controls and instruments shall be securely mounted on the control compartment inner door. All controls and instruments shall be clearly labeled to indicate function.

2. The pump mode selector switch shall be of the Hand-Off-Auto type to permit override of automatic level controls and manual actuation of shutdown of each pump motor. The operation of each pump in the manual mode shall bypass all safety shutdown circuits except for the pump motor overload shutdown.

3. Switches shall be oil-tight, as manufactured by Allen-Bradley Type 800H, or approved equal, providing three (3) switch positions, each of which shall be clearly labeled according to function.

4. Separate indicator lamps, which shall operate at 120 volts input, shall be provided mounted above the H.O.A. selector switches. The lamps shall be easily replaceable from the front of the control compartment door without removing switch modules from their mounted positions.

5. A six (6) digit, non-resettable, elapsed time meter shall be connected to each motor starter to indicate the total running time of each pump in “hours” and “tenths of hours”. The elapsed time meter shall be HK Series as manufactured by Eagle Signal, or approved equal.

6. An alternator shall be provided for the three pumps such that any one of the pumps can be selected as the lead pump. Pump starting sequences shall be 1-2-3, 2-3-1, and 3-1-2. Alternator shall be Diversified Electronics ARA Triplexor, or approved equal.

7. The Control panel shall provide unpowered contacts for monitoring by the SCADA System as follows:

a. Pump 1 Run
b. Pump 2 Run
c. Pump 3 Run
d. Pump 1 Failure
e. Pump 2 Failure
f. Pump 3 Failure
g. Pump 1 in Auto

h. Pump 2 in Auto
i. Pump 3 in Auto
j. High level Alarm
k. Low level Alarm

L. Phase Monitor

1. The 3-phase power monitor shall measure the main incoming power to the control panel. The monitor shall be a UL recognized component capable of detecting loss of phase, phase reversal, and low voltage on any phase. It shall feature an adjustable voltage range between -15% to +25% of the service voltage, with an adjustable trip delay from 2 to 20 seconds.

2. Reset shall be automatic.

3. The monitors shall be Diversified Electronics model SLA or approved equal.

M. Control Components: The pumps shall be controlled based on the level in the wetwell. The liquid level in the wetwell shall be sensed by an ultrasonic level transmitter with backup monitoring by polypropylene weighted floats.

N. The ultrasonic level sensor shall be flange mounted to a stilling well extending the depth of the wetwell and connected to a level indicating transmitter. The level transmitter shall provide relay contracts to the pump control panel for Lead Start, Lag Start and All Pumps Off.

O. The floats shall be secured at the top of the wetwell via a stainless steel hatch mounted bracket designed specifically for the float installations. The floats shall be Anchor Scientific Solo Float, or approved equal. High and low station levels shall be alarmed.

P. Floats switches shall be provided for Lead Start, Lag Start, All Pumps Off, High Level Alarm and Low Level Alarm. Pump control switches shall be connected to the pump controls in parallel to the level transmitter relay contacts to function as a backup control but set at a separate higher elevation to level transmitter.

PART 3 EXECUTION

3.01 REQUIREMENTS:

A. Unless otherwise noted on the Drawings, the bottom of the cabinet shall be mounted a minimum of 20 inches above the top of the wetwell opening, properly aligned and adequately supported independent of the connecting

raceways. Controls and indicators on installed control panel shall be no higher than six (6) feet above the ground.

B. All wiring in the control panel shall be neatly formed, grouped, and identified to provide a neat and orderly appearance.

C. Ground Resistance - Tests shall be made on the entire grounding system for the continuity of connections and for resistance to the flow or current through ground connections. The ground resistance of conduits, equipment cases, and supporting frames shall not vary appreciably from that of the system as a whole. The ground resistance of the system shall not exceed 10 ohms.

END OF SECTION

SECTION 13330

INSTRUMENTATION AND CONTROLS, SCADA HARDWARE

PART 1 GENERAL

1.01 THE REQUIREMENT:

A. The Contractor shall furnish, test, install and place in satisfactory operation all equipment required to provide a complete and operable Supervisory Control and Data Acquisition (SCADA) system, as specified herein and as shown on the Contract Drawings, even if each needed item is not specifically specified or shown.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. In addition to the requirements specified in this section, the requirements of specification Section 13300 - Instrumentation and Controls, General Requirements and the sections referenced therein shall be applied.

1.03 SUBMITTALS:

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples and as specified in Section 13300 - Instrumentation and Controls, General Requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. The SCADA hardware configuration as specified herein, as specified in related sections and as shown on the Contract Drawings depicts overall system configuration requirements. Unless otherwise specified, designs which vary from this concept will be rejected.

B. All discrete and analog data acquisition, pre-processing, storage and process control functions shall be performed at the PLC level.

C. PLC-to-PLC communication protocols shall be Ethernet based.

2.02 TOOLS, SUPPLIES, AND SPARE PARTS:

A. Tools, supplies and spare parts shall be provided as specified in Section 13300 - Instrumentation and Controls, General Requirements, and as specified for

each equipment item. In addition, the following items shall be provided:

1. One (1) of each type of CPU module for PLC equipment furnished under this Contract.

2. One (1) of each type of communication module for PLC equipment furnished under this Contract.

3. Two (2) of each type of input/output module for PLC equipment furnished under this Contract.

4. Two (2) of each type and size of PLC and equipment power supply furnished under this Contract.

5. One (1) data communications radio.

2.03 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS):

A. Refer to specification Section 13320 – Instrumentation and Controls, Control Enclosures for TVSS requirements.

B. Provide TVSS protection for all specified spare analog inputs and outputs.

2.04 UNINTERRUPTIBLE POWER SUPPLIES (UPS):

A. UPS units shall be provided for all new SCADA panels and computers.

B. UPS units at sites without ATS and generators shall be sized to provide a minimum of thirty (30) minutes backup time. At sites with ATS and generators, UPS units shall be sized for a minimum of fifteen (15) minutes. Each UPS shall consist of a free standing UPS module and battery modules as required to meet backup runtime requirements.

C. UPS units provided for SCADA computers shall be connected to the computer via a digital communication port to provide status and automatic shutdown of the computer.

D. UPS units provided for PLCs shall be provided with a dry contact output to alarm on UPS trouble or failure. This fail output shall be wired into the PLC I/O to represent UPS status.

E. Each UPS shall be sized to match the maximum power requirements of the associated digital equipment, control panel power supplies and accessories plus twenty percent (20%) spare capacity. Upon loss of the AC supply, the inverter shall continue to supply normal

power to the device, drawing DC power from the batteries.

F. Each UPS shall meet the following requirements:

1. Input voltage shall be 117 VAC, single phase, 60 Hz.
2. Voltage regulation shall be plus or minus five percent (±5%) for line and load changes.
3. The output frequency shall be phase-locked to the input AC line on AC operation and shall be 60 hertz (±0.5%) when on battery operation.
4. The batteries shall be of the sealed, lead acid or lead calcium gelled electrolyte type, suitable for high temperatures.
5. Sound absorbing enclosure.
6. EMI/RF noise filtering.
7. Surge protection shall be provided on the AC input circuit, which shall have a UL TVSS clamping voltage rating of 400 V with a <5 ns response time.
8. Adjustment allowed to prevent UPS from going offline when on a standby generator supplied power source.

G. UPS systems shall be APC, Powerware Ferrups, or approved equal.

2.05 PROGRAMMABLE LOGIC CONTROLLERS (PLC), GENERAL:

A. The CSI shall furnish programmable logic controllers (PLCs) as specified herein and as shown on the Drawings. PLCs shall be provided complete with rack, power supply, I/O cards, special function cards, instructions, memory, input/output capacity and appurtenances to provide all features and functions as described herein. PLC I/O cards may be supplied by third party vendors if approved by the PLC manufacturer and the Engineer. No substitutions will be permitted.

B. All components of the PLC system shall be of the same manufacturer, who shall have fully tested units similar to those being furnished, in an industrial environment with associated electrical noise. The PLC system shall have been tested to meet the requirements of NEMA Standard ICS 2-230 (Arc Test) and IEEE C37.90.1 (SWC). The processing unit shall perform the operations functionally described herein, based on the program stored in memory and the status of the inputs and outputs.

C. The programmable controller shall be designed to operate in an industrial environment. The PLC shall operate in an ambient temperature range of 0°-60°C and a relative humidity of five to ninety-five percent (5% - 95%), non-condensing. The PLC shall operate on supply voltages of 90-132 VAC at 47-63 Hz, or 24 VDC if provided with a battery backup system. Overcurrent and undervoltage protection shall be provided on the power supply.

D. System configuration shall be as shown on the Contract Drawings. PLC types shall be designated on the Communications System diagram and correspond to the specifications herein. Only a single type of processor shall be supplied for all PLCs of a designated type. Memory, processor and PLC type shall be adequate for all control functions specified. Memory backup shall be provided during loss of power for the configuration, logic program and current operating parameters/addresses.

E. The processor and its associated memory shall be enclosed in a modular enclosure. A multiple-position selector switch or equivalent shall be used to select processor operating mode. LED-type indicating lights shall be provided to indicate processor, memory and battery status. Errors in memory shall be recognized and shall activate the memory error indicating lights. The PLC processor shall monitor the internal operation of the PLC for failure and provide an alarm. Memory shall consist of battery-backed RAM or EEPROM, which shall retain the control program for at least one (1) year, in the event of power loss. Visual indication shall be provided if battery charge is insufficient to maintain the program in RAM memory for at least two (2) weeks.

F. The instruction set for the PLC shall include the following, as a minimum:

1. Relay type instructions
2. Counter and timer instructions
3. Comparison instructions (equal, greater than, limit tests, etc.)
4. Integer, long integer and floating point mathematical instructions
5. Advanced math and trigonometric functions
6. Matrix and array instructions
7. Logical instructions (and, not, or, etc.)
8. Bit modification, moving and shift instructions
9. Diagnostic instructions

10. Sequencer instructions
11. Program control instructions (jump, goto, subroutine, etc.)
12. PID control loops
13. Block read and write capability
14. Master and slave communications capabilities
15. Immediate I/O and communications update instructions
16. Real-time clock and date

G. In addition to a communications port for communications as shown on the Contract Documents, additional communication ports shall be provided for any other devices as required (i.e., operator interface unit, connection to a notebook computer for programming and configuration).

2.06 PLC TYPE FOR SCADA PANELS:

A. PLCs for in-plant SCADA panels as specified or shown in the Contract Documents shall meet the general requirements for PLCs and shall meet but not be limited to the following requirements:

1. 10/100 Mbps Ethernet Port
2. Minimum Rack Size: Thirteen (13) slots, not to include processor or power supply
3. I/O modules shall be of a dedicated type, i.e. AI, AO, DI, DO. No mixed I/O modules shall be acceptable.
4. Memory and I/O sized to meet functional requirements.
5. PLC manufacturer type shall be coordinated with existing facility PLCs so that the same software programming language is used for all PLCs. PLCs shall be Allen–Bradley SLC-5/05 series, 64 K memory (1747-L553).

2.07 PLC INPUTS/OUTPUTS FOR SCADA PANELS:

A. Input/output hardware within SCADA panels shall be plug-in modules in associated I/O rack assemblies. Each PLC within an enclosure shall handle the required number of process inputs and outputs, plus a minimum of ten percent (10%) pre-wired spares for each I/O type furnished, with the exception of discrete inputs, which shall have a minimum of twenty percent (20%) pre-wired spares, plus a minimum of twenty percent (20%) spare I/O

rack expansion space for the addition of future circuit cards or modules.

B. PLC input/output systems and processing modules shall be of the same model series.

C. Discrete inputs (DI) shall be 24 VDC (integral to PLC), developed from dry field contacts. Units shall be Allen Bradley Model 1746-IB16, 16-point discrete input modules.

D. Discrete outputs (DO) shall be 120 VAC / 28 VDC 5A dry contacts. Output contacts may be powered from the field equipment or powered from 24 VDC / 120 VAC sourced from PLC control panel's power system, as required to interface with field equipment. Outputs to solenoid valves shall be 120 VAC, powered from the PLC or control panel unless specified or shown otherwise. Provide interposing relays as specified in Section 13320 – Instrumentation and Controls, Control Enclosures as required to meet dry contact rating. Units shall be Allen Bradley Model 1746-OW16, 16-point relay output modules.

E. Analog input (AI) circuits shall be isolated, 12-bit (minimum) resolution type. Analog input hardware shall be provided as required for all types of analog inputs being transmitted to the PLC. In general, analog input modules shall be capable of receiving 4-20 mA signals. Each input circuit shall have optical isolation to protect the equipment against high voltage transients. Units shall be Allen Bradley Model 1746-NI8, 8-channel analog input module.

F. Analog outputs (AO) shall be coordinated with the receivers but shall generally be isolated 24 VDC, 4-20 mA outputs powered from the PLC. Each output circuit shall have optical isolation to protect the equipment against high voltage transients. Units shall be Allen Bradley Model 1746-NO8I, 8-channel analog output module.

G. Input/output modules shall be configured for ease of wiring and maintenance. The modules shall be connected to wiring arms which can be disconnected to permit removal of a module without disturbing field wiring. Covers shall be provided to prevent operator personnel from inadvertently touching the terminals. The process interface modules shall be provided with screw-type terminal blocks with barriers between adjacent terminals for connection of field inputs. Terminals shall be suitable for accepting up to and including No. #22...#12 AWG (0.2...4 mm2) wire.

H. Output failure mode shall be selectable so that upon station or communication system failure, all outputs shall be placed in the non-conducting mode or remain as they were prior to failure. Light-emitting diodes shall be provided for status indication for each input and output point.

I. Signal and control circuitry to individual input/output boards shall be arranged such that board failure shall not disable more than one-half (1/2) of the control loops within any group of controlled equipment (e.g., one pump out of a group of three pumps, two pumps out of four, etc.). Where possible, individual control loops and equipment shall be assigned to individual boards such that failure of the board will disable only one (1) loop or piece of equipment.

J. External power supplies shall be provided with the PLC as required to meet specified installed I/O power requirements, plus spares. Power supplies shall be modular units, shall be fully redundant and shall alarm to the PLC upon failure. Power supplies shall have a line regulation of 0.05% and meet the environmental and power requirements specified herein.

K. Manufactured PLC cabling systems may be used to replace individual wiring of I/O to terminal blocks. Cabling system shall consist of an I/O module connector, multiconductor cable and an interface module consisting of terminals. The terminals shall accept 22-12 AWG wire and be rated for the signals carried. If required, an interface module may consist of components (fuses, relays, surge protection, etc.) and terminals. PLC cabling systems shall be as manufactured by Allen-Bradley, Phoenix Contact, Weidmüller, or approved equal.

L. Control circuits and signals entering hazardous areas shall be provided with intrinsically safe barriers meeting the requirements of the NEC and UL698.

2.08 PLC EQUIPMENT FOR RTU PANELS:

A. PLCs within RTU panels as specified or shown in the Contract Documents shall meet the general requirements for PLCs and shall meet but not be limited to the following requirements:

1. Unit shall be provided with a minimum of two (2) communications ports; one port shall be dedicated for use with the network communications equipment, and one port shall be dedicated for use by a portable programming computer (not supplied as part of this project).

2. I/O modules shall be of a dedicated type, i.e. AI, AO, DI, DO. No mixed I/O modules shall be acceptable.

3. Memory and I/O shall be sized to meet functional requirements.

4. Base unit shall include ten (10) 120 VAC discrete input points, six (6) discrete relay output points and two (2) 0-10 VDC voltage input points.

5. PLC shall be Allen-Bradley, Micrologix 1100, 1763-L16BBB.

6. PC Programming/Configuration Cable shall be Allen-Bradley 1761-CBL-PM02.

7. Discrete Input Expansion Module shall meet the following requirements:

   a. Sixteen (16) points per module

   b. 24 VDC input

   c. Discrete Input Expansion Module shall be Allen-Bradley 1762-IQ16.

8. Analog Input Expansion Module shall meet the following requirements:

   a. Four (4) points per module, 4-20 mA, 24 VDC.

   b. Analog Input Expansion Module shall be Allen-Bradley 1762-IF4.

2.09 FIBER OPTIC ETHERNET SWITCHES (CONTROL PANEL MOUNTED):

A. Fiber Optic Ethernet switches for mounting within control panels for communications connection to the facility Control Console: The CSI shall provide all fiber optic communications equipment and shall install in all control panels, whether provided under this section or not.

B. The switch shall be a managed 10/100 Mbps switch with a minimum of four (4) Ethernet ports and two (2) Fiber Optic ports. Ethernet ports shall be RJ45 and auto-sensing with indicators for status of each port. Fiber Optic ports shall be multimode, ST connectors.

C. Switches shall be industrial grade and specifically meant for industrial control use. The switch shall also be compatible for communications to the Ethernet Fiber Optic Switch in the Communications Room.

D. Subject to compliance with these specifications Ethernet switches for mounting within a control panel shall be Hirschmann RS-20 Series, Phoenix Contact, Digi/Milan or equal as approved by the Engineer.

2.10 FIBER OPTIC CABLE SYSTEM:

A. Fiber Optic Cables

1. Fiber optic cables shall be heavy-duty, multi-fiber breakout style cable, designed for high tensile strength and durability, and suitable for installation in aerial runs and for long pulls through conduit. Cables shall be specially designed for outdoor environments.

2. Cables shall be suitable for installation with a rated pull strength capability in excess of 340 lbs. The CSI shall use procedures, measurements and precautions so that no more than 50% of the maximum rated pull strength capability of the cable is ever applied during any point in the installation procedure.

3. Cables shall be suitable for installation with a minimum bend radius of three (3) inches or less. The CSI shall use procedures, measurements and precautions so that the cable is never exposed to a bend radius of less than six (6) inches during any point in the installation procedure.

4. Jacketing shall be polyethylene, with high abrasion and cut-through resistance. Outer jacket shall be UV stabilized for outdoor use and overall ruggedness. Jackets shall have low friction resistance and high strength so that long pulls in conduit will not cause damage.

5. Fibers shall have a 62.5-micron core. Multimode fiber core shall utilize low loss fiber, with a typical maximum attenuation of 3.0 dB/km.

6. Each sub-channel shall be tight buffered with a 2.5 mm PVC jacket, and internal strength fibers. Subchannels shall be breakout style, for ease of handling.

7. Fibers shall be hard silica clad, with a thin hard polymer optical cladding, over a pure fused silica core. Cables shall have Kevlar ripcord and all subchannels shall be color-coded.

8. Cables shall have a minimum of six (6) fibers or additional fibers as shown in the contract drawings.

9. Fiber-optic cables shall be manufactured by Corning, Belden, 3-Com or approved equal.

B. Fiber Optic Patch Panels

1. Fiber Optic cables shall always be terminated at protected fiber optic patch panels, which shall be designed to protect the terminated cables and provide a fiber-termination terminal strip for connections to local equipment.

2. Each control panel or termination area which connects to fiber optic cables shall be provided with one or more fiber optic patch panels, with sufficient termination points for every fiber in every cable. The installer shall terminate, test and secure every fiber within every cable, even if the additional fibers are designated as “spare” or “future by others”.

3. Patch panel termination connectors shall be SC or ST-style. Connectors are to remain individually booted until used.

4. Where fibers are to be connected to local equipment, a pre-terminated fiber jumper of suitable length shall be provided to make the connection between the patch panel and the equipment.

5. Patch panels shall be Corning or approved equal.

2.11 RADIO COMMUNICATIONS SYSTEM:

A. The Control System Integrator (CSI) shall provide all equipment and services necessary to implement a spread spectrum radio communications link for operation of the golf course lake discharge valves.

B. All radio systems installed under this contract shall be designed and configured to provide a minimum of 20 dB fade margin over the manufacturer’s minimum requirements. The Contractor/CSI shall be responsible for implementing all needed measures required to insure this capability.

C. The CSI shall be responsible to perform a field radio path test to determine the communications requirements between the golf course irrigation station RTU and the North Water Reclamation Facility (NWRF). The test will

be performed prior to the submittal of any radio communications equipment and make use of communications hardware equal to that specified as part of this project. The test will duplicate as much as possible the actual operating conditions at the RTU and the NWRF including path, frequency and transmission power to determine necessary antenna height requirements, expected signal strength performance and possible signal interference concerns.

D. The CSI shall perform signal strength testing upon completion of the installation and provide documentation confirming the performance of the final installation. Testing results outside the performance range of the field test shall be investigated and corrected.

E. At each radio location, provide new antennas, antenna structure, cable, connectors and surge protection, as specified.

F. The master radio station at the NWRF is utilizing an existing omni-directional antenna and radio communications panel, located at the Administration Building radio tower. The connection between the radio panel and the in-plant SCADA system occurs in the control building over an existing Ethernet fiber optic link.

G. Ethernet Radio: Ethernet radio shall meet the following requirements:

1. Unlicensed Spread Spectrum Frequency Range

2. Date Rate 512 kbps over-the-air

3. Remote Dual Gateway

4. Ethernet radio shall be Microwave Data Systems Model iNET 900.

H. 12VDC Radio Power Supply: Refer to Section 13320 – Instrumentation and Controls, Control Enclosures for power supply specifications.

I. Spread Spectrum YAGI Directional Antenna: YAGI antenna shall meet the following requirements:

1. 6 dB gain

2. YAGI antenna shall be as manufactured by Laird Technologies, Maxrad or approved equal.

J. Antenna Cable

1. Antenna cable shall meet the following requirements for installations of 100 feet or less:

    a. 1/2” foam dielectric, 50 ohm, suitable for use with type N captivated connectors.

    b. Attenuation: 1.45 dB / 100 ft at 450 MHz.

    c. Antenna cable shall be Andrew Heliax LDF4-50A.

    d. Antenna cable connectors shall be captivated connectors suitable for the antenna cable. Connectors shall be Andrew 1/2-inch connectors, L4PNM-RC/L4PNF-RC.

2. Antenna cable shall meet the following requirements for installations over 100 feet:

    a. 7/8” foam dielectric, 50 ohm, suitable for use with type N captivated connectors.

    b. Attenuation: 0.808 dB / 100 ft at 450 MHz.

    c. Antenna cable shall be Andrew Heliax LDF5-50A.

    d. Antenna cable connectors shall be captivated connectors suitable for the antenna cable. Connectors shall be Andrew 7/8-inch connectors, L5TDM-PS/L5TDF-PS.

K. Antenna Cable Surge Protector: Antenna cable surge protector shall meet the following requirements:

1. Selected for application and cable size, bulkhead mount.

2. Shall be combined with connector type selections to allow operation with surge arrestor bypassed.

3. Shall be Polyphaser, IS-50NX series or approved equal.

L. Antenna cable transmission accessories (hangers, cable ground kits, weather-proofing kits, etc.) shall be provided by Andrew or approved equal. Accessories shall be furnished and installed as recommended by the manufacturer for the design conditions specified.

M. Radio Antenna Mounting Structure

1. The exact radio antenna mounting requirements will be determined through performance of the field radio path test to determine the needs for communicating to the RTU based on the specified fade margin requirement.

2. For bid purposes, the radio antenna at the new RTU is intended for mounting to the existing structure at the Owner's golf course irrigation pump station. The antenna will be installed with a two (2) inch galvanized steel mast with V-type brackets to provide offset to the building eave.

3. Install all lightning protection per the NFPA 780 and UL-96 regulations.

PART 3 EXECUTION

3.01 REQUIREMENTS:

A. Fiber optic cables shall be installed in one section without splicing from one designated termination point to the next.

B. The installed cable shall be terminated on all fibers. Fibers shall be tested individually with all strands providing full light transmission. If any fiber within the cable fails the testing criteria, the entire cable shall be replaced at no additional cost to the Owner.

C. Cables shall be tested under actual loading conditions using a light source and calibrated digital power meter. The Power Budget of the fiber with connectors shall be calculated and compared to actual measurements. Any significant visual defect or power loss in excess of 2 dB shall be cause for a failed test.

D. A written report shall be prepared for each fiber test, troubleshooting or maintenance event. The report shall identify the fiber serviced or tested, define the procedure, describe the results of the testing including comparison to the calculated Power Budget and provide conclusions. The report shall be submitted to the Engineer for review.

E. In addition to the requirements specified in this section, refer to Section 13300 - Instrumentation and Controls, General Requirements.

END OF SECTION

North Water Reclamation Facility
Manatee County, Florida

PLC Input / Output Schedule

TAG	DESCRIPTION	TYPE	MIN	MAX	EGU	PANEL	COMMENTS
OL-316-1	Aeration Basin 1 Internal Recycle Pump No. 1 In Remote	DI	OFF	REMOTE		SP-4	
OL-316-2	Aeration Basin 1 Internal Recycle Pump No. 1 Fast Run Status	DI	OFF	FAST		SP-4	
OL-316-3	Aeration Basin 1 Internal Recycle Pump No. 1 Slow Run Status	DI	OFF	SLOW		SP-4	
OA-316	Aeration Basin 1 Internal Recycle Pump No. 1 Fail	DI	NORMAL	FAIL		SP-4	
HC-316-1	Aeration Basin 1 Internal Recycle Pump No. 1 Call to Run Fast	DO	OFF	FAST		SP-4	
HC-316-2	Aeration Basin 1 Internal Recycle Pump No. 1 Call to Run Slow	DO	OFF	SLOW		SP-4	
ZSL-316	Aeration Basin 1 Internal Recycle Pump No. 1 No Flow	DI	OFF	ALARM		SP-4	
OL-317-1	Aeration Basin 1 Internal Recycle Pump No. 2 In Remote	DI	OFF	REMOTE		SP-4	
OL-317-2	Aeration Basin 1 Internal Recycle Pump No. 2 Fast Run Status	DI	OFF	FAST		SP-4	
OL-317-3	Aeration Basin 1 Internal Recycle Pump No. 2 Slow Run Status	DI	OFF	SLOW		SP-4	
OA-317	Aeration Basin 1 Internal Recycle Pump No. 2 Fail	DI	NORMAL	FAIL		SP-4	
HC-317-1	Aeration Basin 1 Internal Recycle Pump No. 2 Call to Run Fast	DO	OFF	FAST		SP-4	
HC-317-2	Aeration Basin 1 Internal Recycle Pump No. 2 Call to Run Slow	DO	OFF	SLOW		SP-4	
ZSL-317	Aeration Basin 1 Internal Recycle Pump No. 2 No Flow	DI	OFF	ALARM		SP-4	
OL-326-1	Aeration Basin 2 Internal Recycle Pump No. 1 In Remote	DI	OFF	REMOTE		SP-4	
OL-326-2	Aeration Basin 2 Internal Recycle Pump No. 1 Fast Run Status	DI	OFF	FAST		SP-4	
OL-326-3	Aeration Basin 2 Internal Recycle Pump No. 1 Slow Run Status	DI	OFF	SLOW		SP-4	
OA-326	Aeration Basin 2 Internal Recycle Pump No. 1 Fail	DI	NORMAL	FAIL		SP-4	
HC-326-1	Aeration Basin 2 Internal Recycle Pump No. 1 Call to Run Fast	DO	OFF	FAST		SP-4	
HC-326-2	Aeration Basin 2 Internal Recycle Pump No. 1 Call to Run Slow	DO	OFF	SLOW		SP-4	
ZSL-326	Aeration Basin 2 Internal Recycle Pump No. 1 No Flow	DI	OFF	ALARM		SP-4	
OL-327-1	Aeration Basin 2 Internal Recycle Pump No. 2 In Remote	DI	OFF	REMOTE		SP-4	
OL-327-2	Aeration Basin 2 Internal Recycle Pump No. 2 Fast Run Status	DI	OFF	FAST		SP-4	
OL-327-3	Aeration Basin 2 Internal Recycle Pump No. 2 Slow Run Status	DI	OFF	SLOW		SP-4	
OA-327	Aeration Basin 2 Internal Recycle Pump No. 2 Fail	DI	NORMAL	FAIL		SP-4	
HC-327-1	Aeration Basin 2 Internal Recycle Pump No. 2 Call to Run Fast	DO	OFF	FAST		SP-4	
HC-327-2	Aeration Basin 2 Internal Recycle Pump No. 2 Call to Run Slow	DO	OFF	SLOW		SP-4	
ZSL-327	Aeration Basin 2 Internal Recycle Pump No. 2 No Flow	DI	OFF	ALARM		SP-4	
OL-701	Golf Course Storage Lake Control Valve No 1 In Remote	DI	OFF	REMOTE		DFS RTU	
ZCO-701	Golf Course Storage Lake Control Valve No 1 Command to Open	DO	OFF	OPEN		DFS RTU	
ZCC-701	Golf Course Storage Lake Control Valve No 1 Command to Close	DO	OFF	CLOSE		DFS RTU	
ZIO-701	Golf Course Storage Lake Control Valve No 1 Open	DI	OFF	OPEN		DFS RTU	
ZIC-701	Golf Course Storage Lake Control Valve No 1 Closed	DI	OFF	CLOSED		DFS RTU	
OA-701	Golf Course Storage Lake Control Valve No 1 Fail	DI	OFF	FAIL		DFS RTU	
OL-702	Lake Storage Outfall Isolation Valve In Remote	DI	OFF	REMOTE		DFS RTU	
ZSC-702	Lake Storage Outfall Isolation Valve Closed	DO	OFF	OPEN		DFS RTU	
ZSO-702	Lake Storage Outfall Isolation Valve Open	DO	OFF	CLOSE		DFS RTU	
ZCC-702	Lake Storage Outfall Isolation Valve Command to Close	DI	OFF	OPEN		DFS RTU	
ZCO-702	Lake Storage Outfall Isolation Valve Command to Open	DI	OFF	CLOSED		DFS RTU	
OA-702	Lake Storage Outfall Isolation Valve Fail	DI	OFF	FAIL		DFS RTU	
OA-707	Lake Storage Return Valve Fail	DI	OFF	FAIL		DFS RTU	
OL-707	Lake Storage Return Valve in Remote	DI	OFF	REMOTE		SP-3	
ZSC-707	Lake Storage Return Valve Closed	DI	OFF	CLOSED		SP-3	
ZSO-707	Lake Storage Return Valve Open	DI	OFF	OPEN		SP-3	
ZCC-707	Lake Storage Return Valve Command to Close	DO	OFF	CLOSE		SP-3	
ZCO-707	Lake Storage Return Valve Command to Open	DO	OFF	OPEN		SP-3	
FI-709	Golf Course Lake Return Flow	AI	0	1500	GPM	SP-8	
FI-710	Golf Course Lake Storage Flow	AI	0	1500	GPM	SP-4	
OA-711	Golf Course Lake Storage Control Valve Fail	DI	OFF	FAIL		SP-4	
OL-711	Golf Course Lake Storage Control Valve in Remote	DI	OFF	REMOTE		SP-4	
ZCC-711	Golf Course Lake Storage Control Valve Close Command	DO	OFF	CLOSE		SP-4	

North Water Reclamation Facility
Manatee County, Florida

PLC Input / Output Schedule

ZCO-711	Golf Course Lake Storage Control Valve Open Command	DO	OFF	OPEN		SP-4	
ZSC-711	Golf Course Lake Storage Control Valve Closed	DI	OFF	CLOSED		SP-4	
ZSO-711	Golf Course Lake Storage Control Valve Opened	DI	OFF	OPEN		SP-4	
ZSC-712	Effluent Pump Station to Lake Storage Valve Closed	DI	OFF	CLOSED		DFS	
ZCC-712	Effluent Pump Station to Lake Storage Valve Command to Close	DO	OFF	CLOSE		DFS	
PIT-713	M.A.R.S System Pressure	AI	0	1500		DFS	
ZCO-713	M.A.R.S Return Valve Open Command	DO	OFF	OPEN		SP-8	
ZSO-713	M.A.R.S Return Valve Opened	DI	OFF	OPEN		SP-8	
OL-714	Lake Gravity Disk Filters Inlet Valve in Remote	DI	OFF	REMOTE		SP-8	
ZI-714	Lake Gravity Disk Filters Inlet Valve Position Feedback	AI	0	100	%	SP-8	
ZC-714	Lake Gravity Disk Filters Inlet Valve Position Command	AO	0	100	%	SP-8	
PIT-717	Effluent To Storage System Pressure	AI	0	1500		SP-4	
ZSC-719	Effluent Pump to Storage Valve Closed	DI	OFF	CLOSED		SP-4	
ZSO-719	Effluent Pump to Storage Valve Open	DI	OFF	OPEN		SP-4	
ZCC-719	Effluent Pump to Storage Command to Close	DO	OFF	CLOSE		SP-4	
ZCO-719	Effluent Pump to Storage Command to Open	DO	OFF	OPEN		SP-4	
OL-723	Lake Gravity Disk Filter No. 1 Overflow	DI	OFF	OVERFLOW		SP-8	
OL-726	Lake Gravity Disk Filter No. 1 in Backwash	DI	OFF	BACKWASH		SP-8	
OA-724-1	Lake Gravity Disk Filter No. 1 Drive Motor No. 1 Overload	DI	NORMAL	ALARM		SP-8	
OA-724-2	Lake Gravity Disk Filter No. 1 Drive Motor No. 1 Fail	DI	NORMAL	ALARM		SP-8	
OL-724	Lake Gravity Disk Filter No. 1 Drive Motor No. 1 Run Status	DI	NORMAL	ON		SP-8	
OA-725-1	Lake Gravity Disk Filter No. 1 Drive Motor No. 2 Overload	DI	NORMAL	ALARM		SP-8	
OA-725-2	Lake Gravity Disk Filter No. 1 Drive Motor No. 2 Fail	DI	NORMAL	ALARM		SP-8	
OL-725	Lake Gravity Disk Filter No. 1 Drive Motor No. 2 Run Status	DI	NORMAL	ON		SP-8	
OA-724	Lake Gravity Disk Filter No. 1 Common Alarm	DI	NORMAL	ALARM		SP-8	
OL-733	Lake Gravity Disk Filter No. 2 Overflow	DI	OFF	OVERFLOW		SP-8	
OL-736	Lake Gravity Disk Filter No. 2 in Backwash	DI	OFF	BACKWASH		SP-8	
OA-734-1	Lake Gravity Disk Filter No. 2 Drive Motor No. 1 Overload	DI	NORMAL	ALARM		SP-8	
OA-734-2	Lake Gravity Disk Filter No. 2 Drive Motor No. 1 Fail	DI	NORMAL	ALARM		SP-8	
OL-734	Lake Gravity Disk Filter No. 2 Drive Motor No. 1 Run Status	DI	NORMAL	ON		SP-8	
OA-735-1	Lake Gravity Disk Filter No. 2 Drive Motor No. 2 Overload	DI	NORMAL	ALARM		SP-8	
OA-735-2	Lake Gravity Disk Filter No. 2 Drive Motor No. 2 Fail	DI	NORMAL	ALARM		SP-8	
OL-735	Lake Gravity Disk Filter No. 2 Drive Motor No. 2 Run Status	DI	NORMAL	ON		SP-8	
OA-734	Lake Gravity Disk Filter No. 2 Common Alarm	DI	NORMAL	ALARM		SP-8	
OL-743	Lake Gravity Disk Filter No. 3 Overflow	DI	OFF	OVERFLOW		SP-8	
OL-746	Lake Gravity Disk Filter No. 3 in Backwash	DI	OFF	BACKWASH		SP-8	
OA-744-1	Lake Gravity Disk Filter No. 3 Drive Motor No. 1 Overload	DI	NORMAL	ALARM		SP-8	
OA-744-2	Lake Gravity Disk Filter No. 3 Drive Motor No. 1 Fail	DI	NORMAL	ALARM		SP-8	
OL-744	Lake Gravity Disk Filter No. 3 Drive Motor No. 1 Run Status	DI	NORMAL	ON		SP-8	
OA-745-1	Lake Gravity Disk Filter No. 3 Drive Motor No. 2 Overload	DI	NORMAL	ALARM		SP-8	
OA-745-2	Lake Gravity Disk Filter No. 3 Drive Motor No. 2 Fail	DI	NORMAL	ALARM		SP-8	
OL-745	Lake Gravity Disk Filter No. 3 Drive Motor No. 2 Run Status	DI	NORMAL	ON		SP-8	
OA-744	Lake Gravity Disk Filter No. 3 Common Alarm	DI	NORMAL	ALARM		SP-8	
LAL-750	Lake Gravity Disk Filter Backwash Pump Station Low Level	DI	OFF	LOW		SP-8	
LAH-750	Lake Gravity Disk Filter Backwash Pump Station High Level	DI	OFF	HIGH		SP-8	
OL-751	Lake Gravity Disk Filter Backwash Pump Station Pump No. 1 Run Status	DI	OFF	ON		SP-8	
OA-751	Lake Gravity Disk Filter Backwash Pump Station Pump No. 1 Fail	DI	NORMAL	FAIL		SP-8	
OL-752	Lake Gravity Disk Filter Backwash Pump Station Pump No. 2 Run Status	DI	OFF	ON		SP-8	
OA-752	Lake Gravity Disk Filter Backwash Pump Station Pump No. 2 Fail	DI	NORMAL	FAIL		SP-8	
HS-805	Sodium Hypochlorite Metering Pump No. 1 Run Command	DO	OFF	ON		SP-3	
OL-805-1	Sodium Hypochlorite Metering Pump No. 1 In Remote	DI	OFF	REMOTE		SP-3	

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OL-805-2	Sodium Hypochlorite Metering Pump No. 1 Run Status	DI	OFF	ON		SP-3	
OA-805	Sodium Hypochlorite Metering Pump No. 1 Fail	DI	OFF	FAIL		SP-3	
SI-805	Sodium Hypochlorite Metering Pump No. 1 Speed Feedback	AI	0	100	%	SP-3	
SC-805	Sodium Hypochlorite Metering Pump No. 1 Speed Command	AO	0	100	%	SP-3	
HS-806	Sodium Hypochlorite Metering Pump No. 2 Run Command	DO	OFF	ON		SP-3	
OL-806-1	Sodium Hypochlorite Metering Pump No. 2 In Remote	DI	OFF	REMOTE		SP-3	
OL-806-2	Sodium Hypochlorite Metering Pump No. 2 Run Status	DI	OFF	ON		SP-3	
OA-806	Sodium Hypochlorite Metering Pump No. 2 Fail	DI	OFF	FAIL		SP-3	
SI-806	Sodium Hypochlorite Metering Pump No. 2 Speed Feedback	AI	0	100	%	SP-3	
SC-806	Sodium Hypochlorite Metering Pump No. 2 Speed Command	AO	0	100	%	SP-3	
HS-807	Sodium Hypochlorite Metering Pump No. 3 Run Command	DO	OFF	ON		SP-3	
OL-807-1	Sodium Hypochlorite Metering Pump No. 3 In Remote	DI	OFF	REMOTE		SP-3	
OL-807-2	Sodium Hypochlorite Metering Pump No. 3 Run Status	DI	OFF	ON		SP-3	
OA-807	Sodium Hypochlorite Metering Pump No. 3 Fail	DI	OFF	FAIL		SP-3	
AI-810	Reclaimed Water Discharge Chlorine Residual	AI	0	5	ppm	SP-8	
LAL-1001	Plant Drain Pump Station Low Level	DI	OFF	LOW		SP-8	
LAH-1001	Plant Drain Pump Station High Level	DI	OFF	HIGH		SP-8	
LI-1002	Plant Drain Pump Station Level	AI	0	15	FEET	SP-8	
OL-1011-1	Drain Pump 1 In Auto Status	DI	OFF	AUTO		SP-8	
OL-1011-2	Drain Pump 1 Run Status	DI	OFF	ON		SP-8	
OA-1011	Drain Pump 1 Fail	DI	NORMAL	FAIL		SP-8	
OL-1012-1	Drain Pump 2 In Auto Status	DI	OFF	AUTO		SP-8	
OL-1012-2	Drain Pump 2 Run Status	DI	OFF	ON		SP-8	
OA-1012	Drain Pump 2 Fail	DI	NORMAL	FAIL		SP-8	
OL-1013-1	Drain Pump 3 In Auto Status	DI	OFF	AUTO		SP-8	
OL-1013-2	Drain Pump 3 Run Status	DI	OFF	ON		SP-8	
OA-1013	Drain Pump 3 Fail	DI	NORMAL	FAIL		SP-8	
FI-1015	Plant Drain Pump Station Flow	AI	0	5000	GPM	SP-1	

SECTION 13340

INSTRUMENTATION AND CONTROLS, DFS RTU EQUIPMENT

PART 1 GENERAL

1.01 THE REQUIREMENT:

A. The Contractor shall engage the services of Data Flow Systems (DFS) for the upgrade and modification of existing remote and master DFS SCADA locations. The scope shall include furnishing, testing, installing and placing in satisfactory operation all equipment required to provide a complete and operable Supervisory Control and Data Acquisition (SCADA) system, as specified herein and as shown on the Contract Drawings, even if each needed item is not specifically specified or shown.

B. At the North Reclamation Facility, where the existing Hyper SCADA Server is located, the CONTRACTOR (DFS) will provide all hardware and software development services (graphics, database, alarming, trending, communications, etc.) to upgrade the server to a HyperTAC3 (HT3) server. The upgrade will provide complete communications, monitoring and control of all existing DFS sites.

C. The Contractor shall provide, install and configure a Digi One IAP Protocol converter to convert the Hyper SCADA (Modbus) to Allen-Bradley TCP protocol at the North Water Reclamation Facility. The converter shall be connected to the existing control room Ethernet network.

D. The contractor shall perform all hardware and software services to add the monitoring and control of the outfall discharge valve to the Effluent Pump Back Pump Station No. 2 DFS RTU.

E. These specifications are intended to cover the furnishing, shop testing, delivery, complete installation and field testing of all equipment and appurtenances for the complete system herein specified, whether specifically mentioned in the Specifications or not. This includes all discrete and analog signal surge suppression, loop power supplies and isolation necessary for interfacing to the instrumentation and electronic equipment provided on this project.

F. For all units there shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these specifications or not. This installation shall include field-testing of the entire installation and instruction

of the regular operating personnel in the care, operation, and maintenance of all equipment.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. In addition to the requirements specified in this section, the requirements of specification Section 13300 - Instrumentation and Controls, General Requirements and the sections referenced therein shall be applied.

1.03 SUBMITTALS:

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples and as specified in Section 13300 - Instrumentation and Controls, General Requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. The RTU hardware configuration as specified herein, as specified in related sections and as shown on the Contract Drawings depicts overall system configuration requirements. Unless otherwise specified, designs which vary from this concept will be rejected.

B. The Remote Terminal Unit (RTU) shall be properly sized and equipped to provide complete local automatic control. In addition to using the existing protocol converter for use in the Citect Human Machine Interface (HMI), all configurable operational parameters shall be selectable from the Control Room Hyper SCADA HMI terminal. The RTU shall incorporate a Radio Transceiver compatible with the owner’s existing frequency and Input / Output (I/O) function modules required to meet the monitor and control requirements. Function module card connectors shall be gold-over-nickel plated to inhibit corrosion. The RTU shall be capable of operating in a temperature ranging from -10 to 60 Degrees Celsius (14 to 140 Degrees Fahrenheit).

C. SERVICE PORT

1. The RTU shall support a local serial interface service port for access to all the functions of the unit and local monitoring of the radio communications link. The RTU shall support an automatic antenna alignment function utilizing the local serial interface.

D. POWER SUPPLY MODULE

1. All function modules in the RTU shall run off DC voltage from +7.5 volts to +13 volts. The Power Supply Module (PSM) shall supply +12 volts. A battery backup shall be provided to operate the system in event of power failure. The PSM shall be surge protected. The PSM shall be short circuit protected by current limiting. Normal operation shall automatically resume when the short circuit overload is removed. The PSM shall be sized to operate the system with the battery removed. The PSM shall provide a battery backed, isolated bias voltage source. The circuit breaker for the PSM shall be part of the module. Neither the use of tools nor the disconnection of any wires shall be required to replace the PSM.

E. SURGE PROTECTION

1. Multiple staged surge protection shall be provided for all power supply and power monitoring circuits. This design shall provide a very high level of non-destructive transient immunity. With the exception of a direct lightning strike, the device shall protect the RTU power supply and power monitoring circuits from damage due to voltage transients. The unit shall provide circuit protection to withstand multiple transients in excess of 6,500 volts, 3,250 amps, without damage. Damage shall be limited to a blown fuse when exposed to larger transients. The device shall be transient-tested to ANSI standard C62.41. The unit shall be the Transient Filter Shield TFS001 as manufactured by Data Flow Systems. The AC power input protection shall be the Single Phase Suppresser, SPS001 as manufactured by Data Flow Systems. All surge protection shall be UL Listed.

F. BACKUP BATTERY

1. The RTU shall have the uninterruptible power supply (UPS) function built in. The unit’s internal power supply module shall keep the battery at a float charge. The battery shall not be damaged by deep discharges.

G. RADIO INTERFACE MODULE

1. The RTU shall require one radio interface module (RIM). The RIM shall control the terminal radio during the polling sequence. The RIM shall have a service port to provide communications link monitoring. The service port shall also provide the capability to directly monitor and/or control each

module in the RTU. The RIM utilized at the RTU shall be interchangeable with the RIM at the central site. All radio communications shall be in ASCII and utilize an error detecting data transfer protocol. Each RIM shall have an FM radio transceiver mounted to it. Replacement of the RIM shall trigger an automatic configuration of the new module to accommodate the site address and function (plug & play).

H. FUNCTION MODULES

1. The function modules shall be designed so they do not have configuration switches or straps. The function modules shall be designed with surge suppression on all inputs and outputs. Replacement of a function module shall not require the use of tools or the removal of any interface wires. There shall be no components associated with the function module mounted to the motherboard (passive backplane). The function modules shall be backward compatible with all older modules of same type. All the function modules shall support central site computer access to the revision level of the module over the radio communications link.

I. DIGITAL MONITOR MODULE

1. The digital monitor module (DMM) shall accept 12 on/off or pulsed inputs of 12 to 30 volts AC or DC. Other AC or DC voltages shall be accommodated with the use of an inline voltage converter device. Status reporting of the digital inputs shall have an accuracy of +- 2 seconds to the time the event occurred at the RTU. The DMM shall have LEDs to indicate: the status of each input point; receive communications; transmit communications; CPU fault; and power status. The configuration of the monitor points as alarm points, monitor points (pump run time monitors), or pulsed input points shall be operator changeable at the central site. The custom configuration of the DMM shall not require any software or firmware changes in the RTU. Replacement of the DMM shall trigger an automatic configuration of the new module by the central site (plug & play).

J. DIGITAL CONTROL MODULE

1. The digital control module (DCM) shall be available in two configurations, providing eight (8) digital outputs and four (4) digital inputs, or four (4) digital outputs and eight (8) digital inputs. Each control point shall accommodate 60 to 280 volt AC

devices. Each control point shall be capable of driving a 0.5 amp load @ 280 volts AC (140 VA), with inrush current of 5 amps. Any discrete control point shall have the capability of being automatically controlled by any discrete monitor point, at the same RTU or at any other RTU. This shall be accomplished during configuration at the central site and shall be available for an unlimited number of control points. Each input shall accept ON/OFF inputs of 12 to 30 volts AC or DC. Other AC or DC voltages shall be accommodated with the use of an inline voltage converter device. Status reporting of the digital inputs shall have an accuracy of +- 2 seconds to the time the event occurred at the RTU. The configuration of the monitor points as alarm points or monitor points (pump run time monitors) shall be operator selectable. The configuration shall not require any software of firmware changes in the system. The DCM shall have LEDs to indicate: the status of each output point; receive communications; transmit communications; CPU fault; and power status. Replacement of the DCM shall trigger an automatic configuration of the new module by the central site (plug & play).

K. ANALOG MONITOR MODULE

1. The analog monitor module (AMM) shall monitor up to 4 analog inputs, each capable of accepting 4-20 ma or 0-5 VDC. The analog input shall provide 12-bit accuracy. The analog inputs shall be individually optically isolated. The AMM shall have support-configurable reporting granularity and alarm thresholds. All configurable parameters shall be operator-controlled. The AMM shall have LEDs to indicate: the status of receive communications; transmit communications; CPU fault; and power status. The AMM shall be capable of supplying 24 VDC power source for 4-20 ma transmitters. Replacement of the AMM shall trigger an automatic configuration of the new module by the central site (plug & play).

L. ANALOG CONTROL MODULE

1. The analog control module (ACM) shall control up to 4 analog outputs, each capable of producing 4-20 ma output driving a 0 to 1000 ohm load. The analog output shall have 12-bit accuracy. Each analog control shall have configurable engineering units. All configurable parameters shall be operator controlled. ACM shall have LEDs to indicate: receive communications; transmit communications;

CPU fault; and power status. Any analog control point shall have the capability of being automatically controlled by any analog monitor point, at the same RTU or at any other RTU. This shall be accomplished during configuration at the central site and shall be available for an unlimited number of control points. The ACM shall be capable of supplying 24 VDC power source for 4-20 ma transmitters. Replacement of the analog control module shall trigger an automatic configuration of the new module by the central site computer (plug & play).

2.02 TOOLS, SUPPLIES, AND SPARE PARTS:

A. Tools, supplies and spare parts shall be provided as specified in Section 13300 - Instrumentation and Controls, General Requirements, and as specified for each equipment item. In addition, the following items shall be provided:

1. One (1) of each module used in the RTUs under this contract.

2.03 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS):

A. Refer to specification Section 13320 – Instrumentation and Controls, Control Enclosures for TVSS requirements.

B. Provide TVSS protection for all specified spare analog inputs and outputs.

PART 3 EXECUTION

3.01 REQUIREMENTS:

A. In addition to the requirements specified in this section, refer to Section 13300 - Instrumentation and Controls, General Requirements.

3.02 INSTALLATION

A. The Contractor shall install the equipment in accordance with the Contract Documents, manufacturer’s instructions and shop drawings. Rigidly support and mount equipment level and plumb, and in such a manner as to provide accessibility; protection from damage; isolation from heat, shock, and vibration; and freedom from interference with other equipment, piping, and electrical components.

B. Include the services of a factory trained and qualified employee of the equipment manufacturer to inspect the complete equipment installation to assure that it is installed in accordance with the manufacturer's recommendations, make all adjustments necessary to place the system into trouble-free operation and instruct the operating personnel in the proper care and operation of the equipment furnished. Provide services at both the field installation site as well as the central site.

C. All workmanship utilized in the manufacture and installation of this system shall be of the highest quality and performed in a manner consistent with all accepted industry practices.

END OF SECTION

SECTION 15050

PIPE AND PIPE FITTINGS - GENERAL STATEMENT

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. General:

1. Furnish all labor, materials, tools, equipment, and services for all pipe and pipe fittings as indicated in accordance with provisions of Contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation.

4. See Division 1 for General Requirements.

B. Related specification sections include but are not limited:

1. 15062 - Ductile Iron Pipe and Fittings

2. 15063 – High Density Polyethylene (HDPE) Pipe

3. 15067 – Plastic Pipe for Pressure Service

4. 15100 - Valves and Appurtenances

1.02 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

B. Verify on shop drawings, dimensions, schedule of pipe, linings, coatings, fittings, hangers, supports, and miscellaneous appurtenances. When special fittings are necessary, verify locations of items and include complete details.

C. Yard piping drawings. Submit scaled drawings showing locations and dimensions to and from fittings, valves, structures, gates, and related appurtenances. Provide scaled drawings to a minimum scale of 1/8-inch equals 1-foot. Provide details to minimum scale of 1/8-inch equals 1-foot. Information shall include but not necessarily be limited to:

1. Dimensions of piping lengths

2. Invert or centerline elevations of piping crossings

3. Acknowledgment of bury depth requirements

4. Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.

5. Line slopes and vents

PART 2 PRODUCTS

2.01 GENERAL PIPING SYSTEMS

A. Unless otherwise shown on drawings or drawing schedule, piping system materials, fittings, and appurtenances are subject to requirements of specific technical specifications and shall be as follows:

Service Category	Pipe Size Range in Inches	Piping System
IR – Internal Recycle (Mixed Liquor)	30	Above ground – AWWA C115 and C151 Class 53 ductile iron, Protecto 401 ceramic epoxy lining, flanged, AWWA C110 and C111 flanged ductile iron fittings, Protecto 401 ceramic epoxy lining
Plant Drain Pump Station Force Main	6-8	In valve vault and above ground – AWWA C115 and C151 Class 53 ductile iron, Protecto 401 ceramic epoxy lining, flanged, AWWA C110 and C111 flanged ductile iron fittings, Protecto 401 ceramic epoxy lining
	8	Below ground – AWWA C150 and C151 ductile iron pipe, push on or mechanical joints, Protecto 401

		ceramic epoxy lined, 350 psi pressure class with AWWA C153 compact ductile iron fittings, Protecto 401 ceramic epoxy lined, mechanical joints, 350 psi working pressure
	8	In wet well to valve vault- HDPE SDR 11
Lake Gravity Disk Filter Backwash Pump Station	4 to 6	Above ground – AWWA C115 and C151 Class 53 ductile iron, cement-lined, flanged, AWWA C110 and C111 flanged ductile iron fittings, cement-lined
	4	Wet well to valve vault- HDPE SDR 11
	4 to 6	Below ground- AWWA C-900 PVC SDR 18 with AWWA C153 compact ductile iron fittings, mechanical joints, 350 psi working pressure interior and exterior fusion bonded epoxy coating
EFF – Treated Effluent FW – Filter Water Effluent RCW – Reclaimed Water REJ – Reject SRCW – Stored Reclaimed Water SPW – Storage Pond Water	4 to 48	Above ground – AWWA C115 and C151 Class 53 ductile iron, cement-lined, flanged, AWWA C110 and C111 flanged ductile iron fittings, cement-lined
	4 to 12	Below ground – AWWA C150 and C151 ductile iron pipe, push-on or mechanical joints, cement-lined, 350 psi pressure class
	14 to 20	Below ground – AWWA C150 and C151 ductile iron pipe, cement-lined, push-on joints, 250 psi pressure class
	24	Below ground–AWWA C150 & C151 DIP cement-lined, push-on joints, 200 psi pressure class
	4 to 24	Below ground – AWWA C153 compact ductile iron fittings, mechanical joints, 350 psi working pressure interior and exterior fusion bonded epoxy coating
	30 to 48	Below ground – AWWA C150 and C151 ductile iron pipe, cement-lined, push-on joints, 150 psi pressure class, AWWA C110 and C111 ductile iron fittings, mechanical joint, 250 psi working pressure, cement-lined
Sodium	½ to 3	Above and below ground – Schedule

Hypochlorite		80 PVC solvent weld.
EFF – Treated PW – Potable Water	½ to 3	Above ground – Schedule 80 PVC, Type K copper. Below ground – AWWA C901 HDPE tubing, DR-9, 200 psi working pressure.
Drain	4-8	PVC SDR-26 pipe and fittings

PART 3 EXECUTION

3.01 DELIVERY, INSPECTION AND STORAGE

A. Inspect materials thoroughly upon arrival. Remove damaged or rejected materials from site.

B. Observe manufacturer's directions for delivery and storage of materials and accessories.

C. Store materials on-site in enclosures or under protective coverings above ground to keep them clean and dry.

3.02 HANDLING OF PIPE

A. Protect pipe coating during handling using methods recommended by manufacturer. Use of bare cables, chains, hooks, metal bars, or narrow skids in contact with coated pipe is not permitted.

B. Prevent damage to pipe during transit. Repair abrasions, scars, and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

C. Erect piping to accurate lines and grades and support as required on drawings or described in specifications. When temporary supports are used, ensure that sufficient rigidity is provided to prevent shifting or distortion of pipe. Install expansion devices, as necessary, to allow expansion and contraction movements.

3.03 PIPING - GENERAL

A. Minimum bury. Unless otherwise shown on the drawings, provide a minimum of 36-inches earth cover over

exterior buried piping systems and appurtenances conveying water, fluids, or solutions.

3.04 PIPING WITHIN BUILDINGS, STRUCTURES AND UNITS

A. Install piping in vertical and horizontal alignment as shown on drawings. Alignment of piping smaller than 4-inches may not be shown. However, install according to drawing intent and with ample clearance and allowance for:

1. Expansion and contraction

2. Operation and access to equipment, doors, windows, hoists, moving equipment

3. Headroom and walking space for working areas and aisles

4. Install vertical piping plumb and horizontal piping runs parallel with structure walls

B. Use methods of piping support as shown on the drawings and as required in Section 15141 – Pipe Support Systems. Where pipes run parallel and as same elevation or grade, they may be grouped and supported from common trapeze-type hanger, provided hanger rods are increased in size as specified for total supported weight. The pipe in the group requiring the least maximum distance between supports shall set the distance between trapeze hangers.

C. Locate and size sleeves required for piping system. Arrange for chases, recesses, inserts, or anchors at proper elevation and location.

D. Install service piping to provide every plumbing fixture and equipment requiring potable water with suitable supply and soil or waste and vent connection as required by code. Consult manufacturer's data and large scale details of rooms containing plumbing fixtures before roughing in piping. Plug or cap piping immediately after installation.

E. Use reducing fittings throughout piping systems. Bushings will not be allowed unless specifically approved.

F. Provide drain pans and piping from items of equipment where condensation may occur. Run drain piping to

nearest floor drain or rainwater downspout. Condensate drain piping shall generally be 1-inch except where otherwise indicated.

G. Soil, waste, vent and rainwater piping installation:

1. Install horizontal soil or waste lines with fall to produce flow rate of 2-feet per second or 1/8-inch per foot. Hold as close to construction as possible to maintain maximum headroom. Make changes of direction with 1/8 bends, and junctions with wye fittings. Use short wye fittings in vertical pipe only. Install handhold test tee at base of each stack. Install cleanouts at dead ends, at changes of direction, and at 50-foot intervals on horizontal runs. Where cleanouts occur in concealed spaces, provide with extensions to floors above or to wall as required.

2. Run vent stack parallel to each soil or waste stack to receive branch vents from fixtures. Each vent stack shall originate from soil or waste pipe at its base. Where possible, combine soil, waste, or vent stacks before passing through roof so as to minimize roof openings. Offset pipes running close to exterior walls away from such walls before passing through roof to permit proper flashing. Provide pipes passing through roofs with cast iron increases minimum of 12-inches below roof one size larger than pipe but in no case less than 4-inches. Terminate each vent with approved frostproof jacket.

3. Provide each vent pipe passing through roof with 4-lb sheet lead flashing consisting of 18 x 18-inch base with tubular vertical sleeve surrounding pipe with 1-inch minimum spacing and turning in 2-inches at top. Provide gasket seal between top and lead sleeve.

4. Carry vent stacks 4-inches and larger full size through roof. Extend vent stacks at least 12-inches above roofing.

5. Provide each roof drain with 4-lb sheet lead flashing 36 x 36-inch square clamped under flashing ring of drain.

H. Potable or service water piping installation:

1. Install drain tees with capped nipples of PIS brass 3-inches long at low points. If low points occur in concealed piping, provide approved flush access panel. These drains are not shown on drawings.

2. Slope water lines down to drain points not less than 1-inch in 60-feet.

3. Wherever threaded piping is installed, provide clean-cut tapered threads with ends thoroughly reamed after cutting to remove burrs. Pipe joint cement permitted only on external threads. For screwed nipples for connections to flush valves, lavatory supplies, and other equipment with threaded connections use iron, copper, or brass pipe.

4. Install ball, butterfly, gate, check, and plug valves where indicated or required to adequately service all parts of system and equipment. Unless otherwise indicated, install valves on each branch serving restroom. Install valve on inlet and outlet connections of heat exchangers and on other equipment connected to water lines.

5. Install union between valves and connections to each piece of equipment and install sufficient number of unions throughout piping system to facilitate installation and servicing. On copper pipe line, install wrought copper solder-joint copper to copper unions for lines 2-inches and smaller; for lines 2-1/2-inches and over, install brass flange unions.

6. Construct and equip plumbing fixtures and equipment with anti-siphon devices as to entirely eliminate any danger of siphoning waste material into potable water supply system.

7. Where exposed pipes 6-inches in size and smaller pass through floors, finished walls, or finished ceilings, fit with nickel or chrome-plated plates large enough to close hole completely around pipes. Secure plates to pipe by set screw in approved manner.

8. Size supply branches to individual fixtures as scheduled or indicated on drawings.

9. Install piping so as to be free to expand with proper loops, anchors, and joints with injury to system or structure.

10. Provide branches to wall hydrants or hose bibbs in exterior location with interior shutoff and drain valves.

11. Provide approved type vacuum breaker installations indicated or as required by Code.

3.05 PIPING OUTSIDE BUILDINGS AND STRUCTURES

A. Install piping as shown on drawings with ample clearance and allowance for expansion or contraction.

B. Install flexible joint within two (2) feet of point where pipe enters or leaves structure. Provide balance of piping with standard laying lengths and in accordance with drawings.

3.06 PIPE INTERSECTIONS WITH STRUCTURES AND UNITS

A. Enter and exit through structure walls by using wall seals specified or as shown on drawings.

3.07 EQUIPMENT PIPE CONNECTIONS

A. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges. Where push-on joints are used in conjunction with flanged joints, final positioning of push-on joints shall not be made until flange joints have been tightened without strain.

B. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint. Provide tightening torque in accordance with manufacturer's recommendations.

C. Support and match flange face to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.

D. Permit piping connecting to equipment to move freely in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened. Align,

level, and wedge equipment into place during fitting and alignment of connecting piping. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment. To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened. Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange. Realign as necessary, install flange bolts, and make equipment connection.

E. Provide utility connections to equipment shown on drawings, scheduled or specified.

F. Obtain rough-in data from approved shop drawings on equipment. Obtain rough-in data for relocating existing equipment and coordinate with Owner.

G. Unless otherwise specified, make piping connections to equipment, including but not limited to installation of brass and fittings, strainers, pressure-reducing valves, flow control valves, and relief valves provided with or as an integral part of equipment.

H. Furnish and install sinks, brass, fittings, strainers, pressure-reducing valves, flow control valves, pressure relief valves, and shock absorbers which are not specified to be provided with or an integral part of equipment.

I. For each potable or service water supply piping connection to equipment, furnish and install union and gate or angle valve. Minimum size to be 1/2-inch.

J. Furnish and install "P" trap for each waste piping connection to equipment if waste is connected directly to building sewer system. Size trap as required by Plumbing Code.

K. Stub piping for equipment, sinks, lavatories, supply and drain fittings, key stops, "P" traps, miscellaneous traps, and miscellaneous brass through wall or floor and cap and protect until such time when later installation is performed. Run piping mains and branches in laboratory benches, built-in counters, and cabinet work if acceptable to Construction Manager.

3.08 ANCHORAGE AND BLOCKING

A. Block, anchor, or harness exposed piping subjected to internal pressure, in which mechanical, push-on, flexible, or similar joints are installed to prevent separation of joints.

B. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by internal pressure in buried piping tees, wye branches, plugs, or bends.

C. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall. Concrete blocks shall not cover pipe joints. Provide bearing area of concrete in accordance with drawing detail. In event that adequate support cannot be achieved against undisturbed soil, install restrained piping joints.

D. Provide reaction blocking, anchorages, or other supports for fittings as shown on drawings for piping installed in fills, unstable ground, above grade, or exposed within structures.

3.09 CLEANING

A. Clean interior of piping systems thoroughly before installing. Maintain pipe in clean condition during installation.

B. Before jointing pipe, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.

C. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.

D. At completion of work and prior to final acceptance, thoroughly clean work installed under these specifications. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing or from other causes. Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.

3.10 PIGGING, FLUSHING AND CLEANING

A. All mains and distribution lines shall be pigged, cleaned and flushed to remove all sand and other foreign matter. The Contractor shall be responsible for developing a pigging and flushing plan to be submitted to the Engineer for approval prior to pigging and flushing. The contractor shall dispose of all water used for pigging and flushing without causing a nuisance or property damage. Any permits required for the disposal of flushing water shall be the responsibility of the Contractor.

B. Flushing water used by the Contractor shall be taken from an approved metered source. The water utility will provide the meter and designate the source. Flushing water shall be at the Contractor’s expense. Flushing water shall be potable water for potable water mains.RCW mains may be flushed with potable or reclaimed water.

C. The cleaning of the new piping system shall be accomplished by the controlled and pressurized passage of a series of hydraulic or pneumatic polyurethane plugs of varying dimensions, coatings, and densities; which shall be selected by the pipe cleaning Contractor. The Contractor shall provide a means to enter the pig into the system, control and regulate flow, monitor flows and pressures, and to remove the pig from the system. The contractor shall maintain a constant surveillance of the system and immediately report to the proper authority any inline problems encountered or any malfunctions discovered in the piping system. A record of pig models, sizes, styles, and other pertinent information shall be kept by the Contractor and turned over to the Owner

3.11 TESTING AND INSPECTION

A. Upon completion of piping, but prior to application of insulation on exposed piping, test all piping systems. Utilize pressures, media and pressure test duration at specified on piping specification sheets. Isolate equipment which may be damaged by the specified pressure test conditions. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates. Select each gage so that the specified test pressure falls within the upper half of the gage's range. Notify the Engineer 24 hours prior to each test.

B. Unless otherwise specified, completely assemble and test new piping systems prior to connection to existing pipe systems.

C. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.

D. Provide all necessary equipment and perform all work required in connection with the tests and inspections.

E. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

3.12 DISINFECTING POTABLE WATER PIPELINES

A. All record drawing requirements must be submitted to the Owner/Engineer prior to starting the bacteriological testing of the water lines.

B. Prior to being placed in service, all potable water pipe lines shall be chlorinated in accordance with AWWA 651, "Standard Procedure for Disinfecting Water Main". The procedure shall meet Health Department requirements. The location of the chlorination and sampling points shall be determined by the Engineer. Taps for chlorination and sampling shall be uncovered and backfilled by the Contractor as required.

C. The general procedure for chlorination shall be to flush all dirty or discolored water from the lines, and then introduce chlorine in approved dosages through a tap at one end while water is being withdrawn at the other end of the line. The chlorine solution shall remain in the pipe line for 24 hours.

Water for flushing, filling and disinfecting the new lines will be provided by the owner and must be obtained without contaminating existing pipe lines. Water obtained from existing pipe lines for this purpose shall pass through an approved air gap or backflow prevention device.

D. Following the chlorination period, all treated water shall be flushed from the lines at their extremities and replaced with water from the distribution system. Bacteriological sampling (taken by the Contractor and provided to an approved laboratory by the Contractor) and analysis of the replacement water shall then be

made by an approved laboratory or the Health Department in full accordance with the AWWA Manual C651. The line shall not be placed in service until the requirements of the Florida Department of Environmental Protection (FDEP) and County Public Health Department are met. Results of the bacteriological tests together with certified record drawings must be submitted to the Health Department (FDEP) within 30 days of the tests.

E. Special disinfecting procedures when approved by the County may be used where the method outlined above is not practical.

3.13 LOCATION OF BURIED OBSTACLES

A. Furnish exact location of buried utilities encountered and any below grade structures. Reference items to definitive reference point locations such as found property corners, entrances to buildings, existing structure lines, fire hydrants, and related fixed structures. Include such information as location, elevation, coverage, supports, and additional pertinent information which will be required by future contractors for replacement servicing, or adjacent construction around any buried facility.

B. Incorporate information to "Record Drawings".

3.14 SPECIAL REQUIREMENTS AND PIPING SPECIALTIES

A. Insulating joints: Provide insulating joints where dissimilar metals are joined together and where specifically indicated on drawings. Type of joint shall be as detailed and in accordance with the following requirements:

1. Insulating flanges: Provide each unit to consist of flat-faced rubber gaskets.

2. Insulating unions: Provide "dielectric" union by Epco or equal.

3. Insulating couplings: When joining larger diameter dissimilar metal pipe, use insulating coupling equal to Rockwell No. 416, Dresser Style 39, or equal. When pipes have different outside diameters, use insulating reducing couplings equal to Rockwell No. 417, Dresser Style 39-62, or equal.

B. Welding:

1. Have each welding operator affix an assigned symbol to all his welds. Mark each longitudinal joint at the extent of each operator's welding. Mark each circumferential joint, nozzle, or other weld in two places 180˜F apart.
2. Use only certified welders meeting procedures and performance outlined in Section 9 of the ASME other codes and requirements per local building and utility requirements.

3. Have all welds conform to highest industrial practice in accordance with ANSI B31.3 and ANSI B31.1 or other codes and requirements per local building and utility requirements.

C. Protective coatings and linings:

1. Where coatings, linings, paint, tests and other items qualified in applications of service are stated, pipe and fittings shall be included in referenced conditions.

2. Where specified, provide coal-tar epoxy linings and coatings in accordance with AWWA C210 to a minimum thickness of 20 mils in not less than two coats.

3. Where specified, provide cement mortar lining in accordance with AWWA C205.

4. Where specified, provide Protecto 401 lining.

5. Where specified, galvanize surface in accordance with hot-dip method using any grade of zinc acceptable to ASTM B6.

6. Where specified, field paint pipe in accordance with Section 09900 – Painting and Coatings and Section 09902 – Pipe and Equipment Painting.

7. Where specified, coat pipe 24-inch in diameter and smaller with extruded polyethylene coating equal to EnCoat.

   a) Where specified, line pipe with a blend of high-density and low density polyethylene powders complying with ASTM D1248 and

uniformly fused and bonded to the pipe to a minimum thickness of 40 mils.

D. Underground alarming tape. Provide underground warning tape constructed of heavy gage 0.004-inch polyethylene film to identify all buried utilities except 3-inch and smaller irrigation pipe. Provide 6-inch wide tape as follows:

Film Legend	Film Color
Electric line below	Red
Telephone line below	Orange
Water line below	Blue
Sewer line below	Green
Nonpotable water below	Brown
Reclaimed Water Below	Purple

E. Install tape directly above each buried utility at a as shown on the Drawings.

END OF SECTION

SECTION 15062

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Install within the project site all materials and incidentals including flanged joint, mechanical joint, push-on joint, and restrained joint ductile iron pipe and/or ductile iron restrained, flanged, or mechanical joint fittings for potable water mains, reclaimed water mains, wastewater treatment plant process piping, and gravity sewers, complete, as shown on the project drawings.

B. The Contractor shall coordinate all deliveries with the related Vendor(s) in a manner not to impede construction.

1.02 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

B. Except as otherwise shown on the Drawings, either push-on, mechanical, restrained, or flanged joints shall be used. Prior to commencing work, jointing systems for pipe shall be submitted to the Owner’s Representative for approval.

C. All ductile iron pipe and fittings to be installed under this Contract shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. Furnish in duplicate to the Owner’s Representative sworn certificates of such tests and their results.

D. Shop Drawings including layout drawings shall be submitted to the Owner’s Representative for approval and shall include dimensioning, methods and locations of supports and all other pertinent technical specifications for all piping to be furnished. Layout Drawings shall be to scale, and shall clearly indicate the amount of pipe to be restrained from each fitting.

E. The Contractor shall transmit from the Vendor to the Owner’s Representative, the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pipe shall be supplied in lengths not in excess of 21-feet.

B. Buried Pipe shall conform to ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, current editions. Below grade pipe 4 to 12-inches in diameter shall be rubber-ring type push-on joint or mechanical joint, pressure Class 350. Below grade pipe 14 to 20-inches in diameter shall be rubber-ring type push-on joint, Pressure Class 250. Below grade pipe 24-inches in diameter shall be rubber-ring type push-on joint, pressure Class 200. Below grade pipe 30 to 60-inches in diameter shall be rubber-ring type push-on joint, pressure Class 150.

C. Mechanical joint fittings for 4 to 24-inch diameter ductile iron pipe shall be compact ductile iron cast in accordance with ANSI/AWWA C153/A21.53. The working pressure rating for the fittings shall be 350 psi.

D. Mechanical joint fittings for 30 to 60-inch diameter ductile iron pipe shall be standard size ductile iron cast in accordance with ANSI/AWWA C110/A21.10. The working pressure rating for the fittings shall be 250 psi.

E. Gaskets shall be EPDM (Ethylene-Propylene Dine Monomer) such as the “Fastite Gasket” of American Ductile Iron Pipe Co., or approved equal in conformance with ANSI/AWWA C111/A21.11, latest edition.

F. All mechanical joints and push-on joints for pipe, fittings and valves on the wastewater treatment plant site shall be restrained. Restraints shall be Megalug by EBAA Iron, Romac, or equal. Restraints may also be American Ductile Iron Pipe’s Fast Grip Gasket, U.S. Pipe’s Field Lok Gasket, or equal.

G. Below grade pipe shall have a one-mil coal tar enamel coating on the outside. The coal tar enamel shall be in accordance with ANSI/AWWA C151/A21.51.

H. All buried ductile iron pipe and fittings shall be provided with a 4-mil thick cross laminated high density polyethylene encasement or an 8-mil thick polyethylene encasement per ANSI/AWWA C105/A21.5. Color of encasement shall be in accordance with Manatee County requirements based on the service type of the pipe.

I. Flanged ductile-iron pipe for above ground piping shall conform to current ANSI/AWWA C115/A21.15 with factory applied screwed long hub flanges except as otherwise specified hereinafter. Flanges shall be faced and drilled after being screwed on the pipe with flanges true to 90 degrees with the pipe axis and shall be flush with end of pipe conforming to ANSI B16.1, 125 pounds standard. Flanged pipe shall be special thickness Class 53.

J. Flanged fittings shall be ductile as specified herein. Flanges and flanged fittings shall be flat face and shall conform to ANSI/AWWA C110/A21.10 for 350 psi pressure ratings between 4 and 24-inch diameter pipe and for 250 psi pressure ratings for 30 to 60-inch diameter pipe. Full face type 1/8-inch thick SBR rubber ring gaskets shall conform to ANSI/AWWA C111/A21.11.

K. Bolts and nuts on flanged fittings shall be Grade B, ASTM A-307, cadmium plated and conform to ANSI B16.1 for Class 125.

L. Pipe and fittings exposed to view in the finished work to be painted shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of Koppers No. 621 rust inhibitive primer or approved equal. All other pipe and fittings shall be shop coated on the outside with a 1.0 mil thick bituminous coat in accordance with ANSI/AWWA C151/A21.51.

    1. Should portions of the pipe inadvertently be given the outside coating of coal tar enamel instead of the rust inhibitive primer as required for exposed piping, the surfaces shall be sealed with a non-bleeding sealer coat such as Inertol Tar Strop, or Mobil Anti-bleeding Aluminum Sealer. Sealing shall be part of the work of this section.

M. All ductile iron pipe and fittings carrying clarifier effluent, effluent, filter effluent, reclaimed water, reject, and potable water shall have a standard thickness cement lining and seal coats on their interiors in accordance with ANSI/AWWA C104/A21.4.

N. All ductile iron pipe and fittings carrying raw wastewater, internal recycle, mixed liquor, plant drain wastewaters, return activated sludge, thickened sludge and waste activated sludge shall have an interior lining of Protecto 401 ceramic epoxy applied at a nominal thickness of 40 mils. The Protecto 401 material shall be a high-build, multi-component, Amine-cured, Novalac epoxy lining. At least 20% of the volume of the lining material shall be ceramic quartz pigment. The linings shall be checked for thickness using a magnetic film thickness gauge and the method outlined in SSPC-PA-2, Film Thickness Rating. The interior lining of all pipe and fittings shall be tested for pinholes with a non-destructive 2,500 volt test. Each pipe and fitting shall be marked with the date of application of the lining system and with its sequence number of application on that date. The pipe and fitting manufacturers shall supply a certificate attesting that the lining material used was as specified, and that the lining material was applied as required by the specifications and the lining material manufacturer.

O. All interior linings for potable water piping shall be EPA/NSF approved.

P. Pipe and fitting manufacturers shall be the American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, McWane, Tyler, or approved equal.

PART 3 EXECUTION

3.01 HANDLING PIPE AND FITTINGS

A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before installation, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Owner’s Representative.

B. All pipe and fittings shall be subjected to a careful inspection and hammer test just prior to being installed.

C. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Owner.

3.02 UNDERGROUND PIPE INSTALLATION

A. Alignment and Grade: The pipelines shall be laid and maintained to lines and grades established by the Drawings and Specifications, with fittings, valves and hydrants at the required locations unless otherwise approved by the Owner's Representative. Valve-operating stems shall be oriented to allow proper operation. Hydrants shall be installed plumb.

B. Underground Conflicts: Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care shall be exercised to avoid damage to existing structures. When obstructions that are not shown on the drawings are encountered during the progress of the work and interfere so that an alteration of the Drawings is required, the Owner's Representative will alter the Drawings or order a deviation in line and grade or arrange for removal, relocation, or reconstruction of the obstructions. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the Owner's Representative, to provide clearance as required by federal, state, or local regulations or as deemed necessary by the Owner's Representative to prevent future damage or contamination of either structure.

C. Trench Construction:

1. Trench preparation shall proceed in advance of pipe installation for only as far as necessary to allow proper pipe installation. The width of the trench at the top of the pipe shall be ample to permit the pipe to be laid and joined properly and allow the backfill to be placed as specified.

2. Bedding shall be provided and compacted in accordance with the details shown on the Drawings.

3. Holes for the bells shall be provided at each joint but shall not be larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. Other than noted previously, the trench bottom shall be true and even in order to provide support for the full length of the pipe barrel, except that slight depression may be provided to allow withdrawal of pipe slings or other lifting-tackle.

4. When excavation of rock is encountered, all rock shall be removed to provide a clearance of at least 6-inches below and on each side of all pipe, valves, and fittings for pipe sizes 24-inches or smaller, and 9-inches for pipe 30- inches and larger. When excavation is completed, a bed of sand, crushed stone or earth that is free from stones, large clods, or frozen earth shall be placed on the bottom of the trench to the previously mentioned depths, leveled, and tamped. These clearances and bedding procedures shall also be observed for pieces of concrete or masonry and other debris or subterranean structures, such as masonry walls, piers, or foundations that may be encountered during excavation.

5. This installation procedure shall be followed when gravel formations containing loose boulders greater than 8 inches in diameter are encountered. In all cases, the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection, or point of rock, boulder, or stones of sufficient size and placement which, in the opinion of the Engineer could cause a fulcrum point.

6. Should the trench pass over a sewer or other previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.

7. When the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed, to a minimum of at least 3-inches, or to the depth ordered by the Engineer and replaced under the directions of the Engineer with clean, stable backfill material. The bedding shall be

consolidated and leveled in order that the pipe may be installed as specified.

8. When the bottom of the trench or the subgrade is found to consist of material that is unstable to such a degree that, in the judgment of the Engineer it cannot be removed, a foundation for the pipe and/or appurtenance shall be constructed using piling, timber, concrete, or other materials at the direction of the Engineer.

3.03 PIPE INSTALLATION

A. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, valves, and hydrants shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or equipment in such a manner as to prevent damage to pipeline material and protective coatings and linings. Under no circumstances shall pipeline materials be dropped off or dumped into the trench. The trench shall be dewatered prior to installation of the pipe.

B. All pipe fittings, valves, hydrants, and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Owner’s Representative who may prescribe corrective repairs or reject the materials.

C. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign material before the pipe is laid.

D. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

E. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

F. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or

other means approved by the Owner's Representative. When practical, the plug shall remain in place until the trench is pumped completely dry. Care shall be taken to prevent pipe flotation should the trench fill with water.

G. Trench width at the top of pipe, bedding conditions, and backfill placement and compaction shall be such that design loadings on the pipe will not be exceeded.

H. Joint Assembly: Pipe joints shall be assembled in accordance with the Manufacturer's instructions and the requirements of ANSI/AWWA C600.

I. Pipe Deflection: When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, or where long radius curves are permitted, the amount of deflection shall not exceed that shown in AWWA C600, latest edition.

J. Pipe Cutting: Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without creating damage to the pipe or lining. Ductile cast iron may be cut using an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw, milling wheel saw, or oxyacetylene torch. Cut ends and rough edges shall be ground smooth and for push-on joint connections, the cut end shall be beveled.

K. Thrust Restraint:

1. All pipe joints, plugs, caps, tees, and bends shall be suitably restrained by attaching steel tie rods or restrained joints as specified.

2. Thrust-restraint design pressure shall be equal to the test pressure of the line.

3. Restrained mechanical joints utilizing setscrew retainer glands or steel harness and tie rods shall be used in place of concrete. Steel tie rods or other components of dissimilar metal shall be protected against corrosion by hand application of a bituminous coating or by encasement of the entire assembly within an 8-mil thick, loose polyethylene casing in accordance with ANSI/AWWA C105/A21.5.

3.04 ABOVE GROUND PIPE INSTALLATION

A. Install pipe in horizontal or vertical planes, parallel or perpendicular to building surfaces unless otherwise shown. Support pipe and fittings to prevent strain on joints, valves and equipment. Install flanged joints so that contact faces bear uniformly on the gasket. Tighten bolts with relatively uniform stress.

3.05 TESTING

A. Hydrostatic pressure and leakage test shall conform to Section 4 of AWWA C600, with the exception that the Contractor shall furnish all gauges, meters, pressure pumps and other equipment needed to test the line.

B. The pressure required for the field hydrostatic pressure test shall be 180 psi for potable water lines and reclaimed water lines, and shall be 150 psi for force mains. The Contractor shall provide temporary plugs and blocking necessary to maintain the required test pressure of 180 psi or 150 psi. Corporation cocks at least 3/4-inches in diameter, pipe riser and angle globe valves shall be provided at each pipe dead-end in order to bleed air from the line. Duration of pressure test shall be at least two hours.

C. The leakage test may be conducted at the same time as the pressure test, and shall be of not less than one hour duration. All leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage as shown by test. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced. The pipe lines shall be tested in such sections as may be required. The line shall be filled with water and all air removed and the test pressure shall be maintained in the pipe for the entire test period by means of a force pump to be furnished by the Contractor. Accurate means shall be provided for measuring the water required to maintain this pressure. The amount of water required is a measure of the leakage.

D. The amount of leakage which will be permitted shall be in accordance with AWWA C600 Standards for all pressure tests. No pipe installation shall be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD(P)1/2}{133,200^*}$$

L = Leakage in gallons per hour
S = Length of pipe in feet
D = Nominal diameter in inches
P = Pressure in psi

* Note: If 20-foot pipe lengths are used, factor to be 148,000

E. Ductile iron pipe used for gravity sanitary sewers shall be tested for leakage by conducting infiltration tests, exfiltration tests, or low pressure air tests as specified in Section 02072 – Gravity Sewer Construction.

3.06 SURFACE PREPARATION AND PAINTING

A. All piping and fittings exposed to view shall have their surfaces prepared and painted with a prime coat as defined in these Specifications. Surface preparation and shop priming is a part of the work of this Section.

END OF SECTION

SECTION 15063

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes materials and methods of installation of HDPE pipe. Pipe is intended for use in a reclaimed water system or in a potable water system.

1.02 SUBMITTALS

A. Provide manufacturer's Certificate of Compliance with specified requirements.

B. All submittals shall be in accordance with Section 01340 – Shop Drawings, Project Data and Samples.

1.03 HANDLING AND STORAGE

A. All pipe, fittings, valves and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe.

B. Materials, if stored, shall be kept safe from damage. The interior as well as all sealing surfaces of all pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves shall be drained and stored in a manner that will protect them from damage or freezing.

C. Pipe stored outside and exposed to prolonged periods of sunlight shall be covered with canvas or other opaque material. Air circulation shall be provided under covering.

D. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Pipe shall not be stored close to heat sources.

E. Gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis. Mechanical-joint bolts shall be handled and stored in a manner that will ensure proper use with respect to types and sizes.

1.04 REFERENCE DOCUMENTS

A. Ductile Iron Pipe A.N.S.I. A21-51.

B. HDPE Pipe AWWA C906.

C. HDPE Pipe AWWA C901.

D. Water Resources Act, Chapter 373, F.S.

E. Chapter 17-40 Florida Administrative Code.

F. Chapter 17-610 Florida Administrative Code.

G. American National Standards Institute (ANSI).

H. American Water Works Association (AWWA).

I. American Society for Testing Materials (ASTM)

J. American Association of State Highway Transportation Officials (AASHTO).

K. American Society of Sanitary Engineers (ASSE).

L. Plastic Pipe Institute (PPI).

1.05 SHOP DRAWINGS AND SUBMITTALS

A. In general, shop drawings and related manufacturer’s product certification shall be made in accordance with the General and Special Conditions of the Contract for approval prior to construction or fabrication of the material by the manufacturer. The following items which require shop drawings are brought to the Contractor’s attention. The list may not include all items for which shop drawing submittals are required to meet the requirements of the project.

1. Detail drawings of all classes of pipe, joints, and fittings.

2. Detail Drawings of restrained and flexible joints, including test reports to confirm thrust restraint capacities and restraining mechanism application.

3. Pipeline laying schedule tabulated and referenced to construction line and grade controls shown on plans, with station, offset and elevations. References shall be provided for pipe fittings, valves, service connections and other important features of the pipeline.

4. All Appurtenant Items.

B. Certification and test reports for the materials, manufacturing, and testing of the types of pipe supplied shall be performed and furnished by the pipe manufacturer in accordance with the latest standards of the industry as described in Sub-section 1.2 herein.

C. Provide a statement in writing from the HDPE pipe manufacturer that it is listed with the Plastic Pipe Institute as a qualified extruder for the polyethylene resin being used to manufacture the pipe for this project.

PART 2 PRODUCTS

2.01 REFERENCES

A. The following documents are a part of this Section. Where this Specification section differs from these documents, the requirements of this section shall apply.

1. ASTM D1248-84, Polyethylene Plastics Molding and Extrusion Materials.
2. ASTM D3350-84, Polyethylene Plastic Pipe and Fittings Material.
3. ASTM F714-85, Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

2.02 HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS

A. General:

1. All High Density Polyethylene (HDPE) shall be manufactured by Driscopipe, a subsidiary of Phillips Petroleum Company; PLEXCO, Division of Chevron Chemical Company; or approved equal.

2. All HDPE pipe 4-inches in diameter and larger shall have a Ductile Iron Pipe outside diameter unless otherwise specified in the Contract Documents.

3. All HDPE piping system components shall be the products of one manufacturer.

B. HDPE Pipe Specifications

1. High Density Polyethylene pipe 4-inches diameter and larger shall conform to material standard ASTM D3350 345464 C/E cell classification rated as PE 3408 by the Plastics Pipe Institute. Minimum pressure rating shall be 160 psi SDR 11 (Standard Dimension Ratio) for pipe sizes 4 inches and greater in diameter. For pipe sizes 3-inches and smaller in diameter, the minimum pressure rating shall be 200 psi SDR 9. All pipe 4-inches in diameter and greater shall have a ductile iron pipe O.D. HDPE pipe ½ " to 3-inches in diameter shall have a steel pipe O.D. Pressure ratings are at standard test conditions and temperature of 73.4^{O}F (23^{O}C).

2. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration of not less than 2 percent.

3. The maximum allowable hoop stress shall be 800 psi at 73.4 degrees F.

4. The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe in this project.

C. Fittings.

1. D.I./HDPE Mechanical Joint Adaptors.

a. The manufacturer of the HDPE pipe shall supply all D.I./HDPE mechanical joint adaptors and accessories required to perform the work as shown on the Drawings.
b. The D.I./HDPE mechanical joint adaptor shall consist of:

(1) A molded or fabricated HDPE mechanical joint transition fitting
(2) A standard rubber gasket for a D.I. mechanical joint.
(3) A D.I. mechanical joint backup drive ring.
(4) Cor-Ten mechanical joint tee bolts.
(5) A stainless steel stiffener inserted in the MJ end of the HDPE transition fitting.

c. The D.I./HDPE mechanical joint adaptor shall be connected to the HDPE pipe by a heat-fused joint on one end, and connected to a ductile iron pipe valve, or fitting with a mechanical joint on the other end.

d. The tee bolts and backup drive ring shall act as a joint restraint to keep the connecting pieces from pulling apart.

e. The HDPE transition fitting shall be molded or fabricated by the manufacturer of the HDPE pipe. All molded fittings shall be fully pressure rated to match the SDR pressure rating for which they are made. Fabricated fittings shall be rated for internal pressure service equivalent to the full pressure rating of the mating pipe.

f. If rework compounds are required, only those generated in the manufacturer's own plant from resin compounds of the same class and type from the same raw material supplier shall be used.

g. Solvent epoxy cementing and mechanical joining with bolt on wrap around clamps shall not be used for connections.

D. HDPE Pipe Jointing Method

1. HDPE pipe shall be jointed by the butt-fusion process in accordance with pipe manufacturer's directions. Contractor shall provide butt-fusion technicians who are trained and certified by the P.E. pipe manufacturer to complete the project. The date of technician certification shall not exceed 12 months before commencing construction.

2. All HDPE pipe joined by butt-fusion shall be made from the same class and type of raw material made by the same raw material supplier.
3. Butt-fusion means the butt-joining of the pipe by softening the aligned faces of the pipe ends in a suitable apparatus and pressing them together under controlled pressure.

4. The internal and external beads resulting from the butt-fusion process shall be visible and examined for penetration 360 degrees around the pipe diameter.

5. Short pieces of pipe between valves and fittings shall be DIP with all joints retrained for sizes 4-inches and larger. For 3-inch and smaller HDPE pipe, the short pieces shall be brass or Sch. 80 PVC with IP threads and DI, HDPE or brass fittings with all joints restrained.

PART 3 EXECUTION

3.01 GENERAL

A. All polyethylene pipe shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer’s recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with polyethylene pipe. The pipe supplier shall certify in writing that the Contractor is qualified to join, lay, and pull the pipe or representative of the pipe manufacturer shall be on site to oversee the pipe joining. Expenses for the representative shall be paid for by the Contractor.

3.02 PIPE INSPECTION

A. The Contractor shall obtain from the pipe manufacturer a certificate of inspection to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications. The Contractor shall submit these certificates to the Engineer prior to installation of the pipe materials. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid. Joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor. The entire product of any plant may be rejected when, in

the opinion of the Owner, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

3.03 TRANSPORTATION

A. Care shall be taken during transportation of the pipe that it is not cut, kinked, or otherwise damaged.

3.04 STORAGE

A. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers at pipes under anticipated temperature condition. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

B. Pipes shall be stored in such a manner as to limit their exposure to ultraviolet light as the pipe color will fade. Excessive loss of color in the pipe material may result in the rejection of piping material by the Project Representative.

3.05 HANDLING PIPE

A. The handling of the joined pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Slings for handling the pipeline shall not be positioned at butt-fused joints. Sections of the pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and the ends rejoined. <u>The dragging of fused HDPE pipe along asphalt and concrete paving will not be allowed</u>.

B. The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged at night to prevent animals or foreign material from entering the pipe line or pipe section.

C. Waterproof nightcaps of approved design may be used but they shall be so constructed that they will prevent the entrance of any type of natural precipitation into the

pipe and will be fastened to the pipe in such a manner that the wind cannot blow them loose.

D. The practice of stuffing cloth or paper in the open ends of the pipe will not be permitted.

E. Where possible, the pipe shall be raised and supported at a suitable distance back from the open end such that the open end will be below the level of the pipe at the point of support.

3.06 LAYING PIPE.

A. Joints:

1. All HDPE pipe shall be jointed by the heat fusion process which produces homogeneous, seal, leak tight joints.

2. Restrained mechanical joints shall be provided at tie-ins with valves and other pipe materials.

B. Butt Fusion Testing:

1. Contractor shall test the first fusion of the day on a daily basis.

2. In testing, the fusion shall be allowed to cool completely, and then fusion test straps shall be cut out. The test shall be a minimum of 12″ or 30 times the wall thickness in length with the fusion in the center, and minimum of 1″ or 1.5 times the wall thickness in width. Bend the test strap until the ends of the strap touch. Contractor shall not commence until a fusion test has passed the bent strap test.

3.07 PIGGING, FLUSHING AND CLEANING

A. All mains shall be pigged, cleaned and flushed to remove all sand and other foreign matter. The Contractor shall be responsible for developing a pigging and flushing plan to be submitted to the Engineer for approval prior to pigging and flushing. The Contractor shall dispose of all water used for pigging and flushing without causing a nuisance or property damage. Any permits required for the disposal of flushing water shall be the responsibility of the Contractor.

B. Flushing water used by the Contractor for reclaimed water mains shall be provided by the County at the North Water Reclamation Facility. The flushing water

shall consist of plant effluent (reclaimed water). The Contractor shall be responsible for conveying the reclaimed water to the point of application. Flushing water for potable water mains shall be taken by the Contractor from the potable water system at the North Water Reclamation Facility. The County will provide a water meter and backflow device, the Contractor shall compensate the County for the meter usage and the quantity of potable water used.

3.08 INSPECTION AND TESTING

A. All HDPE pipelines shall remain undisturbed for 24 hours to develop complete strength at all joints. The Contractor shall conduct two (2) hydrostatic tests on each HDPE pipeline. The first test shall be performed when the pipe is above ground and before it is installed. The second test shall be performed on the pipe when it is below ground after installation.

B. Hydrostatic Testing for High Density Polyethylene Pipe:

1. HDPE hydrostatic testing shall be done in accordance with ASTM 2164-02 as briefly described below. Testing phase shall last 2-hours.

2. For any test pressure from 1.0 to 1.5 times the system design pressure, the total test time including initial pressurization, initial expansion, and time at test pressure, shall not exceed eight (8) hours. If the pressure test is not completed due to leakage, equipment failure or other reason, the test section shall be de-pressurized, and allowed to “relax” for at least eight (8) hours before bringing the test section up to test pressure again.

3. The test procedure consists of initial expansion, and the test phase:

   a. During the initial expansion phase, the test section is pressurized to 10 psi above the test pressure (see Table A for Expansion Pressure), and sufficient make-up water is added each hour for three (3) hours to return to the expansion phase pressure.
   b. After the initial expansion phase, about four (4) hours after pressurization, the test phase begins.
   c. During the test phase, the pipe is stabilized at the test pressure (see Table A). The pressure shall remain steady within 5% of

this target value for two (2) hours. If the pressure falls below 5% of the test pressure (see Table A), leakage or insufficient expansion is indicated, and the test shall be repeated after the pipe is allowed to “relax” as indicated above. Make-up water is not allowed during the test phase.

TABLE A

Pipe Class	Expansion Pressure	Test Pressure	5% Pressure Reduction
SDR 17	150 psi	140 psi	133 psi
SDR 13.5	170 psi	160 psi	152 psi
SDR 11	170 psi	160 psi	152 psi
SDR 9	210 psi	200 psi	190

3.09 CONNECTIONS TO EXISTING SYSTEM

A. Connections to existing pipelines shall be made as shown on the Contract Drawings. Coordination between the Owner and the Contractor shall be required in order to accomplish this task. The Contractor shall supply connection procedures to the Owner for approval two (2) weeks prior to the proposed connection date.

END OF SECTION

SECTION 15066

PLASTIC PIPE (GRAVITY SEWER)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, equipment, materials, pipe and incidentals and shall construct gravity sewers or drains, complete, as shown on the drawings and as herein specified.

B. The work shall include furnishing, laying and testing gravity sewer/drain pipe.

1.02 SUBMITTALS DURING CONSTRUCTION

A. The Contractor shall submit prior to construction, Shop Drawings, Working Drawings and Samples for approval to the Engineer.

B. The Contractor shall submit to the Engineer not less than fourteen (14) calendar days after the date of the Notice to Proceed, a list of materials to be furnished, the names of suppliers and an expected schedule of delivery of materials to the site.

C. The Contractor shall furnish in duplicate to the Engineer sworn certificates that all tests and inspections required by the Specifications under which the pipe is manufactured have been satisfied.

D. The pipe manufacturer shall inspect all pipe joints for out-of-roundness and pipe ends for squareness. The Contractor shall furnish to the Engineer, a manufacturer's Notarized Affidavit stating all pipe meets the requirements of ASTM, ASCE, ANSI, the Contract Documents, as well as all applicable standards regarding the joint design with respect to square ends and out-of-round joint surfaces.

1.03 INSPECTION AND TESTS

A. All pipe and accessories installed under this Contract shall be inspected and tested as required by the Standard Specifications to which the material is manufactured. The pipe shall be tested at the place of manufacture or taken to an independent laboratory by the manufacturer.

B. Each length of pipe shall be subject to inspection and approval at the factory, point of delivery and site of work. Sample of pipe to be tested shall be selected at random by the Engineer or the testing laboratory and shall be delivered by the Contractor to the testing laboratory approved by the Engineer.

C. When the specimens tested conform to applicable standards, all pipe represented by such specimens shall be considered acceptable based on the test parameters measured. Copies of test reports shall be submitted to the Engineer prior to the pipe installation. Acceptable pipe shall be stamped with an appropriate monogram under the supervision of the testing laboratory.

D. All pipe test specimens failing to meet the applicable standards shall be rejected. The Contractor may provide two additional test specimens from the same shipment or delivery for each failed specimen. The pipe shall be acceptable if both of these additional specimens meet the requirements of the applicable standards.

E. Pipe which has been deemed unacceptable by the Engineer shall be removed from the work site by the Contractor and shall be replaced with acceptable pipe.

PART 2 MATERIALS

2.01 GENERAL

A. The sizes of gravity sewer pipe shall be shown on the Drawings.

B. Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel.

2.02 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

A. PVC pipe, sizes 4" through 12", for use in non-pressure gravity sewer mains and laterals shall have an SDR of 26 and conform to ASTM D-3034. PVC pipe shall be made of PVC plastic, homogenous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects. The pipe shall be uniform in color, density and other physical properties.

B. PVC pipe sizes over 12" shall be approved by Manatee County.

C. All pipe shall be in compliance with the above standard and be clearly marked as follows at intervals of 5 feet or less:

1. Manufacturer's name or trademark.
2. Nominal pipe size.
3. PVC cell classification (eg. 12454-B).
4. The legend "Type PSM SDR-26 PVC Sewer Pipe" and the designation ASTM D-3034.

D. In addition to the above mentioned requirements, all PVC sanitary sewer pipe shall be color coded green to conform to Manatee County Standards.

E. PVC sewer fittings shall conform to the requirements of ASTM D-3034 and shall have an SDR of 26. Six inch PVC fittings for sewer laterals shall be SDR 26. Fittings shall be molded in one piece with elastomeric joints and minimum socket depths as measured in accordance with ASTM D-3034. Fittings not currently available in molded form may be fabricated in accordance with ASTM D-3034 with manufacturer's standard pipe bells and gaskets. Gasket shall have a minimum cross sectional area of 0.20 sq. in. and conform to ASTM F-477 specification.

2.03 JOINTING PVC PIPE

A. The PVC joints shall be of the push-on type so that the pipe and fittings may be connected on the job without the use of solvent cement or any special equipment. The push-on joint shall be a single rubber gasket conforming to ASTM F-477, designed to be assembled by the positioning of a continuous molded rubber ring gasket in an annular recess in the pipe of fitting socket and the forcing of the plain end of the entering pipe into the socket, thereby compressing the gasket radially to the pipe to form a positive seal. The gasket and annular recess shall be designed and shaped so that the gasket is locked in place against displacement as the joint is assembled. The rubber ring joint shall be designed for thermal expansion or contraction with a total temperature change of at least 75 degrees F in each joint per length of pipe. The bell shall consist of an integral wall section with a solid cross-section elastomeric ring which shall meet requirements of ASTM F-477. The thickened bell section shall be designed to be at least as strong as the pipe wall. Lubricant furnished for lubricating joints shall be nontoxic, shall not support the growth of bacteria, and shall have no deteriorating effects on the gasket or pipe material.

B. Wyes and riser fittings shall be gasketed connections. If female adapters SDR 26 or 35 are unavailable, solvent welds shall be acceptable upon approval by the Engineer.

C. Rubber doughnuts are not to be used.

2.04 JOINTS FOR DISSIMILAR PIPE

Joints between pipe of different materials shall be made using mechanical joint connections. Metal piping shall not be threaded into plastic fittings, valves, or couplings, nor shall plastic piping be threaded into metal valves, fittings, or couplings.

2.05 PIPE BEDDING AND PIPE COVER MATERIALS

A. Pipe bedding and cover material shall be as specified in the Contract Documents.

B. Pipe bedding and cover material for polyethylene coated ductile iron pipe fittings shall be well graded sand.

PART 3 EXECUTION

3.01 PIPE DISTRIBUTION

The Contractor shall not distribute material on the job faster than it can be used to good advantage. He shall unload pipe which cannot be physically lifted by workers from the trucks, by a forklift, or other approved means. He shall not drop pipe of any size from the bed of the truck to the ground. He shall not distribute more than one week supply of material in advance of laying, unless otherwise approved by the Engineer.

3.02 PIPE PREPARATION AND HANDLING

A. The Contractor shall inspect all pipe and fittings prior to lowering them into trench. Cracked, broken, or otherwise defective materials are not acceptable and shall not be used. The Contractor shall clean the ends of the pipe thoroughly. He shall remove foreign matter and dirt from inside of pipe and keep the pipe clean during and after laying.

B. The Contractor shall use proper implements, tools and facilities for the safe and proper protection of the work. He shall lower the pipe into the trench in a manner to avoid any physical damage to the pipe, remove all damaged pipe from the job site and under no circumstances shall the pipe be dropped or dumped into trenches.

3.03 LINE AND GRADE

A. The Contractor shall not deviate more than 1/2-inch for line and 1/4-inch for grade from the

line design and design grade established by the Engineer provided that such variation does not result in a level or a reverse sloping invert. He shall measure the grade at the pipe invert and not at the top of the pipe. The Contractor shall furnish, set and control the line and grade by laser beam method. Other methods of controlling line and grade may be submitted to the Engineer for approval if using the laser beam method proves to be impractical because of other conditions.

B. The Contractor shall use the laser beam method of maintaining line and grade. The Contractor shall submit evidence to the Engineer that a qualified operator shall handle the equipment during the course of construction. A "Caution-Laser Light" placard shall be displayed in a conspicuous place. When "in the pipe" method is used, grade boards shall be installed for the first 50 feet of pipe. The Contractor shall check the line and grade at any additional points at which offset stakes have been placed and when requested by the Engineer. A fan shall be provided to circulate the air if bending of the beam due to air temperature variations becomes apparent with "in the pipe" units. However excessive air velocity shall not be permitted to cause pulsating or vibrating of the beam. If, in the opinion of the Engineer, the beam cannot be accurately controlled, this method of setting line and grade shall be discontinued. When the above ground method is used, the set-up shall be checked with the three grade boards including one set at the upstream manhole. If the laser has a gradient indicator, two boards may be used to check the set-up. The grade board at the up-stream manhole shall be retained to check into as pipe laying progresses.

3.04 PREPARATION OF TRENCH

A. The Contractor shall provide pipe bedding material under all of the pipe for the full trench width. The minimum depth of bedding material below the pipe barrel shall be as follows

Pipe Size	Minimum Depth of Bedding Under Pipe Barrel
15" & Smaller	4 inches
18" to 36"	6 inches
42" & Large	9 inches

B. The depth of pipe bedding material under the pipe bell shall not be less than three inches under normal trench conditions.

C. The Contractor shall hand-grade bedding to proper grade ahead of the pipe laying operation. The bedding shall provide a firm, unyielding support along the entire pipe length.

D. Should the Contractor excavate the trench below the required depth for pipe bedding material placement without direction from the Engineer, the Contractor shall fill the excess depth with pipe bedding material as specified herein to the proper subgrade.

E. The Contractor shall excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.

3.05 DEWATERING

The Contractor shall prevent water from entering the trench during excavation and pipe laying operations to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.

3.06 LAYING AND JOINTING PIPE AND FITTINGS

A. The Contractor shall lay pipe upgrade with spigot ends pointing in direction of flow. After a section of pipe has been lowered into the prepared trench, he shall clean the end of the pipe to be joined, the inside of the joint and, if applicable, the rubber ring immediately prior to joining the pipe. The Contractor shall assemble the joint in accordance with the recommendations of the manufacturer of the type

of joint used. He shall provide all special tools and appliances required for the jointing assembly.

B. The Contractor shall lay all pipe uniformly to line and grade so that the finished sewer shall present a uniform bore. Variations from line and grade in excess of the tolerances specified under LINE AND GRADE are not acceptable and the work shall be rejected.

C. The Contractor shall check the pipe for alignment and grade after the joint has been made. The pipe bedding shall form a continuous and uniform bearing and support for the pipe barrel between joints. Sufficient pressure shall be applied to the joint to assure that the joint is "home" as defined in the standard installation instructions provided by the pipe manufacturer. The Contractor shall place sufficient pipe cover material to secure the pipe from movement prior to installing the next joint to assure proper pipe alignment and joint makeup.

D. Pipe 21" and smaller intended to be in straight alignment shall be laid so that the inside joint space does not exceed 3/8" in width. If interior joints on 24" and larger pipe laid either in straight alignment or on a curve are greater than 3/8", the Contractor shall thoroughly clean the joint surfaces and fill and seal the entire joint with premixed mortar conforming to ASTM C-387 only after the trench has been backfilled, unless otherwise approved by the Engineer. Trowel smooth on the inside surface. Water shall not be allowed to rise in or around, or pass over any joint before it has substantially set.

E. When the Contractor lays pipe within a movable trench shield, he shall take all necessary precautions to prevent pipe joints from pulling apart when moving the shield ahead.

F. The Contractor shall prevent excavated or other foreign material from getting into the pipe during the laying operation. He shall close and lock the open end of the last laid section of

pipe to prevent entry of foreign material or creep of the gasketed joints when laying operations cease, at the close of the day's work, or whenever the workers are absent from the job.

G. The Contractor shall plug or close off the pipes which are stubbed off with temporary plugs.

H. The Contractor shall take all necessary precautions to prevent the "uplift" or floating of the line prior to the completion of the backfilling operation.

I. The Contractor shall make connections of non-reinforced pipe to manholes or concrete structures, so that a standard pipe joint is located at a minimum of 18" outside the edge of structure.

J. When field cutting and/or machining the pipe is necessary, the Contractor shall use only tools and methods recommended by the pipe manufacturer and approved by the Engineer.

K. Service lateral shall be constructed by the Contractor as shown on the standard sewer details and located approximately as shown on the Contract Drawings.

3.07 LAYING PLASTIC PIPE

A. Polyvinyl chloride (PVC) pipe shall be installed by the Contractor in accordance with the instructions of the manufacturer, as shown on the Drawings and as called out in the Contract Documents.

B. The Contractor shall lay the pipe, bedding and backfill to lines and grade shown on the Drawings and called out in the Contract Documents. Blocking under the pipe will not be permitted.

C. The Contractor shall install a green metallic tape as shown in these Standards below finish grade along the entire pipeline PVC sewer main pipe route.

D. The Contractor shall use care in the handling, storage and installation of pipe. Storage of pipe on the job site shall be done in accordance with the pipe manufacturer's recommendation.

3.08 BACKFILL IN THE PIPE ZONE

A. The pipe zone shall be considered to include the full width of the excavated trench from the bottom of the trench to a point above the top outside surface of the barrel of the pipe.

B. The Contractor shall pay particular attention to the area of the pipe zone from the flow line to the springline of the pipe to ensure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of the pipe zone.

C. The Contractor shall take care to insure that the pipe does not rest directly on the bell or pipe joint, but is uniformly supported on the barrel throughout its entire length.

D. After the pipe is laid by the Contractor to line and grade, he shall place and carefully compact pipe bedding material for the full width of the trench to the springline of the pipe. He shall place the material around the pipe in 6-inch layers and thoroughly hand tamp with approved tamping sticks supplemented by "walking in" and slicing with a shovel to assure that all voids are filled.

E. The Contractor shall backfill and carefully compact the area above the pipe springline with pipe cover material to a point 12" above the top outside surface of the pipe barrel. Pipe bedding material may, at the Contractor's option, be substituted for pipe cover material.

3.09 EXCESS TRENCH WIDTH

A. Normal trench widths shall be as shown on the Drawings. If the normal trench width below the top of the pipe is exceeded for any reason, the Contractor shall furnish an adequate support for

the pipe. The Engineer may determine that the pipe being used is strong enough for the actual trench width or the Contractor may furnish a stronger pipe or a concrete cradle for approval.

B. Concrete thickness under the pipe shall be one-third of the nominal diameter of the pipe, but not less than four inches. Concrete block or brick may be used for adjusting and maintaining proper grade and elevation of pipe. After the pipe is laid to line and grade, the Contractor shall place 3,000 psi concrete under the pipe for the full width of the trench to form a cradle of the required length and thickness with the concrete brought up to a level equal to 1/4 of the inside pipe diameter below the springline of the pipe. Start and terminate the concrete cradle at the face of a pipe bell or collar. Do not encase pipe joints at the ends of the concrete cradle.

C. After the concrete has taken initial set, the Contractor shall place cover material over the concrete cradle and up to a level 12" above the pipe barrel and for the full width of the trench. Cover material shall be placed by hand or by equally careful means.

3.10 CONNECTING DISSIMILAR PIPE MATERIALS

The Contractor shall use the following method to connect dissimilar pipe materials. Use concrete closure collars only when approved by the Engineer and then only to make connections between dissimilar pipe when standard rubber gasketed joints or flexible couplings are impracticable. Before the closure collars are poured, wash the pipe to remove all loose material and soil from the surface on which the concrete will be placed. Wet nonmetallic pipe thoroughly prior to pouring the collars. Wrap and securely fasten a light gauge of sheet metal or building-felt around the pipe to insure that no concrete shall enter the line. Place reinforcement as shown on the plans. Make entire collar in one pour using 3,000 psi concrete and extend a minimum 12" on each side of the joint.

The minimum thickness around the outside diameter of the pipe shall be 6". No collar shall be poured in water. After the collars are poured and have taken their initial set, cure by covering with well-moistened earth.

3.11 PIPE BULKHEADS

A. Connections for future sewers shall be bulkheaded by the Contractor in the following manner:

1. All wyes and bell-and-spigot pipe sewers 18" in diameter or smaller shall be bulkheaded with caps or disc stoppers with factory-fabricated resilient joints. The disk or cap shall be banded or otherwise secured to withstand all test pressures without leakage.
2. Connections 21" and 24" in diameter shall be bulkheaded with a four-inch brick wall, using clay brick or concrete brick. The wall shall be capable of withstanding all test pressures without leakage.
3. Connections 27" in diameter and larger shall be bulkheaded with an eight-inch wall, using clay brick or concrete brick. The wall shall be capable of withstanding all test pressures without leakage.

3.12 AIR TEST FOR GRAVITY SEWERS - GENERAL

A. Gravity sewers shall be required to pass the low pressure air test described herein.

B. Air loss rates may be measured by the Engineer. These tests shall be performed by the Contractor under the observation of the Engineer and County Inspector.

C. The groundwater height above the installed pipe shall be determined by attaching a transparent plastic tube to a pipe nipple in the manhole and using the plastic tube as a manometer. A test hole may be dug directly above the sewer main for visual inspection.

D. The ends of branches, laterals, tees, wyes and

stubs included in a test section shall be plugged to prevent air leakage. All plugs shall be secured to prevent blowout due to internal pressure. A test section is defined as the length of sewer between manholes.

E. The Contractor shall repair all visible leaks in manholes and pipe, even if the leakage test requirements are met.

3.13 LAMP TEST FOR GRAVITY SEWER MAINS

A. Prior to testing, the Contractor shall prepare the lines for testing. All lines shall be thoroughly cleaned.

B. The Contractor shall furnish all equipment necessary for testing including, but not limited to, ladders, a lamping light and a vehicle to use as power source.

C. Gravity lines shall be lamped from both the upstream and downstream ends between the manholes.

D. A minimum image of 75% shall be acceptable.

E. Failure to meet the 75% image requirement shall result in the Contractor having to video tape the line at his own expense. The Engineer or his representative shall be present while the line is video taped. The tape shall be submitted to Manatee County for evaluation.

F. The Contractor shall relay or otherwise correct any line deemed unacceptable by the Engineer. This work shall be done entirely at the Contractor’s expense.

G. Grouting of sewer lines or re-rounding machines are not approved corrective measures.

H. Sewer lines shall be re-lamped and may be required by Manatee County to be video taped again.

3.14 FINAL SEWER CLEANING

A. Prior to final acceptance and final manhole-to-manhole inspection of the sewer system by the Engineer, the Contractor shall flush and clean all parts of the system, remove all accumulated construction debris, rocks, gravel, sand, silt and other foreign material from the sewer system at or near the closest downstream manhole.

B. During the final manhole-to-manhole inspection of the sewer system, the Engineer may require the Contractor to reflush and clean any section or portion of the line if any foreign matter is still present in the system.

END OF SECTION

SECTION 15067

PLASTIC PIPE FOR PRESSURE SERVICE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes materials and methods of installation of Plastic Pipe for pressure service as shown on the Drawings and as Specified herein.

1.02 SUBMITTALS

A. Three certified copies of the tests made by the manufacturer or by a reliable commercial laboratory shall be submitted to the Engineer with each shipment of pipe.

B. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

1.03 HANDLING AND STORAGE

A. All pipe, fittings, valves, hydrants and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe.

B. Materials, if stored, shall be kept safe from damage. The interior as well as all sealing surfaces of all pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage or freezing.

C. Pipe stored outside and exposed to prolonged periods of sunlight shall be covered with canvas or other opaque material. Air circulation shall be provided under covering.

D. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete.

Pipe in tiers shall be alternated: bell, plain end; bell, plain end. Pipe shall not be stored close to heat sources.

E. Gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis. Mechanical-joint bolts shall be handled and stored in a manner that will ensure proper use with respect to types and sizes.

PART 2 - MATERIALS AND EQUIPMENT

2.01 PLASTIC PIPE

A. Pipe for pressure service shall be Class 12454-A or B rigid PVC compound in accordance with the requirements of ASTM D1784. Pipe and appurtenances for use in potable water systems shall bear the seal of approval for potable water use of the National Sanitation Foundation or other accredited testing laboratory. All pipe shall have markings indicating pipe size, manufacturer's name, AWWA and/or ASTM specification number, working pressure, and production code.

B. PVC pressure rated pipe having a nominal diameter between 1.5" and 3", shall be made of 2000 psi hydrostatic design stress compounds designated PVC 1120 and shall conform to ASTM D2241. PVC pipe shall be furnished in 20-foot lengths unless otherwise noted. PVC pipe shall have a standard dimension ratio of SDR 21 and a water pressure rating of 200 psi. Pipe couplings shall have a dimension ratio of SDR 21 and a water pressure rating of 200 psi. Pipe shall have both ends beveled for use with gasketed couplings or one end beveled and one end with a bell. Couplings and gaskets shall be furnished with each length of pipe. Rubber ring gaskets shall conform to ASTM D3139 Nontoxic gasket lubricant shall be as specified by the manufacturer.

C. Pressure pipe 4-inches through 12-inches in diameter shall conform to the requirements of AWWA C900 for PVC pipe with cast iron pipe equivalent outside diameters. Pipe shall be pressure class 235 unless otherwise shown. Pipe shall have a minimum wall thickness equivalent to a dimension ratio of DR 18 unless otherwise shown. Pipe may be furnished with plain ends for use with elastomeric-gasket couplings or with one end plain and one end with a gasket bell. Couplings and

gaskets shall be furnished with the pipe. Gaskets shall conform to ASTM D3139. Nontoxic gasket lubricant shall be as specified by the pipe manufacturer.

D. Pressure pipe 14-inches through 36-inches in diameter shall conform to the requirements of AWWA C 905 for PVC pipe with cast iron pipe equivalent outside diameters. Pipe 16-inch through 24-inch shall have a minimum wall thickness equivalent to a dimension ratio of DR 18 unless otherwise shown. Pipe shall be pressure Class 235 unless otherwise shown. Pipe 30-inch through 36-inch shall have a minimum wall thickness equal to a dimension ratio of DR 21 unless otherwise shown. Pipe shall be pressure Class 200 unless otherwise shown. Pipe may be furnished with plain ends for use with elastometric gasket couplings or with one end plain and one end with a gasket bell. Couplings and gaskets shall be furnished with the pipe. Gaskets shall conform to ASTM 1869. Non-toxic gasket lubricant shall be as specified by the pipe manufacturer.

2.02 FITTINGS

A. Fittings for use with PVC pipe 3-inches through 24-inches in diameter shall be compact mechanical joint ductile-iron fittings conforming to the requirements of ANSI/AWWA C153/A21.53. Fittings for use with pipe 30-inches and larger shall be mechanical joint gray iron or ductile-iron conforming to the requirements of ANSI/AWWA C111/A21.11a. Bolts for use with mechanical joints shall conform to the requirements of the joint standard. Fittings shall be suitable for a working pressure of 150 psi.

B. Exterior Coating. Fittings for buried service shall be coated with a bituminous coating approximately 1 mil thick. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun and shall be strongly adherent to the pipe.

C. Polyethylene Encasement. All buried ductile iron fittings shall be provided with a 4-mil thick cross-laminated high density polyethylene encasement or an 8-mil thick polyethylene encasement per ANSI/AWWA C105/A21.5.

D. Fittings in exposed locations which are to be painted shall be primed with a universal shop primer suitable for use under the finish paint specified.

E. Linings. Fittings shall have a cement-mortar lining conforming to the requirements of ANSI A21.4/AWWA C104 or a Protecto 401 ceramic epoxy depending upon the type of fluid being conveyed. Cement mortar linings shall be used for all ductile iron fittings conveying potable water and reclaimed water. Protecto 401 shall be used for all ductile iron fittings conveying wastewater sludge, backwash water, leachate, mixed liquor, sludge thickening water, and plant drain water.

2.03 RESTRAINED JOINTS

A. Restrained Joints. Restrained joints for use with PVC pipe shall consist of retainer glands fabricated of ductile-iron conforming to ASTM A536. The gland shall be such that it can replace the standard mechanical joint gland and can be used with the standardized mechanical joint bell conforming to ANSI/AWWA A21.11/C111 and ANSI/AWWA A21-53/C153. The retainer glands shall have a pressure rating equal to that of the PVC pipe on which it is used.

B. PVC push-on joints adjacent to restrained fittings shall be restrained using harness restraint devices. This harness restraint shall be split to enable installation of the restraint after the spigot has been installed into the bell. The restraint shall consist of a split ring that fits behind the bell, a split restraint ring that installs on the spigot and a number of tie bars to connect the other two parts. Restraint components shall be of ductile-iron conforming to ASTM A536. The restraint ring shall consist of a plurality of individually activated gripping surfaces to hold the spigot and maximize restraint capability.

C. Twist off nuts, sized same as the tee-head bolts shall be used to insure proper actuating of restraining devices.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Excavation. Excavate trenches as specified in Section 02221 – Trenching, Bedding and Backfill for Pipe..

B. All pipe and appurtenances shall be examined at the point of delivery. Material found to be defective due to manufacture or damage in shipment shall be rejected. Tests as specified in the applicable material standard

may be performed to ensure conformance with the standard.

3.02 TRENCH CONSTRUCTION

A. Alignment and Grade. The pipelines shall be laid and maintained to the lines and grades established by the Drawings and Specifications, with fittings, valves and hydrants at the required locations unless otherwise approved by the Engineer. Valve-operating stems shall be oriented to allow proper operation. Hydrants shall be installed plumb.

B. Underground Conflicts. Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care shall be exercised to avoid damage to existing structures. When obstructions that are not shown on the drawings are encountered during the progress of work and interfere so that an alteration of the plans is required, the Owner’s Representative will alter the Drawings or order a deviation in line and grade or arrange for removal, relocation, or reconstruction of the obstructions. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the Owner’s Representative, to provide clearance as required by the Owner’s Representative to prevent future damage or contamination of either structure.

C. Trench Construction. The trench shall be excavated to the required alignment, depth, and width. Trench preparation shall proceed in advance of pipe installation for only as far as necessary to allow proper pipe installation. The width of the trench at the top of the pipe shall be ample to permit the pipe to be laid and joined properly and allow the backfill to be placed as specified.

D. PVC pipe shall be installed with pipe bedding and backfill as shown on the drawings.

E. Holes for the bells shall be provided at each joint but shall not be larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. Other than noted previously, the trench bottom shall be true and even in order to provide support for the full length of the pipe barrel, except that a slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle.

F. When excavation of rock is encountered, all rock shall be removed to provide a clearance of at least 6-inches below and on each side of all pipe, valves and fittings. When excavation is completed, a bed of sand, crushed stone or earth that is free from stones, large clods, or frozen earth, shall be placed on the bottom of the trench to the previously mentioned depths; leveled, and tamped. These clearances and bedding procedures shall also be observed for pieces of concrete or masonry and other debris of subterranean structures, such as masonry walls, piers, or foundations that may be encountered during excavation. This installation procedure shall be followed when gravel formations containing loose boulders greater than 8-inches in diameter are encountered. In all cases, the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection, or point or rock, boulder, or stones of sufficient size and placement which, in the opinion of the Engineer could cause a fulcrum point.

G. Should the trench pass over a sewer or other previous excavation, the trench bottom shall be sufficiently compacted to provide support equal to that of the native soil or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.

H. When the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed, to a minimum of at least 4-inches, or to the depth ordered by the Engineer and replaced under the directions of the Engineer with clean, stable backfill material. The bedding shall be consolidated and leveled in order that the pipe may be installed as specified.

I. When the bottom of the trench or the subgrade is found to consist of material that is unstable to such a degree that, in the judgment of the Engineer it cannot be removed, a foundation for the pipe and/or appurtenance shall be constructed using piling, timber, concrete, or other materials at the direction of the Engineer.

3.03 PIPE INSTALLATION

A. The Contractor shall install all pipe in accordance with the recommendations of the pipe manufacturer and as specified herein.

B. The Contractor shall take care in handling, storage and installation of pipe and fittings to prevent injury to the pipe or coatings. All pipe and fittings shall be examined before installation and pipe which is deemed to be defective by the Owner/Engineer shall not be installed.

C. The Contractor shall thoroughly clean and keep thoroughly clean, all pipe and fittings prior to during and after installation.

D. The Contractor shall lay the pipe to the lines and grades shown on the Contract Drawings with bedding and backfill as shown on the Drawings or called out in the Contract Documents. Blocking under the pipe shall not be permitted except through casing sleeves.

E. The Contractor shall keep the open ends of all pipe closed with a tightly fitting plug when installation is not in progress or the potential exists for dirt or debris to enter the pipe.

F. The pipe or accessories shall not be dropped into the trench under any circumstances.

G. The Contractor shall construct all water mains pursuant to the provisions of "Recommended Standards for Water Works", Part 8, incorporated by reference in Rule 17-555.330(3), F.A.C.

H. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, and valves, and hydrants shall be lowered carefully into the trench by means of suitable tools or equipment in such a manner as to prevent damage to pipeline materials. Under no circumstances shall pipeline materials be dropped or dumped into the trench. The trench shall be dewatered prior to installation of the pipe.

I. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

J. Trench width at the top of pipe, bedding conditions, and backfill placement and compaction shall be such that design loadings on the pipe will not be exceeded.

K. Joint Assembly. Pipe joints shall be assembled in accordance with the manufacturer's instructions.

L. Pipe Deflection. When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, or where long radius curves are permitted, the amount of deflection shall not exceed 75% of the amount recommended by the manufacturer.

M. Pipe Cutting. Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without creating damage to the pipe. Ends shall be cut square and perpendicular to the pipe axis.

N. Burrs shall be removed from spigots and ends shall be smoothly beveled. Field cut ends shall be marked for proper depth of joint assembly.

O. Locator Tape. Install all plastic pipe with a locator tape of the type specified.

P. Electronic Marker. Install electronic markers of the type specified for all buried piping at 24-inches below grade.

Q. Thrust Restraint. All plugs, caps, tees, and bends, unless otherwise specified, shall be provided with reaction backing, or restrained joints as specified.

R. Thrust-restraint design pressure shall be equal to 1.5 times the design pressure of the line.

3.04 TESTING

A 48-hour notice is needed prior to testing. A letter stating the reasons testing should be scheduled ahead of other jobs must accompany all emergency testing requests.

B. Owner’s Representative and Contractor must be present for all testing, except for testing tapping valves and sleeves.

C. All pressure pipe lines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipe lines shall be subjected to a hydrostatic pressure test for two (2) hours at full working pressure, but not less than 180 psi for water/reclaimed (150 psi for force main). Maximum length of pipe to be tested at one time is 2,600 feet. If line is longer than 2,600

feet and cannot be sectioned in 2,600 feet (max.) lengths, the allowable leakage will be figured at 2,600 feet.

D. Allowable leakage shall be determined by AWWA C600 table for hydrostatic tests. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof; to maintain the test pressure after the air in the pipe line has been expelled and the pipe has been filled with water.

E. All digging on the job site in the right-of-way must be completed before any testing of water or sewer. Any digging or boring across water or sewer lines after they have been tested may result in a retest of the lines at the County's request.

F. If any revisions or changes are made after initial testing, lines will be re-tested at the County's request.

G. Disconnect water supply during test.

H. All force mains will be tested from the valves in the valve vault at the lift station to the point of connection whether it be against a valve on another force main or into a manhole.

I. All services to be aboveground during test. The services should be the correct length so they will be one (1) foot inside right-of-way line.

J. All fire hydrant gate valves to be open during test.

K. All visible leaks are to be repaired, regardless of the amount of leakage.

L. Check gauge pressure periodically during test. If test pressure drops to 175 psi for water/reclaimed lines or to 145 psi for force mains during test, the line must be repumped back to 180 psi for water/reclaimed (150 psi force mains) and the amount of leakage measured. The test will continue on with the remaining time left. At the end of the test, the line must be repumped again back to 180 psi (150 psi for force main) and the amount of leakage measured and added to any previous leakage determined earlier in the test.

M. After the line passes the test, the pressure will be blown off from the opposite end of line from the gauge location. Fire hydrants, services and end-of-line blow

offs will be opened to demonstrate they were on line during the test.

N. At end of test, the test gauge must return to zero. The pressure gauge must read 0 psi to a maximum of 300 psi in 5 psi increments.

O. The section of line being tested must be identified on the charge sheet. The length and size of pipe, the exact area being tested and the valves being tested against, must be identified. Use Station numbers if available.

P. A copy of the charge sheet will be given to the Owner’s Representative and the Contractor at the end of the test.

END OF SECTION

SECTION 15100

VALVES AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and as specified herein.

B. All valves and appurtenances shall be of the size shown on the Drawings and to the extent possible, all equipment of the same type shall be from one manufacturer.

C. 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.

D. The equipment shall include, but may not be limited to, the following:

1. Plug Valves
2. Pressure Regulating Valves
3. Swing Check Valves
4. Resilient Seated Gate Valves
5. Air Release Valves (ARV)
6. Corporation Stops and Saddles
7. Valve Boxes
8. Restrained Flange Adapter
9. Solid Sleeve Couplings
10. Restraining Clamps
11. Manual Valve Actuators
12. Duckbill Check Valve
13. Tapping Sleeves
14. Small Gate Valves
15. Ball Valves
16. Combination Air Valves (CAV)
17. Butterfly Valves

1.02 DESCRIPTION OF SYSTEMS

A. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of potable water, reclaimed water, chemicals, wastewater, etc., depending on the applications.

1.03 QUALIFICATIONS

A. All of the types of valves and appurtenances shall be products of well established reputable firms who are fully experienced 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 as applicable.

1.04 SUBMITTALS

A. Submit to the Engineer within 30 days after execution of the contract a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.

B. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer for approval in accordance with the requirements of Section 01340 – Shop Drawings, Project Data and Samples.

1.05 TOOLS

A. Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

PART 2 PRODUCTS

2.01 PLUG VALVES

A. Eccentric Plug Valves 3”-36” shall meet or exceed the latest revision of AWWA Standard C517, and shall meet or exceed the requirements of this specification.

B. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanges shall be per the ANSI B16.1 125 lb. standard. End-to-end length of flanged valves shall be per AWWA C517, Table 1. Mechanical joint ends shall be to the AWWA Standard C111-64.

C. Bodies shall be of ASTM A126 Class B cast iron. Port area shall be 100% of standard pipe area. Published and/or calculated Cv flow data will not be accepted in lieu of 100% port area requirement. The body shall have minimal pooling, and provide complete flushing of the

valve every time it cycles. Port of valve shall be rectangular. Round ported valves will not be accepted. Only VE option that will be considered is rectangular seated non 100% port valves. VE option of round port valves will not be accepted. The term “full port” shall represent 100% port.

D. Seats shall be rectangular ported, 1/8" thick welded overlay of not less than 95% pure nickel. Seat area shall at least 1/2” wide and raised, with the raised surface completely covered with weld to insure that the plug face contacts only nickel.

E. Plugs shall be solid one-piece castings of ASTM A536 ductile iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The plug shall not contact the seat prior to 90% closed. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be Chloroprene (CR), or other resilient facing suitable for the application.

F. Bearings shall have sleeve type metal bearings and shall be of sintered, oil impregnated permanently lubricated type 316 ASTM A743 Grade CF8M. Non-metallic bearings shall not be acceptable.

G. Grit Excluders in the form of PTFE washers at the upper and lower journals shall be provided to prevent the entry of grit and foreign solids into the bearing areas.

H. Shaft seals shall be of the multiple V-ring type with a packing gland follower. Shaft seals shall be externally adjustable and repackable under pressure without removing the actuator or bonnet from the valve. An air gap shall exist between shaft packing and bottom of actuator for visual inspection, adjustment or complete replacement of packing without disturbing any portion of the valve or actuator except the packing gland follower. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.

I. Pressure ratings shall be 175 psi (1,207 kPa) on sizes 3”-12" (80-300mm) and 150 psi (1,034 kPa) for 14"-36" (350-900mm). Every valve shall be given a hydrostatic and seat test, with test results being certified when required by the specifications.

J. Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floorstands, etc., as

specified. Valves 6" and larger shall be equipped with worm gear actuators. Non-buried actuators shall clearly indicate valve position.

K. Worm Gears shall be constructed in accordance AWWA C517. Actuators shall be enclosed in a cast iron housing with outboard seals to protect the bearings and other internal components. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Input shaft and fasteners shall be made of stainless steel.

L. Externally adjustable open and closed position stops shall be provided. The adjustable closed position stop shall be used to set closing torque and provide adjustment to compensate for change in pressure differential or flow direction.

M. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuators shall be 90% grease filled. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals.

N. Eccentric plug valves shall have a two year warranty from date of shipment. Manufacturers name shall be casted in body of valve and a metal tag containing a serial number shall be riveted to the valve for future parts identification.

O. Valves and actuators shall be DeZurik PEF, Val-matic 5600R, or Clow F5400.

2.02 PRESSURE REGULATING VALVES

A. Pressure regulating valves shall be a hydraulically operated, diaphragm actuated, pilot controlled modulating globe valves. The valve shall seal by means of a corrosion-resistant seat, and resilient, rectangular seat disc. These and other parts shall be replaceable in the field without removing the valve from the line. The stem shall be guided top and bottom by integral bushings, guides, and bearings. The diaphragm shall not be used as a seating surface, nor shall pistons be used as an operating means. The pilot system shall be furnished complete and installed on the main valve, and shall include one or two solenoid pilot valves, a strainer, separate opening and closing speed controls, and ball valves for isolating the control system from the main valve.

B. Where shown on the drawings, a position transmitter shall be installed on the valve and driven by an extension of the valve stem. It shall be a magnetic, non-contact type with analog output, and shall include terminal strips for the communications link to the PLC and for the solenoid pilots, as well as an LED for zeroing purposes. The enclosure shall be weatherproof per NEMA 4. The valve and controls shall be hydrostatically and operationally tested prior to shipment.

C. The main valve body and cover shall be ductile iron per ASTM A536, Grade 65-45-12. End connections shall be Class 150 flanges per ANSI B16.42 (flat faced), suitable for a maximum working pressure of 250 psi. Main valve bonnet studs and nuts shall be stainless steel. Disc retainer and diaphragm washer shall be cast iron per ASTM A216-WCB. All internal ferrous surfaces shall be coated with 10-12 mils dft of NSF61 certified epoxy, Tnemec Series N140 or approved equal. External surfaces shall be coated with 10-12 mils dft of the same epoxy. The main valve stem, nut, and spring; disc guide, seat and cover bearing shall be stainless steel per ASTM A743. Elastomers (diaphragms, resilient seats and O-rings) shall be Buna-N rubber. Diaphragm shall be nylon reinforced Buna-N rubber. The main valve cover will have an X101 visual valve position indicator for monitoring the valve position at any time.

D. The valve shall have 316 stainless steel anti-cavitation trim internals. The main valve trim will include a solid one piece stainless seat with radial slots to break pressure as it exits the seat area to negate any cavitation damage to the valve pressure boundary areas or downstream piping.

E. All speed controls, isolation ball valves, oversized control line tubing, solenoid valves, needle valves, cover bolts, and nuts shall be stainless steel. Orifice plates, where required, shall be 303 Stainless Steel.

F. A high capacity strainer shall be provided that removes harmful debris from the water supply to protect the pilot control system. The strainer shall have a secondary filter to allow backwashing of the strainer to occur without taking the strainer off line thus providing an uninterrupted supply of filtered water to the pilot system. The strainer shall be provided with a bottom drain stainless steel ball valve with PFTE seals and rated for 400 psi inlet pressure. The stainless

steel mesh shall be 100 microns. The strainer shall be Model F76 as manufactured by Cla-Val or approved equal.

G. Pressure Regulating Valves Controls

1. PRV-713 (Size 20″ 100-20 Reduced Port/Quantity 1)

a. The valve shall function as a combination flow limiting, pressure sustaining, and solenoid shutoff valve. The valve shall modulate to limit the flow through the line discharging into the Golf Course Storage Lake while also sustaining a minimum backpressure. In the event of a drop in inlet pressure, the valve will check close drip tight. The valve shall be supplied with a solenoid valve energized to open remotely.

b. The pilot control system will consist of a CDHS2F differential control, a CRL sustaining control, and the solenoid electrical control.

1) The CDHS2F differential control will sense the pressure off of an inlet mounted X52D-1 orifice plate. It will limit the flow to 8,333 gpm by limiting the differential across a fixed restriction.
2) The CRL sustaining control will monitor inlet pressure and throttle the valve if the inlet drops below some predetermined low set point between 20 and 105 psi.
3) The solenoid control will be a CS3SM solenoid that will override the controls and close the main valve when called to do so. The solenoid shall have a stainless steel body with a weatherproof enclosure per NEMA 4, suitable for operation on 120 VAC, 60 Hertz and be normally closed (energized to open).

c. The pilot system will also contain isolation valves and gages for start up, setting, adjustment, maintenance and troubleshooting.

d. Model 643G-19BCDPSVYKCKOKX D.S. 150 ansi X105 LCW as manufactured by Cla-Val or approved equal.

2. PRV-718 (Size 16″ 100-20 reduced port/Quantity 1)

a. The valve is to provide electronic flow control with hydraulic sustaining backup. The valve shall be supplied with opening and closing solenoids in the pilot system that are controlled by the PLC based on the water level

in the effluent pump station wet well level. When open, the valve will also act as a pressure sustaining valve to maintain a minimum upstream pressure while controlling the flow.

b. The pilot control system will consist of a CRA sustaining control, and two electrically controlled solenoids.

1) The CRA sustaining control will monitor inlet pressure and throttle the valve if the inlet drops below some predetermined low set point between 20 and 105 psi.

2) Two, 2-way solenoids shall be mounted on the valve cover. One will open to exhaust water from the cover (opening) and one will open to admit water onto the cover (closing). The solenoids shall have a stainless steel body with a weatherproof enclosure per NEMA 4, suitable for operation on 120 VAC, 60 Hertz. One solenoid shall be normally closed (energized to open) and the other shall be normally open (energized to close). Upon loss of power, the valve shall default to the close position.

3) The pilot system will also contain isolation valves and gages for start up, setting, adjustment, maintenance and troubleshooting.

4) Provide flange filler to make up any differential in lay length between existing and proposed valve.

5) Model 631G-BW BCPSVYKCKOKX D.S. 150ANSI X105 LCW as manufactured by Cla-Val or approved equal.

3. PRV-712(Existing Size 20″ 100-20 reduced port/Quantity 1)

a. This is an existing valve to be modified to provide electronic flow control with hydraulic sustaining backup. The valve shall be supplied with opening and closing solenoids in the pilot system that are controlled by the PLC. It will also act as a pressure sustaining valve to maintain a minimum upstream pressure, while controlling the flow. In the event of a drop in inlet pressure, the valve will check close drip tight. The existing valve pilot system will be replaced and the main valve will be rebuilt

including all pre-bent tubing, fittings and associated pilot controls.

b. The pilot control system will consist of a CRA sustaining control, and two electrically controlled solenoids.

1) The CRA sustaining control will monitor inlet pressure and throttle the valve if the inlet drops below some predetermined low set point between 20 and 100 psi.

2) Two, 2-way solenoids shall be mounted on the valve cover. One will open to exhaust water from the cover (opening) and one will open to admit water onto the cover (closing). The solenoids shall have a stainless steel body with a weatherproof enclosure per NEMA 4, suitable for operation on 120 VAC, 60 Hertz. One solenoid shall be normally closed (energized to open) and the other shall be normally open (energized to close). Upon loss of power, the valve shall default to the open position.

c. The pilot system will also contain isolation valves and gages for start up, setting, adjustment, maintenance and troubleshooting.

d. The valve kit shall be a kit to convert existing valve into a Model 631G-CFBDSPVYKX D.S. 150ANSI X105 LCW as manufactured by Cla-Val or approved equal.

H. The manufacturer shall provide a direct factory employee for start up and training for the operations and maintenance personnel

2.03 SWING CHECK VALVES

A. Check valves shall be swing-type, flanged with an external hinge arm with outside lever and adjustable weight meeting the requirements of AWWA C508. Double door, torsional-spring, and internal spring type check valves are not acceptable. Check valves shall be flanged and have a design working pressure of no less than 150 psi.

B. The outside lever and weight assembly shall be capable of being relocated to the opposite side without requiring modifications to the valve body.

C. Arms with discs attached shall be hinged at the top of the body and attached to the shaft. Features or

devices to limit arm-travel shall be incorporated into the valve body. Utilization of adjacent pipeline flanges to restrict arm travel will not be allowed. For sizes 6″ and larger, the ratio of bolt diameter to arm width shall not exceed 0.3 and the ratio of bolt diameter thickness shall not exceed 0.9.

D. The disc shall clear the inside of the pipe by 1.125″ minimum throughout its entire travel.

E. Valve materials shall be as follows:

1. Body, cover, disc, weight- cast iron, ASTM A126 c1.B.
2. Rubber disc facing, body O-ring, stuffing box O-ring, cover gasket, hinge pin O-rings- ASTM D-2000 rubber.
3. Stuffing box- bronze, ASTM 138
4. Seat ring, clapper arm, retaining washer- bronze, ASTM B584.
5. Stud nut- bronze, ASTM B62
6. Disc stud- bronze, ASTM B21
7. Stuffing Box Hinge P9n- 303 Stainless Steel, ASTM A276
8. Set screw, jam nut- stainless steel, ASTM A194
9. Cover, volt, nut, test plug- steel, ASTM B18.2.1
10. Weight lever- A36 steel

F. Valves shall be as manufactured by Mueller, Clow, American, Kennedy, M&H, or approved equal.

G. When there is no flow, the check valve disc shall hang lightly against its seat in an almost vertical position. When there is flow, the disc shall swing clear of the waterway.

H. Valves shall be air cushioned to reduce valve slam.

I. Valves shall be constructed so that the disc and body seat may be removed and replaced without removing the valve from the line.

J. Swing Check Valve Locations

1. Plant Drain Pump Station, 8-inch size
2. Lake Gravity Disk Filter Backwash Pump Station, 4`-inch size

2.04 RESILIENT SEATED GATE VALVES

A. Gate valves with 4″ - 24″ diameters shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509 of latest revision and in accordance with

the following specifications. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve. Valves for potable water, reclaimed water and wastewater service shall be epoxy coated.

B. The valves shall be non-rising stem with the stem made of cast or forged stainless steel, specified in AWWA C509. Stem seals shall be provided and shall be of the O-ring type, two above and one below the thrust collar. The top two O-rings shall be field replaceable without removing the valve from service. Low friction thrust bearings shall be provided above and below the stem collar.

C. The sealing mechanism shall consist of a cast iron gate completely encapsulated with a vulcanized synthetic EPDM rubber coating. The resilient sealing material shall be permanently bonded to the cast iron wedge with a rubber tearing bond meeting ASTM D429. The resilient sealing mechanism shall provide zero leakage at 200 psi differential pressure with the line flow in either direction.

D. The valve body, bonnet, and bonnet cover shall be cast iron ASTM A126, Class B. The stem nut shall be solid bronze. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating meeting the requirements of AWWA C550. A handwheel or wrench nut shall be provided for operating the valve. All valves shall be tested in strict accordance with AWWA C509.

E. Valves shall be equal to the following models: American Series 2500, Clow / Kennedy / M&H; U.S. Pipe Metroseal 5460.

F. All internal parts shall be removable from the bonnet without removing the body from the pressure main.

G. Discs of valves shall be operated by methods which will allow operation in any position with respect to the vertical. Valves for interior piping or exposed above grade outside structures, shall be handwheel operated. Valves four inches and larger, buried in earth shall be equipped with 2-inch square operating nuts, extension stems, valve wrenches, valve boxes and covers. Valves shall be fitted with joints suitable for the pipe with which they are to be used. Valves located above grade or in valve vaults shall be OS & Y with flanged joints. All exterior bolts, nuts and washers shall be stainless steel. The direction of opening for all valves shall be to the left (counter-clockwise).

H. Unless otherwise shown or specified, valves shall be rated at not less than 150 psi cold water, nonshock. The manufacturer's name and pressure rating shall be cast in raised letters on the valve body.

2.05 AIR RELEASE VALVES (ARV)

A. Automatic Air Release Valves for Plant Drain Pump Station (ARV-1014) and Lake Gravity Disk Filter Pump Station (ARV- 755): Provide and install automatic air release valves as shown on the drawings.

1. The air release valve shall automatically release accumulated air and gas from the pipeline or system while in operation and under pressure. It shall have an elongated body not more than 12" (305mm) tall suitable for use with sewage, wastewater or other "dirty" fluids and be of the float operated, compound lever type with an adjustable seat.

2. The valve shall be 2" NPT inlet and ½" NPT outlet connections and an additional plugged 2" NPT connection near the bottom for cleaning. There shall also be plugged ½" NPT connections near the top and a 1" NPT connection near the bottom for testing, draining and/or the installation of backflushing accessories.

3. The valve's venting orifice diameter shall be 3/16" for 150 PSI maximum working pressure.

4. The valve body and cover shall be rated for 200 PSI and made from cast iron conforming to ASTM A126 Class B.

5. The float ball, orifice and internal linkage mechanism shall be made from Type 316 stainless steel. Non-metallic components are not acceptable.

6. The seat shall be replaceable and made from Buna-N rubber or other suitable elastomer compounds.

7. The exterior of the valve shall be shop coated with enamel primer

8. The air release valve shall be supplied with backflushing accessories consisting of a SS ball valve for inlet isolation, a 1" SS ball valve for draining and a ½" SS ball valve for flushing, quick connect couplings and a minimum of 5 ft. of rubber hose.

9. Valves shall be Figure 929ISF as manufactured by GA Industries, LLC, Cranberry Township, PA USA or approved equal.

B. Manual Air Release Valves at above grade valve assemblies (ARV 708,713 & 714)

1. 1" Corporation Valve- Mueller B-20046 with plug or approved equal.

2.06 CORPORATION STOPS AND SADDLES

A. Corporation Stops

2. AWWA C800, ASTM B62 red brass, alloy 85-5-5-5, ball type, 300 psi rated working pressure. Mueller B-20046 or approved equal.

B. Saddles

1. Potable Water and Reclaimed Water

a. ASTM B62 red brass, alloy 85-5-5-5, Smith-Blair 325 Bronze saddles
b. Stainless Steel straps, washers and nuts

2. Wastewater, Plant Drain and Backwash

a. Romac Style 306 double bolt stainless steel service saddle.

2.07 VALVE BOXES

A. All buried valves shall have cast-iron two or three piece valve boxes as required. Valve boxes shall be provided with suitable heavy bonnets to extend to elevations at or slightly above the finished grade surface as directed by the Engineer. The barrel shall be two or three-piece, screw type, having a 5 1/4-inch inside diameter on the bottom barrel. The bottom barrel shall have a flange at the bottom having sufficient bearing area to prevent settling, valve boxes shall be complete with cast iron covers. Covers shall have "WATER", "SEWER", or 'RECLAIM', as applicable, cast into the top. All valves shall have actuating nuts extended to within 4' of the lid of the valve boxes. Extension stems shall be attached to the valve operating nut with a stainless steel fastener. Reclaimed valve box lids shall be 9 X 9 inches square, load bearing, painted purple and identified as noted above. Grade adjustment risers shall be the same cast iron material as the valve box assemblies. An AFC

entering device, Part No. B59434, shall be installed in the valve box. Valve boxes shall be provided with a concrete base and identification disks per the detail on the drawings. The valve boxes shall be Tyler Pipe 6850 Series, Box 461-S through 668-S, Russco 461-S through 668-S or an approved equal.

2.08 RESTRAINED FLANGE ADAPTER

A. Restrained flange adapters shall be of the size and pressure rating required for each installation and shall be suitable for use on either PVC, Steel, HDPE (with inserts) or ductile iron pipe.

B. Restrained flange adapters shall be used in lieu of threaded or welded flanged spool pieces. Flange adapters shall be made of ductile iron conforming to ASTM A536, 65-45-12, and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10.

C. Restraint for the flange adapter shall consist of a plurality of individual actuated gripping wedges to maximize restraint capability. Torque limited actuating screws shall be used to insure proper initial set of gripping wedges.

D. The flange adapters hall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum 0.6″ gap between the end of the pipe and the mating flange without affecting the integrity of the seal. The joints shall be capable of deflecting between 5 degrees for 3-inch pipe and 0.5 degrees for 60-inch pipe.

E. For PVC pipe, the flange adapter will have a pressure rating equal to the pipe.

F. For Ductile Iron pipe, the flange adapter shall have a safety factor of 2:1 minimum.

G. The restrained flange adapter is comprised of two rings. The first is the restraint ring which incorporates wedges around the circumference of the ring to grip the pipe firmly and securely. The wedge style of restraint offers enormous pullout strength when compared to set screw restraints. The resiliency of the wedge style restraint allows the flange adapter to withstand severe moment loads.

The second ring is the gasket ring which separates the seals dedicated to each sealing surface. This ring allows pipe to be cut to lengths in the field at a

tolerance of 0.6 inch or more. And the gasket ring also enables the joint to deflect during assembly.

H. The restrained flange adapter shall be coated with fusion bonded epoxy paint at the factory.

I. The flange adapter shall be the Series 2100 Megaflange adapter as manufactured by EBAA Iron, Inc or approved equal.

J. All flange adapters shall have a sufficient number of factory installed anchor studs to meet or exceed the test pressure rating for this project, 180 psi minimum.

2.09 SOLID SLEEVE COUPLINGS

A. Solid sleeve couplings shall be used in locations as shown on the Drawings.

1. Solid sleeve type couplings shall be used with all buried piping. The couplings shall be of ductile iron meeting the requirements of ANSI/AWWA C110/A21.10 as manufactured by U.S. Pipe, American Cast Iron Pipe, McWane, or Equal. Solid sleeves shall be furnished with mechanical joint fittings. The solid sleeve coupling shall be provided with 316 stainless steel bolts and nuts unless indicated otherwise.

2. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.

2.10 RESTRAINING CLAMPS

A. Restraining clamp assemblies as detailed in the drawings for use at hydrant connections to water mains, or at fittings where shown on the drawings, shall be as manufactured by EBAA Iron Sales, Inc., Eastland, TX, or Equal.

2.11 MANUAL VALVE ACTUATORS

A. General

1. All manual valve actuators shall conform to Section 3.8 of the AWWA C504 Standard Specification and shall be manually operated.

2. Actuators shall be capable of seating and unseating the disc against the full design pressure and velocity, as specified for each

class, into a dry system downstream, and shall transmit a minimum torque to the valve. Actuators shall be rigidly attached to the valve body.

3. Valve actuators shall be provided, mounted and tested by the valve manufacturer.

B. Manual Actuators

1. Manual actuators shall have permanently lubricated, totally enclosed gearing with handwheel and gear ratio sized on the basis of actual line pressure and velocities. Actuators shall be equipped with handwheel, position indicator, and mechanical stop-limiting locking devices to prevent over travel of the disc in the open and closed positions. They shall turn counter-clockwise to open valves. Manual actuators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Actuators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 pounds in the handwheel or chainwheel. Actuator components shall withstand an input of 450 foot pounds for 30″ and smaller and 300 foot pounds for larger than 30″ size valves at extreme actuator positions without damage. Valves located above grade shall have handwheel and position indicator, and valves located below grade shall be equipped with a two inch (2″) square AWWA operating nut located at ground level and a cast iron extension type valve box. Valve actuators shall conform to AWWA C504, latest revision.

2.12 DUCKBILL CHECK VALVE

A. Function. When line pressure inside of the valve exceeds the backpressure outside the valve by a certain amount, the line pressure shall force the bill of the valve open, allowing flow to pass. When backpressure exceeds the line pressure by the same amount, the bill of the valve shall be forced closed.

B. Check valves shall be made from EPDM rubber, and the flow operated check type shall have a flanged end connection. The port area shall contour down to a duckbill which shall allow passage of flow in one direction while preventing reverse flow. The flange and flexible duckbill sleeve shall be one piece rubber construction with nylon reinforcement. In sizes 20-

inch and larger, the bill portion shall be thinner and more flexible than the valve body, and formed into a curve of 180°.

C. The flange drilling shall conform to ANSI B16.1 Class 125/ANSI B16.5, Class 150 standards. The valve shall be furnished with SS back-up rings for installation. Nuts and bolts shall be SS.

D. Manufacturer. Valve shall be Red Valve Series 35, Proco Style 710, or approved Equal.

2.13 TAPPING SLEEVE

A. Size: 14 through 42 inches

1. Body and Outlet, ASTM A240 type 304/304L stainless steel. Nominal Pipe Size: 14 through 42 inches. Outlet Size: 3 through 24 inches.
2. Bolts and Nuts, 5/8 inch 304 SS, threaded, coated nuts for galling prevention.
3. Gaskets, ASTM D2000 MBA 710 SBR
4. Test Plug, ¾ inch 304 SS
5. Flange, ASTM A240 type 304SS, AWWA Class D plate flange, ANSI Class 150 drilling, for tapping valves.
6. Manufacturer: Romac Industries, Inc Model STS 420 or approved equal.

B. Size: 4 through 30 inches

1. Body Outlet and Lugs, ASTM A240 type 304 and 304L stainless Steel. Nominal Pipe Size: 4 through 30 inches. Nominal Outlet size: 3 through 12 inches.
2. Bolts, ASTM A193 type 304 stainless steel, 5/8 inch
3. Nuts, ASTM A194 type 304 stainless steel, coated to prevent galling.
4. Gaskets, ASTM D2000, MAA 610 SBR
5. Flange, ASTM A240 type 304SS, for tapping valves
6. Manufacturer: Romac Industries, Inc. Model SST III or approved equal.

2.14 SMALL GATE VALVES

A. Gate valves 2-1/2-in in diameter and smaller in size, shall have flanged or threaded ends as required; and shall be brass conforming to Federal Specification WW-V-54, Type I or II, solid wedge, rising-stem-type gate valves as manufactured by Jenkins Bros. or equal

products as manufactured by Crane, Fairbanks, Kennedy Valve Mfg. Co., or equal.

2.15 BALL VALVES

A. Ball Valves sizes 1/2″ to 4″ shall be TYPE 21 and shall be of true union design with two-way blocking capability. All O-rings shall be EPDM or FKM with PTFE seats. PTFE seats shall have elastomeric backing cushion of the same material as the valve seals. Stem shall have double O-rings and be of blowout-proof design. The valve handle shall double as carrier removal and/or tightening tool. ISO mounting pad shall be integrally molded to valve body for actuation. The ball valves shall have a pressure rating of 230 psi for sizes″1/2″ to 3″ and 150 psi for 4″ at 70 º F. Type 21 Ball Valves must carry a two-year guarantee, as manufactured by Asahi/America, Inc.

B. All ball valves used for chemicals prone to “off-gassing” (e.g. sodium hypochlorite, hydrogen peroxide) shall be vented to avoid entrapment of vapors.

2.16 COMBINATION AIR VALVES (CAV)

A. Wastewater Combination Air Valves shall be automatic float operated valves designed to exhaust large quantities of air during the filling of a piping system and close upon liquid entry. The valve shall open during draining or if a negative pressure occurs. The valve shall also release accumulated air from a piping system while the system is in operation and under pressure. The valve shall perform the functions of both Wastewater Air Release and Wastewater Air/Vacuum Valves and furnished as a single body.

B. Valves shall be manufactured and tested in accordance with American Water Works Association (AWWA) Standard C512.

C. Single body valves sizes 4 in. and smaller shall have full size NPT inlets and outlets equal to the nominal valve size with a 2 in. inlet on 1 in. valves. The body inlet connections shall be hexagonal for a wrench connection. The body shall have 2″ NPT cleanout and 1″ NPT drain connection on the side of the casting.

D. The valve shall have three additional NPT connections for the addition of backwash accessories.

E. The valve shall provide an extended body with a through flow area equal to the nominal size. Floats shall be unconditionally guaranteed against failure including

pressure surges. A resilient bumper shall be provided on 4 in. and larger sizes to cushion the float during sudden opening conditions. The seat shall provide drop tight shut off to the full valve pressure rating.

F. The Valve shall have a full port orifice, a double guided plug, and an adjustable threaded orifice button. The 1 in. body shall be globe style to increase float clearance and reduce clogging. The plug shall be protected against direct water impact by an internal baffle and an extended float stem. The plug shall have a precision orifice drilled through the center stem. The float shall include a sensitivity skirt to minimize spillage.

G. The valve body and cover shall be constructed of ASTM A126 Class B cast iron.

H. The float, plug shafts, and bushings shall be constructed of Type 316 stainless steel. Non-metallic guides and bushings are not acceptable. Resilient seats shall be Buna-N.

I. Backwash accessories shall be furnished and shall consist of an inlet shut-off valve, a blow-off valve, a clean water inlet valve, rubber supply hose, and quick disconnect couplings. Accessory valves shall be quarter-turn, full ported SS valves.

J. The manufacturer shall demonstrate a minimum of (5) years' experience in the manufacture of wastewater air valves. The valves shall be manufactured and tested in accordance with American Water Works Association Standard (AWW) C512. When requested, the manufacturer shall provide test certificates, dimensional drawings, parts list drawings, and operation and maintenance manuals.

K. The exterior of the valve shall be coated with a universal alkyd primer.

L. Wastewater Combination Air Valves shall be Series 804 for CAV-709 and Series 803 for CAV-711 as manufactured by Val-Matic Valve and Manufacturing Corporation, Elmhurst, IL, USA or approved equal.

2.17 BUTTERFLY VALVES

A. Butterfly valves (4" thru 48" size) shall conform to the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designated C504, except as hereinafter specified. Valves shall be Class 150A or B, and equal to those manufactured by Henry Pratt Company,

DeZurik, Mueller or approved equal. All valves shall be factory leak tested at 200 psi.

B. The face-to-face dimensions of flanged end valves shall be in accordance with AWWA Standard Specification C504 for short-body valves. Adequate two-way thrust bearings shall be provided. Flange drilling shall be in accordance with ANSI B16.1. Mechanical Joint end valve dimensions shall be in accordance with AWWA Standard Specification C504.

C. All Butterfly valves shall have a factory applied fusion bonded epoxy coating insides and outside, in accordance with AWWA C550. The interior and exterior surfaces shall be shown to be holiday free using an electronic holiday test, in accordance with AWWA C550.

D. Valve seats shall be an EPDM elastomer. Valve seats 24 inches and larger shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material with stainless Nylock screws and be capable of a 1/8 inch adjustment. Valves 20 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C 504. Where rubber seat is mounted on the valve body, the mating edge of the valve disc shall be 18-8 stainless steel or Nickel-Chrome, 80-20%. Where the EPDM seat is mounted on the valve disc, the valve body shall be fitted with an 18-8 stainless steel seat offset from the shaft, mechanically restrained and covering 360 degrees of the peripheral opening or seating surface.

E. The valve body shall be constructed of ductile iron or close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housing of the through boss-type. Butterfly valves of the “wafer”: or “spool” type will not be accepted.

F. The valve shaft shall be turned, ground, and polished, constructed of 18-8, ASTM A-276, Type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design. Shaft bearings shall be teflon or nylon, self-lubricated type.

G. All valves shall be subject to hydrostatic and leakage tests at the point of manufacture. The Class 150 valves shall be tested in conformance with AWWA C504. During

the hydrostatic test there shall be no leakage through the metal, the end joints or the valve shaft seal. No adjustment of the valve disc will be necessary after pressure test for normal operation of valve.

H. In general, the butterfly valve operators shall conform to the requirements of Section 11 of the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable and as herein specified.

I. Gearing for the operators shall be totally enclosed in a gear case in accordance with the above mentioned AWWA Standard Specification.

J. Operators shall be capable of seating and unseating the disc against the full design pressure or velocity, as specified for each class, into a dry system downstream, and shall transmit a minimum torque to the valve. Operators shall be rigidly attached to the valve body.

K. All valve operators shall conform to Section 11 of the AWWA Standard Specification and shall be manual unless otherwise shown or specified and shall have permanently lubricated, totally enclosed gearing with handwheel and gear ratio sized on the basis of actual line pressure and velocities. Operators shall be equipped with handwheel, position indicator, and mechanical stop-limiting locking devices to prevent over travel of the disc in the open and closed positions when valve is located above grade. They shall turn counterclockwise to open valves. Manual operators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Operators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 pounds on the handwheel or chainwheel when valve is located above grade. Operator components shall withstand an input of 450 foot pounds for 30″ and smaller and 300 foot pounds for larger than 30″ size valves at extreme operator position without damage. Valves located above grade shall have handwheel operators, and valves located below grade shall be equipped with a two-inch (2″) square AWWA operating nut located at ground level and cast iron extension type valve box. Valve operators shall conform to AWWA C504, latest revision.

L. The manufacturer shall certify that the required tests on the various materials and on the completed valves have been satisfactory and that the valves conform to

all requirements of the specifications and the AWWA standard.

M. Where indicated on the Drawings, extension stems, floor stands, couplings, stem guides, and floor boxes as required shall be furnished and installed.

PART 3 EXECUTION

3.01 INSTALLATION

A. All valves and appurtenances shall be installed in the location shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.

B. After installation, all valves and appurtenances shall be tested at least two hours at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the Engineer.

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 their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.

D. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe sections in Division 15.

E. Flanged joints shall be made with high strength, low alloy Corten bolts, nuts and washers. Mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe. All buried bolts and nuts shall be heavily coated with two (2) coats of bituminous paint comparable to Inertol No. 66 Special Heavy.

F. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8 inches. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall

be slipped over each pipe to a distance of about 6 inches from the end, and the middle ring shall be placed on the substantial completion date unless otherwise requested by the Owner.

G. Valve boxes with concrete bases shall be installed as shown on the Drawings. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place a cast iron box over each stem with the base bearing on compacted fill and the top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on the cover shall be parallel to pipe. Remove any sand or undesirable fill from valve box.

3.02 RESTRAINING CLAMPS AND TIE RODS ON PIPE RUN

A. Restraining clamps and tie rods shall be used on all pipe runs, as directed by the Engineer and/or shown on the Drawings. Restraining devices shall be JCM Industries, Inc. - Sur-Grip, EBAA Iron, Inc. - Megalug, Romac, or approved equal. Other types shall be submitted to the Owner’s Representative for approval.

3.03 SHOP PAINTING

A. Ferrous surfaces of valves and appurtenances shall receive a coating of rust-inhibitive primer. All pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.

3.04 FIELD PAINTING

A. All metal valves and appurtenances specified herein and exposed to view will be painted per Section 09900 with a color appropriate to its usage in accordance with the color code.

3.05 INSPECTION AND TESTING

A. Completed pipe shall be subjected to a hydrostatic pressure test for two hours at 180 psi pressure. All leaks shall be repaired and lines retested as approved by the Owner’s Representative. Prior to testing, the gravity pipelines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION

SECTION 15101

BONNETED KNIFE GATE VALVES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install complete and ready for operation four (4) bonneted knife gate valves and appurtenances as shown on the Drawings and as specified herein.

B. All knife gate valves and appurtenances shall be of the size shown on the Drawings and shall be from one manufacturer.

C. All knife gate 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.

1.02 DESCRIPTION OF SYSTEMS

A. All of the knife gate valves and materials specified herein are intended to be standard for use in controlling the flow of activated sludge from the aeration tanks.

1.03 QUALIFICATIONS

A. All of the types of knife gate valves and appurtenances shall be the product of a well established reputable firm which is fully experienced and qualified in the manufacture of the particular knife gate valve to be furnished. The knife gate valve shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.04 SUBMITTALS

A. Submit to the Engineer within 30 days after execution of the contract the name of the manufacturer of the knife gate valves to be furnished, the name of the supplier, and the date of delivery of materials to the site.

B. Complete shop drawings of the knife gate valves and appurtenances shall be submitted to the Engineer for

approval in accordance with the requirements of Section 01340 – Shop Drawings, Project Data and Samples.

C. Operation and Maintenance (O&M) Manuals shall be submitted in accordance with Section 01730 – Operating and Maintenance Data.

D. Submit Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.

E. Submit shop drawings showing all dimensions and all materials used in fabrication.

F. Submit manufacturer's parts list, and operation and maintenance literature and instructions.

G. Submit three (3) copies of the Service Representative's Report of Field Tests.

1.05 TOOLS

A. Special tools, if required for normal operation and maintenance shall be supplied with the knife gate valves.

1.06 QUALITY ASSURANCE

A. Subject to compliance with the requirements of this Section, manufacturers offering bonneted knife gate valves which may be incorporated into the Works include the following:

1. Hilton Valve, Inc. Fig.H-201-B-T304
2. Orbinox
3. Rovalve

B. Related Work Specified Elsewhere

1. Section 09900 – Painting and Coatings

PART 2 PRODUCTS

2.01 BONNETED KNIFE GATE VALVES

A. Provide and install four (4) 30-inch Bonneted Knife Gate Valves to be installed on the existing 30-inch pump suction piping for four (4) proposed axial flow propeller pumps.

B. **Description**

Each Valve shall be resilient seated with a pressure-retaining bonnet that fully encloses the gate. The bonnet shall be rated at the same pressure as the valve body and shall not include any type of internal gate packing or gate wiper. A packing gland shall be located at the top of the bonnet to provide a tight seal to prevent leakage around the stem.

C. **Materials**

1. **BODY & BONNET:** Except for the resilient seat, all wetted parts of the body and bonnet shall be 18-8, ASTM A-276, Type 304SS, including fasteners. Exterior flanges and stiffeners shall be fabricated carbon steel. Flush and drain ports, shall be 304SS. The 304SS body cladding and face rings shall be fully welded to the carbon steel body – "floating" body liners are not acceptable. Each valve shall be provided with 304SS gate guides for installation in a horizontal position. The exterior of the valve shall be provided with an epoxy primer specified in Section 09900.

2. **GATE:** The gate shall be 304SS, suitable for the service conditions, and shall be ground and polished to a minimum surface finish of 32 micro-inch/inch R.M.S. to prevent damage to the seat.

3. **SEAT:** The resilient seat shall be Viton, installed in a self-retaining groove that is cut into the 304SS seat ring, and shall be replaceable without removing the valve from the pipeline. No fasteners or adhesives shall be allowed to hold the seal in place.

4. **STEM:** The stem shall be either A.I.S.I. 303SS or 304SS, with Acme threads.

5. **STEM NUT:** The stem nut shall be of acid-resisting Bronze.

6. **PACKING:** The packing shall be Teflon–impregnated synthetic fiber and the packing follower shall be 304SS. The packing shall be replaceable without disassembling the valve or removing the valve from the pipeline, and while under pressure.

7. **YOKE:** The valve yoke shall be carbon steel, designed to support the manual operator and resist twisting.

D **Construction Details**

1. **FLANGES:** Flanges shall be flat faced. The gasket surfaces shall be 304SS and shall be fully machined with a spiral serrated finish.

   Flanged drilling for the 30-inch valves shall match ANSI B16.1, Class 125. Unless otherwise specified, all flange bolt holes shall be threaded.

2. **LUBRICATION:** The valve shall be designed so that all required lubrication can be completed externally with the valve installed in the pipeline.

3. **DESIGN PRESSURE:** Unless otherwise specified, the 30-inch valves shall be rated at 50 PSIG CWP (cold working pressure).

4. **TESTING:** Manufacturer's Testing shall be conducted as follows:

   a) **Shell Test** – Each valve body and bonnet shall be hydrostatically pressure tested in the manufacturer's shop at 1.5 times the rated working pressure with no visible leakage allowed (leakage through the packing shall not be a cause for rejection, as long as there is no leakage at the rated pressure).

   b) **Gate/Seat Test** – Each valve shall be hydrostatically pressure tested at 1.1 times the rated working pressure in the direction of closure with no visible leakage through the gate material or past the seat.

E. **Manual Operator (Hand-wheel Operated Valves)**

1. The steel hand-wheel shall be sized to seat and unseat the knife gate valve at the specified operating pressure with a maximum rim pull of 60 pounds. A bevel gear operator shall be supplied for the hand-wheel.

2. Bevel gear operators shall be fully enclosed and permanently lubricated, with a sealed housing to prevent contamination.

3. Bevel gear operators shall be provided with a stem cover to protect the stem when the valve is in the open position. The stem cover shall be removable for inspection and maintenance.

4. Hand-wheels shall turn counter clockwise to open the valves.

PART 3 EXECUTION

3.01 INSTALLATION

A. All valves and appurtenances shall be installed in the location shown, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Engineer before they are installed.

B. After installation, all valves and appurtenances shall be tested at least two hours at 50psi working pressure. If any joint proves to be defective, it shall be repaired to the satisfaction of the Engineer.

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 their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.

D. Flanged joints shall be made with 316SS bolts, nuts and washers.

3.02 SHOP PAINTING

A. Ferrous surfaces of valves and appurtenances shall receive a coating of rust-inhibitive primer. All pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.

3.03 FIELD PAINTING

A. All metal valves and appurtenances specified herein and exposed to view will be painted per Section 09900 with a color appropriate to its usage in accordance with the color code.

END OF SECTION

SECTION 15102

POWER-ACTUATING DEVICES FOR VALVES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes furnishing and installing power-actuating devices that are externally mounted on valves as shown on the Drawings and as specified herein. Actuator types included are electric-motor type producing a multi-turn rotary motion.

B. Related Work specified elsewhere:

1. Sections 13300, 13310, 13320, 13330 – Instrumentation and Controls
2. Section 15100 – Valves and Appurtenances
3. Division 16 – Electrical Work

1.02 SUBMITTALS

A. Coordinate with Instrumentation and Valve suppliers. Check installation arrangements to prevent conflicts with piping and other equipment. Provide three (3) sets of final Shop Drawings to Engineer for use in observing installation and for record purposes.

B. All submittals shall be in accordance with Section 01340 – Shop Drawings, Project Data and Samples.

C. Submit certificates from manufacturer showing compliance with specified requirements and standards.

1.03 QUALITY ASSURANCE

A. Power-actuating devices shall conform to the requirements of ANSI/AWWA C540 except as modified in this Section.

B. Actuators shall be assembled to new valves at the valve manufacturer’s factory, bench tested for alignment, and shipped to the job site as a complete assembly.

1.04 ACCEPTABLE MANUFACTURERS

A. Subject to complying with specified requirements, manufacturers offering actuators which are acceptable for use on this project are limited to the following:

1. Rotork IQ/IQT
2. Limitorque MX

1.05 OPERATION AND MAINTENANCE MANUALS

A. Operations and Maintenance manuals shall be submitted as outlined in Specification 01730 – Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 GENERAL

A. Actuators shall be sized for the required operational characteristics of the valves as listed in the Valve Actuator Data Sheet and for the required torque or thrust, shaft diameter, thread characteristics and keyway dimensions of the valve actually furnished.

B. Actuators shall be designed for indoor and outdoor service and shall be capable of mounting in any position.

C. Torque capacity of the actuators shall be sufficient to operate the valves with the maximum pressure differential, as indicated in the Valve Schedule, with a safety factor of 1.5. Actuators in modulating service will be selected such that the required dynamic valve torque is no more than 60% of the electric actuators maximum rated breakaway of torque.

D. Operating time for full limits of travel shall be not more than 2 seconds per inch diameter of the valve, +/- 50 percent through 20 inches; +/- 30 percent for valves 24 inches and larger. Operating time shall not be less than 30 seconds for all modulating valves.

E. Actuators shall be capable of operating in ambient temperatures ranging from 0 degrees F to 160 degrees F.

F. For open/close (non-modulating) actuators, the gearing, motor and contactor shall be capable of up to 60 starts per hour without overheating.

G. For modulating actuators, the gearing, motor and contactor shall be capable of up to 1200 starts per

hour without overheating. This includes both discrete and analog setpoint modulation.

H. The actuators shall include, in one integral housing, individual compartments for the motor, gearing, wiring terminals, and control circuits. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal. The inner seal shall protect the motor and all other internal electrical elements of the actuator from entrance of moisture and dust when the terminal cover is removed. Double cartridge shaft seals shall be provided on the hand wheel and output shafts for weatherproof protection. All external fasteners shall be stainless steel. Compartments shall be provided with moisture and dust-proof rigid cast covers meeting NEMA 6, certified to submergence in 6 ft of water for 30 minutes. Actuators located in classified areas shall be suitable for use in Class 1, Division 1, Group D environments.

I. Gearing shall consist of a worm shaft and worm gear pinion operating in an oil bath. All gearing shall be hardened alloy steel or bronze. The worm gear pinion shall be alloy bronze. Gears shall be rated at twice the output torque of the operator and shall be designed to withstand the stall torque of the motor without failure. Worm gear drive shall be self-locking to prevent creeping of the valve disc in an intermediate position. Heavy-duty grease shall protect gearing and sealed ball bearings of the main shaft for five years without changing. The gearing shall be designed to allow field repair and change in gear ratio. Over-travel of the operator shall be prevented by internal mechanical stops cast into the actuator.

J. A mechanical dial position indicator shall be furnished to continuously indicate the position of the valve at and between the fully open and fully closed positions. The indicator shall be driven by gearing driven off of the main worm gear pinion and shall operate when the actuator is in either the electrical mode or manual mode.

K. A handwheel shall be permanently attached for manual operation. A planetary gear assembly shall be provided between the handwheel and the worm shaft if required to reduce the force necessary to operate the handwheel to less than 40 pounds. A positive declutch mechanism shall engage the handwheel when required. When the actuator is set in the declutched position for

handwheel operation, it shall return automatically to electric operation when the actuator motor is energized. The handwheel shall not rotate during electric operation nor shall a fused motor prevent handwheel operation.

2.02 ACTUATOR ELECTRIC MOTOR AND ACCESSORIES

A. The drive motor shall be specifically designed for actuator service and shall be characterized by high starting torque and low inertia.

B. Motors shall be 460 volts, three phase, 60 Hz AC reversible squirrel cage induction type motors and shall be specifically designed for modulating service where indicated on the Valve Schedule.

C. Motors shall be totally enclosed, non-ventilated, with NEMA Class H insulation minimum and a maximum continuous temperature rating of 120 degree C (rise plus ambient). A 120 VAC space heater shall be provided in the motor compartment.

D. The electric motor shall have a time rating of at least 15 minutes at 104°F (40°C) or twice the valve stroking time, whichever is longer, at an average load of at least 33% of maximum valve torque.

E. Motor bearings shall be permanently lubricated by premium lubricant. The motor shall have plug and socket electrical connection to facilitate easy removal and replacement.

F. The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel with either phase sequence of the three-phase power supply connected to the actuator.

G. The motor shall include single phase protection. A suitable thermal protection device shall be incorporated in the motor or motor starter circuits, connected to a tripping device. Fast acting fuses shall be provided to protect solid state components.

H. The motor shall be capable of starting against the rated load in either the open or closed direction when voltage to the motor terminals is plus or minus ten (10) percent of nameplate rating.

I. Open/Close actuators shall be furnished with electro-mechanical reversing starters. Modulating actuators

shall be furnished with solid state reversing starters utilizing thyristors.

J. Leads from the motor shall be brought to the control circuit (limit switch) compartment without external piping or conduit box. An adequately sized space heater shall be installed in the control circuit compartment to aid in the prevention of damage resulting from condensation. The following items shall be located in the control circuit compartment.

K. Torque limit switches shall be provided to de-energize the motor control circuit in the event of a stall when attempting to unseat a jammed valve and when torque is exceeded during valve travel. Each actuator shall have an open direction torque switch and a close direction torque switch. The torque switches shall be mechanically operated and able to be set in torque units. Torque switches shall be calibrated prior to the actuator's assembly to the valve.

L. Travel limit switches shall be provided to de-energize the motor control circuit when the actuator reaches the limits of travel in the open and close directions. The limit switch drive shall be of the counter gear type and "in step'" with the actuator output drive at all times in either the electrical or manual mode of operation. A minimum of eight (8) contacts, four (4) normally open and four (4) normally closed, shall be supplied at each end of valve travel (total of 16 contacts). Limit switches shall be fully adjustable when power is applied to the actuator.

M. The electrical terminals shall be housed in a double sealed terminal compartment isolated from the rest of the actuator components. All control terminations shall have plug and socket connections such that removal of the terminal compartment cover simultaneously disconnects all wiring in the compartment. The actuators shall be designed to operate from a single 480VAC, 3-phase source. The actuators shall be furnished with fuses inside the terminal compartment. A quantity of two – ¾ inch NPT conduit entries shall be furnished.

N. Motor enclosures shall be as listed in the Valve Actuator Data Sheet.

2.03 ACTUATOR CONTROLS

A. Modulating actuators shall have a position feedback potentiometer mounted directly to the valve actuator gearing inside the gearing compartment. The potentiometer shall provide a 4-20 mA signal corresponding to valve position. Modulating valve actuators shall be designed to respond to either a 4-20 mA DC analog signal or a digital pulse signal as specified herein or as required to coordinate with the requirements of Section 13100.

B. Modulating valve actuators designed to respond to a 4-20 mA DC signal shall be provided with a valve positioner, which shall position the valve proportional to an externally generated 4-20mADC signal. The valve positioning control circuitry shall position the valve by comparing the command signal with the present valve position as indicated by the feedback potentiometer. The positioner shall be field adjustable to fail to the "open," "closed," or "last" position on loss of 4-20 mA DC command signal.

C. Modulating valve actuators designed to respond to "pulse" open/close signals shall operate the valve during the time the open or close pulse signal is high. Modulating actuators designed to respond to "pulse" open/close signals shall have the latching circuitry described for open/close actuators disabled.

D. Actuators shall contain wiring and terminals for the following control functions. All dry contacts shall be rated for 5A at 250VAC.

1. Open, Close, and Stop commands from external dry contacts (utilizing internal 24VDC power supply) and/or from an external signal of 12V to 120V. The inputs for the open, close, stop signals shall be field selectable to respond to either maintained or momentary remote signals. In momentary mode, the actuator shall have internal latching circuitry that causes the operator to drive the valve to its limit of travel upon receipt of the momentary contact signal unless a stop signal is received.

2. Remote Local-Off-Remote selector switch, Open/Close pushbuttons, and Open/Closed pilot lights for a remote manual control station (see below). The remote Local-Off-Remote selector switch and Open/Close pushbuttons shall be a dry

contact input to the actuator control circuitry. The Open/Closed pilot lights shall be powered from the valve actuator control power.

3. Four (4) unpowered contacts shall be provided which can be selected to indicate valve “Opened” and “Closed” position, “Remote” status of the actuator, and fail status of the actuator. The fail status contacts shall activate upon motor overtemperature and actuator overtorque as a minimum.

4. Terminals for 4-20mADC position command and 4-20mADC position feedback as described above for modulating actuators.

E. Local Controls

1. Actuators shall be furnished with a Local-Off-Remote selector switch; Open, Close, and Stop pushbuttons for local control; a red lamp indicating closed and a green lamp indicating open. L-O-R switch shall be padlockable in any of the three positions.

2. When the LOR is in the “Local” position, open/close control shall be by the open and close pushbuttons on the actuator. The stop push button shall stop the actuator travel.

   a. When the LOR is in the “Off” position, the actuator shall not operate.

   b. When the LOR is in the “Remote” position, the actuator shall be controlled by remote inputs from the PLC or from the remote manual controls station.

3. The local controls shall be arranged so that the direction of travel can be reversed without the necessity of stopping the actuator.

F. Remote Manual Control Station

1. Where indicated in the Valve Schedule, manual actuator controls shall be furnished in a separate NEMA 4X stainless steel enclosure (NEMA 7 if located in a classified area). Manual control station controls shall include Hand–Off-Auto Selector switch; Open, Stop, and Close

pushbuttons; a red lamp indicating closed and a green lamp indicating open.

a. When the HOA is in the “Hand” position, open/close control shall be by the open and close pushbuttons on the remote manual control station. The stop push button shall stop actuator travel.

b. When the HOA is in the “Off” position, the actuator shall not operate.

c. When the HOA is in the “Auto” position, the actuator shall be controlled by remote inputs to the valve actuator from the PLC.

2.04 PAINTING AND COATINGS

A. Actuators shall be painted in accordance with the requirements of the specified Standard with finish coats and colors conforming to the requirements of Section 09900 – Painting and Coatings.

PART 3 EXECUTION

3.01 SHIPPING, HANDLING AND STORAGE

A. Assembled actuators and valves shall be packaged, shipped and stored in accordance with the requirements of the specified Standard.

3.02 INSTALLATION

A. Install new actuators and valves as specified for valve installations. Make necessary piping, electrical and instrumentation connections.

3.03 TESTING

A. After installation, test valves and actuators in accordance with the requirements of Section 15100 – Valves and Appurtenances.

VALVE ACTUATOR DATA SHEET

DATA SHEET NOTES

1. Quantity of valves on this project shown underneath.

2. Status of valve:
   Relocate = existing valve with existing actuator to another location.
   Replace = Replace valve with another valve. Use the existing actuator.
   New = Provide and install new valve with new actuator.

3. Nominal diameter of valve.

4. Type of valve: Gate, Ball, Plug, Butterfly, Motorized Check, V-port Ball.

5. Maximum differential pressure across closed valve at time of actuation.

6. Stroking time: Time for full travel operation of valve.

7. Available Voltage.

8. Maximum flow rate through the fully open valve at time of actuation.

9. Type of valve operation required: Open-Close; Throttle; Modulate.

10. Electric enclosure required: NEMA 4 (Water-tight); NEMA 6 (Submersible); NEMA 7 (Hazardous).

1	2	3	4	5	6	7	8	9	10
Valve No.	**Valve Qty**	**Valve Dia.**	**Valve Type**	**Max Diff Pres**	**Stroking Time**	**Voltage**	**Max Flow Rate**	**Type of Oper**	**Elec Enc.**
MOV-701	1	18″	Plug	150 psi	90 sec	480 volt 3 Phase	6,300 GPM	Open/ Close	NEMA 4
MOV-702	1	20″	Plug	150 psi	90 sec	480 volt 3 Phase	8,400 GPM	Open/ Close	NEMA 4
MOV-703	1	18″	Plug	150 psi	90 sec	480 volt 3 Phase	6,000 GPM	Open/ Close	NEMA 4
MOV-707	1	18″	Plug	150 psi	90 sec	480 volt 3 Phase	6,000 GPM	Open/ Close	NEMA 4
MOV-714	1	30″	Plug	150 psi	90 sec	480 volt 3 Phase	10,500 GPM	Modulate	NEMA 4

END OF SECTION

SECTION 15103

INTAKE SCREENS

PART 1 GENERAL

1.01 WORK INCLUDED:

A. This section covers the furnishing and installation of Intake Screens and appurtenances as shown on the drawings and specified herein.

1.02 QUALITY ASSURANCE;

B. The entire intake screen system shall be furnished by a single manufacturer who shall comply with the following:

1. The equipment manufacturer must maintain an ongoing quality assurance program, including ISO-9000 certification.

2. All welders must maintain certification to ASME Section IX. Copies of certifications shall be provided upon request.

3. The single manufacturer supplying this equipment must be able to furnish proof of over 10 installations and 5 years of manufacturing equipment of similar technology.

1.03 SUBMITTALS

A. Shop Drawings – Submit shop drawings in accordance with Section 01340 for approval of the following:

1. Drawing(s) showing screen diameter, screen length, assembly length, interface dimensions for outlet, materials of construction and assembly weight.

2. Weld Certifications

3. Evidence of a statistical control program

4. Provide supporting flow distribution data where calculation methods are verified by physical flow distribution tests.

5. Provide the manufacturer's clean screen assembly headloss per the requirements in Part 2.

PART 2 PRODUCTS

2.01 GENERAL

A. The intake screen system shall be Model T-21HC as manufactured by Johnson Screens, Hendricks Screen Model T21 or approved equal.

2.02 CAPACITY

A. The intake assembly capacity shall be 2,600 GPM at a maximum through-slot velocity, as a result of water withdrawal, of 0.5 feet per second. The corresponding average through-slot velocity shall be 80% - 90% of the maximum velocity. At this flow rate the pressure drop through the clean screen surface shall be approximately .0022 psi. Pressure drop through the entire intake assembly shall be approximately .4243 psi at the rated flow. The hydraulic design of this system is based on this maximum headloss – screens that exceed this headloss are not acceptable.

B. The total intake assembly capacity of 2,600 GPM shall be handled by one (1) intake tee screen assembly.

C. Evidence of the intake assembly capacity and flow distribution shall be able to be provided by a Computational Fluid Dynamic (CFD) analysis, supplied by the manufacturer. Any proposed alternates MUST provide a CFD to support the flow distribution claims. The CFD Analysis Method must be verified by actual physical testing.

2.03 STRENGTH

A. The intake assembly shall be designed to withstand a differential hydrostatic collapse pressure of 4.32 psi (10 feet of water).

B. Design stress used for determining strength of the assembly shall be no more than 90% of the published yield strength of the material used. Strength calculations verifying compliance with these criteria shall be provided upon request.

2.04 CONSTRUCTION

A. The surface wire, support beam and stiffener structure shall be an all-welded matrix designed to provide the specific strength with minimal interference with the through screen flow pattern.

B. End plates and tee body shall be a minimum of 0.15 inches thick. All structural butt welds shall be full penetration fillet welds and shall be the thickness of the thinner component.

2.05 SLOT OPENING SIZE

A. The screen slot size shall be 0.50 inches. The open area for this slot opening shall be 87.57%.

1. Slot size shall be controlled and continuously monitored during manufacture.

2. For slot openings of 0.040″ through 0.100″ the mean slot size shall be within +/- 0.002″ with standard deviation no greater than 0.002″ throughout the assembly.

3. For slot openings greater than 0.100″ the mean slot size shall be within +/- 0.003″ with a standard deviation no greater than 0.003″ throughout the entire assembly.

2.06 MATERIALS

A. The main outlet flange shall mate with a 16″ flange with a flange pattern equal to AWWA C-207, Table 2, Class D.

B. The intake screen material shall be manufactured of 304 stainless steel material.

PART 3 EXECUTION

3.01 INSTALLATION

A. The equipment furnished according to this specification is to be intalled in strict conformance with the manufacturer’s installation instructions.

END OF SECTON

SECTION 15141

PIPE SUPPORT SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. General

1. Furnish all labor, materials, tools, equipment and services for all pipe support and anchor systems, in accordance with the provisions of the Contract Documents.

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

4. The layout of pipe supports is the responsibility of the Contractor, and must take into consideration pipe material, joint type, location, and other requirements of these specifications.

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. American National Standards Institute (ANSI)

2. American Society of Mechanical Engineers (ASME)

3. American Society for Testing and Materials (ASTM)

4. ASTM A575 Merchant Quality Hot-Rolled Carbon Steel Bars

5. American Welding Society (AWS)

6. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)

7. MSS SP-58-67 Pipe Hangers and Supports - Materials and Design

8. MSS SP-69-66 Pipe Hangers and Supports - Selection and Application

9. National Bureau of Standards (NBS)

10. NBS Handbook H-28

1.03 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.

B. Submit itemized list of wall sleeves, anchors, support devices and all other items related to pipe support system.

C. Submit scaled drawings showing guides, hangers, supports, anchors, structural members and appurtenances to describe the pipe support system.

PART 2 PRODUCTS

2.01 MATERIALS

A. All structural steel angles, rods, channels and special devices integral to pipe support systems shall be fabricated from ASTM-A-276 Type 304 stainless steel. Locate supports and accessories to support pipe system at concentrated loads and in accordance with minimum suggested by MSS SP-69-66.

2.02 PIPE SADDLES

A. Provide ASTM-A-276 Type 304 Stainless Steel pipe support saddles for pipe supported from the floor, unless otherwise indicated on the drawings. Pipe saddles equal to B-Line Figure B3092, or equal.

B. Use Schedule 40 ASTM-A-276 Type 304 stainless steel support pipe risers and floor plate recommended by saddle manufacturer.

2.03 WALL BRACKETS

A. Provide ASTM-A-276 Type 304 stainless steel wall bracket supports for pipe located near walls, including all horizontal pipe and all vertical pipe 8-feet or more above floor elevation or as indicated on the

drawings. Provide wall brackets at all changes of direction and as shown on drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install supports capable of supporting the pipe for all service and testing conditions. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.

B. Install pipe support system in accordance with highest industry practices, and in full accordance with manufacturer's recommendations. Adjust supports and hangers to allow for proper pitch of pipes.

C. Ensure design, materials of construction, and installation of pipe hangers, supports, guides, restraints, and anchors for chemical and waste piping are in accordance with ANSI B31.3, and MSS Standard SP-58 and SP-69, except where modified by this specification.

D. Check all physical clearances between piping, support system, and structure. Provide for vertical adjustment after erection.

E. Provide piping system exhibiting pulsation, vibration, swaying, or impact with suitable constraints to correct the condition. Movements from trap discharge, water hammer, and similar internal forces are included in this requirement. No system will be accepted until the adequacy and safety of the system is assured under all anticipated conditions of operation.

F. Weld supports in accordance with the requirements of AWS Code D1.1 Structural Welding.

G. Locate piping and pipe supports so as to not interfere with open accesses, walkways, platforms, and with maintenance or disassembly of equipment.

H. After erection of piping systems, and prior to pipe testing and flushing, inspect for adequacy of clearance for piping and supports.

I. Support pipes for lateral movement with clamps or brackets.

J. Provide 20-gauge ASTM-A-276 Type 304 stainless steel pipe saddle for fiberglass and plastic support points to insure minimum contact width of 4 inches.

3.02 SUPPORT SPACING

A. General: Locate pipe supports at maximum spacing scheduled unless indicated otherwise on the drawings. Provide at least one support for each length of pipe, at each change of direction and at each valve.

B. Steel, stainless steel, cast-iron, and ductile iron support schedule:

Pipe Size - Inches	Maximum Span - Feet
1-1/2 and less	5.0
2 thru 4	10.0
5 thru 8	15.0
10 and greater	20.0

C. Schedule 40 PVC Pipe, Temperature 100° or Less:

Pipe Size - Inches	Maximum Span - Feet
1	5.0
1.5	5.5
2	6.0
3	7.0
4	7.5
6	9.0
8	9.5
10	10.0
12	10.5
14	11.0

D. Schedule 80 CPVC Pipe, Temperature 140° or Less:

Pipe Size - Inches	Maximum Span - Feet
1	5.0
1.5	5.5
2	6.0
3	7.0
4	7.5
6	8.0
8	9.0

10	9.5
12	10.5

3.03 WELDING

A. Identify welding rods clearly identified meeting the requirements of ASTM and American Welding Society Standards.

B. Integral attachments include welded-on ears, shoes, plates, and angle clips. Ensure material for integral attachments is of good weldable quality. Have preheating, welding, and postheat treating in accordance with Chapter V of ANSI B31.3.

3.04 PAINTING

A. All stainless steel items shall not be painted. Painting for all other materials shall comply with Section 09900 – Painting and Coatings.

END OF SECTION

SECTION 16010

ELECTRICAL BASIC REQUIREMENTS

PART 1 GENERAL

1.01 THE REQUIREMENT

A. Furnish all labor, materials, equipment and incidentals required for a complete electrical installation for the Work associated with the Contract Documents, as hereinafter specified and shown on the Contract Drawings.

B. Provide functioning systems in compliance with manufacturer's instructions, performance requirements specified or shown on the Contract Drawings and modifications resulting from reviewed shop drawings and field coordinated drawings.

C. The work, apparatus and materials which shall be furnished under these Specifications and accompanying Contract Drawings shall include all items listed hereinafter and/or shown on the Contract Drawings. Certain equipment will be furnished as specified in other sections of these Specifications which will require wiring thereto and/or complete installation as indicated. All materials necessary for the complete installation shall be furnished and installed by the Contractor to provide complete power, lighting, communication systems, instrumentation, wiring, and control systems as indicated on the Contract Drawings and/or as specified herein.

D. Provide complete bonding and/or grounding systems for all equipment as specified herein, shown on the contract documents, and as required for specific pieces of equipment per manufacturer.

E. The Contractor shall furnish and install the necessary cables, transformers, motor control centers, protective devices, conductors, exterior electrical system, etc., to serve motor loads, lighting loads and miscellaneous electrical loads as indicated on the Contract Drawings and/or as specified hereinafter.

F. The work shall include complete testing of all equipment and wiring at the completion of the work and making any connection changes or adjustments necessary for the proper functioning of the system and equipment.

G. Mount and wire control panels and process instruments furnished under other Divisions of these Specifications unless specifically stated otherwise. Mount and make all field connections to process instrument panels and other control panels furnished under other Divisions of these Specifications. For process instrumentation, furnish and install all conduit, wire and interconnections between primary elements, transmitters, local indicators, surge protection devices and receivers.

H. Mount and wire isolation transformers, operator's stations, and power conversion equipment for all variable speed drive systems furnished under other Divisions of these specifications.

I. Install and wire all thermostats, aqua-stats and other devices furnished under other Divisions of this Specification directly controlling HVAC equipment or fan motors.

J. Mount and wire electric heaters, and heat tracing furnished under other Divisions of this Specification.

K. The scheduling and duration of any power or control interruption for the removal of existing equipment or the installation of new equipment shall be coordinated in advance with the Owner.

L. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost.

M. Provide all temporary power as required to facilitate the Contract phased construction plan.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Related Sections include but are not necessarily limited to:

1. Division 1 - General Requirements
2. Section 02050 - Demolition
3. Section 03300 – Cast-in-Place Concrete
4. Division 11 – Equipment
5. Division 13 Special Construction

1.03 AREA CLASSIFICATIONS

A. Outdoor locations may contain wet, corrosive and hazardous areas.

1. Corrosive and hazardous areas are identified on the Contract Drawings. Areas not identified as such shall be considered wet.

B. Indoor locations may contain unclassified, damp, wet, corrosive and hazardous areas.

1. Damp, wet, corrosive and hazardous areas are identified on the Contract Drawings. Areas not identified as such, but provided with heating shall be considered unclassified. Areas not identified as such, but provided without heating shall be considered damp.

C. Hazardous Locations

1. Hazardous locations shall be as defined in NFPA 70 NEC, NFPA 820 Standard for Fire Protection in Wastewater Treatment and Collection Facilities, and other applicable standards or codes governing the classification of a particular type of facility or location. In addition, areas are classified as shown on Contract Drawings and as follows:

a) Class I Division 1
b) Class I Division 2
c) Class II Division 1
d) Class II Division 2

1.04 DEFINITIONS

A. Outdoor Areas

1. Those locations on the Project site where the equipment is normally exposed to wind, dust, rain, etc. Outdoor areas include areas protected by a roof or rain/sun shields but not enclosed within a structure.

B. Indoor Areas

1. Those locations on the Project site where the equipment is normally protected from wind, dust, rain, etc.

1.05 QUALITY ASSURANCE

A. Referenced Standards

1. American Iron and Steel Institute (AISI)

2. American National Standards Institute (ANSI)

   a) C2, National Electrical Safety Code.

3. American Society for Testing and Materials (ASTM)

4. Factory Mutual System (FM)

   a) A Guide to Equipment, Materials and Services.

5. Institute of Electrical and Electronics Engineers (IEEE)

   a) 141, Recommended Practice for Electrical Power Distribution for Industrial Plants.

   b) 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

6. National Electrical Contractors Association (NECA)

   a) NECA 1, Good Workmanship in Electrical Construction

   b) NECA 200, Recommended Practice for Installing and Maintaining Temporary Electrical Power at Construction Sites.

7. National Electrical Manufacturers Association (NEMA)

   a) 250, Enclosures for Electrical Equipment (1000 V Maximum)

   b) ICS 6, Enclosures for Industrial Control and Systems

8. National Fire Protection Association (NFPA)

   a) 70, National Electrical Code (NEC).

   b) 70E, Standard for Electric Safety in the Workplace

c) 79, Electrical Standard for Industrial Machiner

d) 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities

9. Underwriters Laboratories, Inc (UL)

a) 508, Industrial Control Equipment

b) 508A, Industrial Control

c) 698, Industrial Control Equipment for Use in Hazardous Locations.

B. When a specific code or standard has not been cited, the applicable codes and standards of the following code-making authorities and standards organizations shall apply.

1. American Association of State Highway and Transportation Officials (AASHTO)

2. American Iron and Steel Institute (AISI).

3. American National Standard Institute (ANSI).

4. American Society for Testing and Materials (ASTM).

5. ETL Testing Laboratories, Inc (ETL).

6. Insulated Cable Engineers Association (ICEA).

7. Institute of Electrical and Electronic Engineers (IEEE).

8. Illuminating Engineering Society of North America (IES).

9. Instrument Society of America (ISA).

10. Lightning Protection Institute (LPI).

11. National Electrical Manufacturers Association (NEMA).

12. National Fire Protection Association (NFPA).

13. Occupational, Health and Safety Administration (OSHA).

14. Underwriters Laboratories Inc (UL).

C. In case of conflict or disagreement between codes, standards, laws, ordinances, rules, regulations, drawings and specifications, or within either document itself, the more stringent condition shall govern.

1.06 SUBMITTALS

A. Shop Drawings – All submittals shall be in accordance with Specification 01340 – Sop Drawings, Project Data and Samples.

1. Shop drawings shall be arranged and labeled according to specification section and Contract Drawing.

2. Submit shop drawings prior to purchase or fabrication of equipment. See individual Division 16 sections for additional specific requirements.

3. Prior to submittals of shop drawings, coordinate electrical equipment, particularly motor control equipment, control panels, and instrumentation, with all applicable equipment and systems interfacing with that equipment.

4. Submittals shall be made in the following combinations:

a) Conduits, raceways, cable trays, ductbank details, wire and cable 600V and below, medium voltage cable, boxes and fittings.

b) Medium voltage switchgear, medium voltage motor starters, distribution transformers and secondary substations.

c) Motor control centers and control equipment, low voltage switchboards, safety switches, dry-type (specialty) transformers, panelboards, power factor correction capacitors, grounding.

d) Lamps, interior lighting, exterior building lighting, site lighting.

e) Wiring devices.

f) Alarm systems, communication systems and telephone systems.

g) Provide a wire or cable identification schedule for all power, control, signal, process and protective circuits. The schedule shall be submitted in an electronic spreadsheet type Excel compatible file format and include the following information:

(1) Wire or Cable tag number.
(2) Number of conductors.
(3) Conductor size and type.
(4) Wire or Cable usage description.
(5) Conduit tag number
(6) Conduit routing (to and from).
(7) Conduit size and type.
(8) Additional notes

5. For each product, clearly identify manufacturer by name. When general data sheets are provided as part of the submittal, specifically identify the products to be used on this Project. Provide manufacturer's technical information on products to be used, including:

a) Product descriptive bulletin.

b) Electrical data pertinent to the Project and necessary to assure compliance with Specifications and Contract Drawings.

c) Equipment dimensions, where applicable.

d) Evidence that the products submitted meet the requirements of the standards referenced.

e) Specify part number with explanation of options selected.

6. Ensure that all submittals clearly indicate the equipment is UL or ETL listed.

7. For all equipment, provide manufacturer's installation instructions.

B. When a quality standard has been established by identification of a specific manufacturer or catalog number, submittals for proposed alternates and substitutions shall include:

1. Alternate and substitute equipment cross-referenced to the equipment it is replacing. Submittal shall be marked to show how differences will be accommodated.

2. Calculations and other detail data to allow determination of alternate and substitute equipment equivalency to the equipment it is replacing. Data supplied shall allow detailed comparison of all significant characteristics upon which the design equipment is based.

3. Dimensioned drawings, of the same or larger scale as the Contract Drawings, for all alternate and substitute equipment, which differs in size, configuration, service accessibility or in any significant way from the equipment it is replacing.

   a) Complete system layout, except that portion which is identical to the Contract Drawings.

   b) Redesign and modifications to all work required by the alternate or substitute equipment.

C. Operation and Maintenance Manuals.

1.07 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall unload and handle materials using methods, rigging, and equipment that will prevent damage to the materials. Care shall be used to prevent damage to painted and galvanized surfaces.

1. Bare wire rope slings shall not be used for unloading and handling materials and equipment, except with the specific written permission of the Engineer.

B. Equipment and materials, in accordance with the manufacturer’s recommendations, shall be stored, supported and protected to prevent damage.

1. Stored materials and equipment shall not be allowed to contact the ground.

2. Equipment and materials which incorporate electrical equipment or which have finished painted

surfaces, and other items which would be damaged by outdoor exposure, shall be stored indoors.

a) Provide covering and shielding for all equipment to protect from damage.

b) When such storage would present an unreasonable building space or volume requirement, the equipment or materials may, when acceptable to the Engineer, be stored under weatherproof coverings on shoring or platforms.

3. All small loose items that could be easily lost, stolen, broken, or misused shall not be stored on open platforms or shoring.

4. All storage methods and schedules shall be acceptable to the Engineer.

C. Ensure that equipment is not used as steps, ladders, scaffolds, platforms, or for storage-either inside or on top of enclosures.

D. Protect nameplates on electrical equipment to prevent defacing.

E. Repair, restore or replace damaged, corroded and rejected items at no additional cost to the Owner.

F. Record Drawings

1. The Contractor shall maintain a marked up set of Document Drawings showing actual installed circuit numbers, conduit sizes, cable tray routing, number of conductors, conductor sizes (other than #12AWG) and all other deviations from the design drawings.

2. All underground conduit and concealed items shall be dimensioned on the Document Drawings from permanent, visible, building features. Depths to the top of ductbanks shall be recorded.

3. Provide actual motor size, starter size, and heater size, along with all other protective equipment for all motor circuits as part of the one-line record drawings.

4. Revise all wire/cable identification schedules to indicate as installed conditions.

5. Revise all panelboard schedules to indicate as installed conditions.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Refer to related Division 16 sections. All equipment of a similar type shall be by one manufacturer unless otherwise noted in the Specifications.

2.02 MATERIALS

A. Trade names and catalog numbers may be used in the Contract Drawings or Specifications to establish quality standards and basics of design.

1. Other listed manufacturers in the applicable specification sections with equal equipment may be acceptable.

2. If no other manufacturer is listed then any manufacturer of equal equipment may be acceptable.

B. Listed: Where UL test procedures have been established for the product type, electrical equipment shall be approved by UL or ETL and shall be provided with the UL or ETL label.

2.03 FABRICATION

A. When equipment is shop fabricated for the Project, the electrical devices and enclosures utilized shall be UL or ETL listed and labeled or shall be UL recognized.

B. Shop or Factory Finishes: Interiors of other painted equipment shall be white.

PART 3 EXECUTION

3.01 INSTALLATION

A. Equipment shall be installed in accordance with the requirements of the NEC.

B. Enclosures for use with electrical equipment unless specifically shown or specified elsewhere in the Contract Documents:

1. NEMA 1/12

a) Acceptable in unclassified indoor locations.

2. NEMA 3/3R
   a) Acceptable in damp or wet indoor/outdoor non-corrosive locations

3. NEMA 4X

   a) Use in wet indoor/outdoor corrosive locations.

   b) Enclosures shall be 304-Stainless-Steel minimum. Enclosures constructed of 316-Stainless Steel may be required in extremely corrosive areas as shown on the Contract Drawings

   c) Nonmetallic enclosures shall not be used in areas subject to physical damage or sunlight. Nonmetallic enclosures may be used in interior locations.

4. NEMA 6P

   a) Use in “Accidental Submergence” locations.

5. NEMA 7

   a) Use in all Class I, Division 1, 2, Group A, B, C, D locations.

   b) Unless other enclosures are approved and UL listed for the application.

6. NEMA 9

   a) Use in all Class II, Division 1, 2, Group E, F, G and Class III, Division 1, 2 locations.

   b) Unless other enclosures are approved and UL listed for the application.

7. Exceptions

   a) As modified in other Division 16 sections.

   b) As otherwise indicated on the Contract Drawings.

C. Coordinate the installation of electrical equipment with other trades.

1. Arrange for the building in of equipment during structure construction.

2. Where equipment cannot be built-in during construction, arrange for sleeves, box-outs, openings, etc., as required to allow installation of equipment after structure construction is complete.

D. Verify that equipment will fit support layouts indicated.

E. Equipment Dimensions and Clearances

1. Equipment shall fit in the locations shown on the Contract Drawings.

2. Do not use equipment or arrangements of equipment that reduce required clearances or exceed the space allocation.

F. Install equipment in accordance with the manufacturer’s instructions.

G. Equipment Access

1. Install equipment so it is readily accessible for operation and maintenance.

2. Equipment shall not be blocked or concealed.

3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.

H. Equipment shall be installed plumbed, square and true with the building construction and shall be securely fastened.

I. Outdoor wall-mounted equipment and indoor equipment mounted on earth or water bearing walls shall be provided with corrosion-resistant spacers to maintain 1/4 IN separation between the equipment and the wall.

J. Screen or seal all openings into outdoor equipment to prevent the entrance of rodents and insects.

K. Equipment fabricated from aluminum shall not be placed in direct contact with earth or concrete.

L. Provide all necessary anchoring devices and supports.

1. Use supports as detailed on the Drawings and as specified. Where not detailed on the Drawings or specified, use supports and anchoring devices rated for the equipment load and as recommended by the manufacturer.

2. Supports and anchoring devices shall be rated and sized based on dimensions and weights verified from approved equipment submittals.

3. Hardware shall be malleable type, corrosion resistant and shall be supported by heavily plated machine screws or brass, bronze or stainless steel bolts.

4. Do not cut, weld to, or modify building structural members without written approval by the Engineer of record.

5. Do not mount safety switches and external equipment to other equipment enclosures, unless enclosure-mounting surface is properly braced to accept mounting of external equipment.

M. Contractor shall verify exact rough-in location and dimensions for connection to electrical items to be installed under this Contract.

1. Shop drawings shall be secured from those furnishing the equipment.

2. Proceeding without proper information may require the Contractor to remove and replace work that does not meet the conditions imposed by the equipment supplied.

3. Provide sleeves wherever openings are required through new concrete or masonry members. Place sleeves accurately and coordinate locations with the Engineer.

4. Should any cutting and patching be required on account of failure of the Contractor to coordinate penetrations, such cutting and patching shall be done at the expense of the Contractor.

a) Contractor shall not endanger the stability of any structural member by cutting, digging, chasing, or drilling and shall not, at any time, cut or alter the work without the Engineer's written consent.

1) Provide additional reinforcing if required.

2) Cutting shall be done neatly using proper tools and methods.

b) Subsequent patching to restore walls, ceilings, or floors to their original condition shall be done by workmen skilled in their particular field.

N. Provide concrete foundations or pads required for electrical equipment as indicated or specified.

1. Floor-mounted equipment shall be mounted on a 4IN high concrete housekeeping pad. Pad shall be poured on top of the finished floor or slab.

O. Material that may cause rusting or streaking on a building surface shall not be used.

P. Perform excavation and backfill in accordance with Section 02200 - Earthwork.

Q. Contractor shall coordinate the installation of the conduit and wire associated with the HVAC equipment supplied under this Contract.

R. Enclosed electronic equipment located outdoors shall be provided with sun/rain shields and oriented to minimize sun exposure.

S. Device Mounting

1. Dimensions are to top of item unless otherwise indicated.

2. Mounting heights as indicated below unless otherwise indicated on the Contract Drawings

a) Light switch: 48IN.

b) Receptacle in offices and other finished areas: 16IN.

c) Receptacle in all other locations: 48IN.

d) Telephone outlet for desk-mounted phone: 16IN.

e) Telephone outlet for wall-mounted phone: 64IN.

f) Bracket light above lavatory: 80IN to bottom of fixture.

g) Disconnect / Safety-Switch: 64IN to top of enclosure.

h) Panelboard: 72IN to top of enclosure.

i) Motor starter: 64IN to top of enclosure.

j) Pushbutton motor control station: 48IN to top of enclosure.

3.02 IDENTIFICATION

A. Identify all major items of equipment including controls, panels, switches, contactors, motor starters/controllers, junction boxes and metering by permanent nameplates, with wording approved by the Engineer. Secure nameplates to equipment with stainless-steel screws or rivets. Adhesives may be used in conjunction with mechanical fasteners.

B. Nameplates after installation shall be easily visible and shall bear notations corresponding to those shown on the Record Drawings.

C. All conduits shall be identified with a stamped stainless-steel tag system. Conduit tags shall be permanently attached to each exposed end of conduit runs such as in manholes, pull boxes, panels, motor control centers, junction boxes, etc., and at each point of entry into a structure or building. Each tag shall be stamped with the appropriate conduit number per the conduit and cable schedules.

D. Each instrument shall be identified with a stamped stainless-steel tag system. Instrument tags shall be permanently attached to each individual instrument and stamped with the appropriate tag number per the instrument specification section.

E. Each cable shall be identified with a heat-shrinkable polyolefin label printing system. Instrumentation cables

shall be labeled with the appropriate instrument tag (Example: FIT-200-1). Multiplex cables, power and control cables shall be labeled with the appropriate cable tag number per the equipment tag number (Example: PP1-CKT-9).

F. All motor control centers, power panels, lighting panels, control panels, control cabinets, etc., shall be identified with permanently mounted nameplates.

G. All power and lighting panels shall have matte-finish plastic laminated typed schedules mounted on panel doors.

H. Identification Types

1. Equipment Nameplates

a) Phenolic Resin or Thermoplastic Elastomer

1) Thickness: 3/32IN minimum.
2) Size: As required by text.
3) Letters: White letters on Black background.
4) Mount with stainless-steel screws.

2. Wire and Cable Labels

a) Heat shrinkable Polyolefin
1) Size: As required by wire or cable.
2) Letters: Black letters on White background.
3) Heat-shrink after termination.
4) Replace damaged or illegible labels.

3. Raceway Tags

a) Material: Stainless-Steel
b) Size: As required by text.
c) Attach with stainless-steel wire and permanent crimp sleeve

4. Instrument Tags

a) Material: Stainless-Steel
b) Size: As required by text.
c) Attach with stainless-steel wire and permanent crimp sleeve

5. UNDERGROUND WARNING TAPE

a. Manufacturers: Brady Company, Seton or as approved.
b. Description: 2-inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

3.03 FIELD QUALITY CONTROL

A. Do not remove or damage fireproofing materials.

1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.

2. Repair or replace fireproofing removed or damaged.

B. Make all penetrations through roofs prior to installation of roofing.

C. All penetrations required after installation of roofing, shall be completed by an authorized roofer to maintain the roof warranty.

D. Make all penetrations of electrical work through walls water and weather-tight.

E. Equipment furnished under this Contract for use on future work and all concealed equipment, including conduits, shall be dimensioned, on the Record Drawings, from visible and permanent building features.

F. After installation, all equipment shall be tested as recommended by the manufacturer.

G. Verify all components are operational.

H. Perform ground-fault performance testing as required by NEC Article 230-95(c).

I. Test Equipment Interface

1. Verify systems coordination and operation.

J. Set all adjustable trip protective devices as required for system protection and coordination.

K. Verify all system and equipment ground continuity.

L. Adjust installed equipment for proper operation of all electrical and mechanical components.

M. Replace equipment and systems found inoperative or defective and re-test.

1. If equipment or system fails re-test, replace it with products that conform to Contract Documents.

2. Continue remedial measures and re-tests until satisfactory results are obtained.

3. Remedial measures and re-tests will be done at no cost to the Owner.

N. The Engineer shall be notified of tests and Engineer may witness individual tests.

O. Required certificates of testing and test reports shall be presented to the Engineer upon completion of the tests.

P. At Completion of Installation

1. Test to ensure all equipment is free of short circuits and improper grounds.

2. Test to ensure all equipment is operational.

3.04 CLEANING

A. Clean dirt and debris from all interior and exterior surfaces.

B. Apply touch-up paint as required to repair scratches, etc.

C. Replace nameplates or wire and cable markers damaged during installation.

D. Thoroughly vacuum the interior of all enclosures to remove dirt and debris. Do NOT use pressurized air systems to blow out dirt and debris.

3.05 DEMONSTRATION

A. Demonstrate equipment in accordance with Contract Requirements.

END OF SECTION

SECTION 16050

MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of specification Section 16010 – Electrical, Basic Requirements and the sections referenced therein shall be applied.

B. Specification Section 03300 – Cast-in-Place Concrete

C. Specification Section 09900 – Painting and Coatings

1.02 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

B. In accordance with the procedures and requirements set forth in the Contract requirements, the Contractor shall obtain from the equipment manufacturer and submit shop drawings. Each submittal shall be identified by the applicable Specification Section.

C. Shop drawings shall include but not be limited to:

1. Equipment specifications and product data sheets identifying all materials used and methods of fabrication.

2. Complete assembly, layout, installation, and foundation drawings with clearly marked dimensions.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products for electrical related work of sizes, types, ratings, and materials required, whose products have been in satisfactory use in similar service for not less than three (3) years.

1.04 PROJECT CONDITIONS

A. Protect property from any and all damage that might result from excavating and backfilling.

B. Protect persons from injury at excavations, by barricades, warnings and illumination.

C. Coordinate excavations with weather conditions, to minimize possibility of washouts, settlements and other damages and hazards.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXCAVATING FOR ELECTRICAL WORK

A. General: Do not excavate for electrical work until the work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimized.

B. Excavate with vertical-sided excavations to greatest extent possible, except where otherwise indicated. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger the work or other property. Where not removed, cut sheeting off at sufficient distance below finished grade to not interfere with other work.

C. Depth for sub-base Support: Unless otherwise noted, provide installation of sub-base material(s). Excavate for installation of sub-base material in depth indicated or, if not otherwise indicated, 6IN below bottom of work to be supported.

D. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.

1. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

E. Excavate trenches to the uniform dimensions required for the particular item(s) to be installed and provide sufficient working clearances. Dig trenches to

approximate depth and hand grade bottom to accurate elevation as required.

F. Where rock is encountered, carry excavation 6IN below required elevation and backfill with a 6IN layer of sand prior to installation of conduit.

G. Where soil conditions at bottom of indicated excavation are unsatisfactory, excavate additional depth as directed to reach satisfactory soil-bearing condition. Backfill with sub-base material compacted as directed, to indicated excavation depth.

H. Unless otherwise noted in the Contract Drawings, store excavated material (temporarily) near excavation, in manner that will not interfere with or damage excavation or other work. Do not store under trees (within drip-line).

I. Retain excavated material that complies with requirements for backfill material.

J. Dispose of excess or unsatisfactory excavated material(s) as directed by the Contract requirements and site conditions.

K. Refer to the Contract requirements and site conditions for removal of large subsurface materials.

3.02 DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

B. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

C. Maintain dry excavations for electrical work, by removing water. Protect excavations from inflow of surface water. Pump minor inflow of ground water from excavations; protect excavations from major inflow of ground water, by installing temporary sheeting and waterproofing. Provide adequate barriers that will protect other excavations and below-grade property from being damaged by water, sediment or erosion from or through electrical work excavations.

3.03 BASE PREPARATION

A. Install subbase material to receive electrical work, and compact by tamping to form a firm base for the work.

B. Provide finely-graded subbase material for equipment to be buried.

C. Tamp fill to uniform compacted density.

D. Where conduit crosses over areas which have been previously excavated to depths greater than required for conduit installation, provide suitable support that comply with details shown and Contract requirements.

3.04 BACKFILLING

A. Backfill with approved backfill materials.

B. Backfill with finely-graded subbase material to 6IN above equipment to be buried. Backfill materials shall be soil materials free of clay, rock or gravel larger than 3/4IN, debris, waste, frozen materials, vegetation and other deleterious matter.

C. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to required densities. Do not backfill with frozen soil materials.

D. Backfill simultaneously on opposite sides of electrical work, and compact simultaneously; do not dislocate the work from installed positions.

E. Backfill excavations in 8IN high courses of backfill material, uniformly compacted to the following densities (% of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment.

F. When backfilling excavations for electrical work, backfill to elevations matching finished grades.

G. Backfill trenches with concrete where trench excavations pass within 18IN of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.

H. Do not backfill trenches until tests and inspections have been made and backfilling authorized by the Engineer. Use care in backfilling to avoid damage or displacement of conduit systems.

3.05 INSTALLATION OF CONCRETE WORK

A. Refer to Specification Section 03300 – Cast-in-Place Concrete

B. Miscellaneous Concrete Work

1. Concrete Grouting: Grout openings and recesses as indicated on the Contract Drawings and around all electrical work and other work that penetrates or adjoins all concrete work. Provide formwork where required, and tamp, screed and trowel surfaces. Cure grout as specified for concrete work.

2. Refer to Specification Sections for grouting of equipment base plates on foundations (with high-strength, non-shrinking grout), and similar grouting requirements not defined herein.

C. Clean-Up: Upon completion of work, clean excess concrete and grout from adjacent areas and surfaces. Remove excess concrete and grout by proper methods of removal, using care not to scratch or otherwise damage finished surfaces.

3.06 SUPPORT AND FASTENERS

A. The Contractor shall furnish and install structural supports and fasteners for mounting and installing all electrical, lighting, alarm systems, instrumentation, communications and other equipment furnished under this Contract.

B. Where the weight of equipment exceeds 75LBS and is supported from walls, ceilings, columns and/or beams, such structural supports, methods, and locations shall be approved in writing by a professional engineer currently registered in the State of the projects location.

C. Concrete or Masonry Inserts

1. The Contractor shall be responsible for the furnishing and installation of all conduit sleeves, anchor bolts, masonry inserts, and similar devices

required for installation of equipment furnished under this Contract.

2. The Contractor shall furnish leveling channels for all switchgear, switchboards, motor control centers, and similar equipment spanning 60IN, in any direction, along the floor. The leveling channels shall be provided for installation into the equipment supporting pads. Coordination of the installation of these channels within the concrete pad is essential and required. Pad height shall be as required to maintain coverage of the reinforcement bars while not exceeding the maximum mounting heights requirements of the NEC.

D. Support Fastening and Locations

1. All equipment fastened to structural steel; columns, beams, and trusses shall be made by approved clamps or welded. No holes shall be drilled in structural steel.

2. Where supports or hangers are required for heavy electrical equipment units exceeding 75LBS, the structural engineer of record shall check the structural members. Where required, additional sections shall be provided for a safe installation.

3. All holes in hung ceilings for support rods, conduits, and other equipment shall be made adjacent to ceiling supports where possible, to facilitate removal of ceiling panels.

4. For interior dry areas, a bracket and channel type support of galvanized steel construction shall be provided wherever required for the support of starters, switches, panels, and miscellaneous equipment.

5. For outdoor service or in indoor damp/wet process areas, the support system shall be made of either stainless steel, PVC coated rigid galvanized steel, aluminum or as indicated on the Contract Drawings.

6. All fastening hardware (bolts, nuts, washers, etc.) shall be approved stainless steel materials or as indicated on the Contract Drawings.

7. All supports shall be rigidly bolted together and braced to make a substantial supporting framework.

Where possible, control equipment shall be grouped together and mounted on a single framework. Wherever this occurs, a provision shall be made for ready access to the wiring for connections to the equipment by means of boxes with screw covers.

8. Aluminum support members shall not be installed in direct contact with concrete. Stainless steel or non-metallic "spacers" shall be used to prevent contact of aluminum with concrete.

9. The Contractor is responsible for the design of supporting structures and shall submit design details to the Engineer for acceptance before proceeding with the fabrication and installation.

10. Wherever dissimilar metals come into contact, the Contractor shall isolate these metals as required with nylon washers, 9MIL polyethylene tape, or gaskets.

END OF SECTION

SECTION 16111

CONDUIT AND RACEWAY

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, materials, tools and equipment necessary for furnishing, installing, connecting, testing and placing into service all raceway to include all conduits, conduit fittings, wireway, supports, etc. as required for a complete electric installation as specified herein and indicated on the Contract Drawings.

1. Conduit home runs for lighting, receptacle and other misc. circuits are not necessarily indicated on the Contract Drawings; however, the circuit numbers are shown. Conduit shall be furnished and installed for these circuits.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. In addition to the requirements specified in this section, the requirements of specification Section 16010 – Electrical Basic Requirements, and the sections referenced therein shall be applied.

1. Additional raceway from what is shown on the Contract Drawings may be required. Coordinate with the requirements of equipment provided under other Divisions of the specifications.

1.03 CODES AND STANDARDS

A. Raceway shall comply with the following applicable codes and standards as well as any others within the specifications and drawings. In the event of any conflict between these codes, regulations, standards, and Contract Documents, the most restrictive shall apply.

1. American National Standards Institute (ANSI)

a) C80.4 Fittings for Rigid Metal Conduit and Electrical Metallic Tubing.

b) C80.5 Electrical Rigid Aluminum Conduit.

2. American Society for Testing and Materials (ASTM):

   a) A36, Standard Specification for Structural Steel.

   b) A153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

   c) A307,Carbon Steel Externally Threaded Standard Fasteners.

   d) A563, Standard Specification for Carbon Steel Nuts.

   e) A569, Steel Carbon, Hot-Rolled Sheet and Strip, Commercial Quality.

   f) A570, Hot-Rolled Sheet and Strip, Structural Quality.

   g) A575, Merchant Quality Hot-Rolled Carbon Steel Bars.

   h) A635, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot-Rolled.

   i) D1784, Standard Specification for Rigid Poly (Vinyl Chloride)(PVC)Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

   j) D1788, Standard Specification for Rigid Acrylonitrile-Butadiene-Styrene(ABS) Plastics.

   k) D2564, Solvent Cements for (PVC) Plastic Pipe, Tubing, and Fittings.

   l) F512, Standard Specification for Smooth-Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation.

3. ETL Testing Laboratories, Inc (ETL).

4. National Electric Manufacturers Association (NEMA):

   a) RN-1, Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

b) TC-2, Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

c) TC-6, PVC and ABS Plastic Utilities Duct for Underground Installation.

5. National Electric Contractors Association

a) NECA 1: Standard Practices for Good Workmanship in Electrical Construction

6. National Fire Protection Association (NFPA)

a) 70, National Electric Code (NEC)

b) 79, Electrical Standard for Industrial Machinery

7. Underwriters Laboratories Inc (UL)

a) 1, Flexible Metal Conduit

b) 6A, Electrical Rigid Metal Conduit – Aluminum

c) 209, Cellular Metal Floor Raceways and Fittings

d) 360, Liquid-Tight Flexible Steel Conduit

e) 467, Grounding and Bonding Equipment

f) 514, Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

g) 514B, Conduit, Tubing and Cable Fittings

h) 651, Schedule 40 and 80 Rigid PVC Conduit

i) 870, Wireways, Auxiliary Gutters, and Associated Fittings

j) 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations

k) 1242, Intermediate Metal Conduit

l) 1660, Liquid-Tight Flexible Non-Metallic Conduit

1.04 SUBMITTALS

A. Shop Drawings - All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

1. Proposed routing of all site conduits including direct buried, concrete encased, and long run above ground conduits.

2. Proposed routing of conduits buried under floor slabs.

3. Proposed routing and details of construction, including conduit and rebar, of conduits embedded in floor slabs, columns, etc.

4. Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 – Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The material covered by this Specification is intended to be standard material of proven performance as manufactured by reputable firms. Raceways and appurtenances shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

B. All equipment shall be UL listed and labeled for its intended service.

C. Subject to compliance with the Contract Documents, the listed manufacturers are acceptable.

2.02 RIGID ALUMINUM CONDUIT (RAC)

A. Acceptable Manufacturers

1. Allied Tube and Conduit Corporation

2. Western Tube and Conduit Corporation

3. Wheatland Tube Company

B. RAC and associated fittings shall be manufactured from

6063 aluminum alloy in temper designation T-1.

C. RAC shall be installed for all above ground conduit installations indoor or outdoor unless otherwise noted on the contract drawings.

D. Standards

1. ANSI C80.5

2.03 PVC-COATED RIGID GALVANIZED STEEL CONDUIT (PVC-RGS)

A. Acceptable Manufacturers

1. Thomas & Betts

2. Perma-Cote

3. Rob-Roy Ind.

B. PVC-RGS shall have a minimum 40MIL polyvinyl chloride exterior coating. The coating shall be bonded to hot-dipped galvanized rigid steel conduit conforming to ANSI C80.1. The bond between the polyvinyl chloride coating and the conduit surface shall be greater than the tensile strength of the coating. PVC-RGS shall have a nominal 2MIL, minimum, urethane interior coating and a urethane coating on threads. The PVC-RGS conduit shall have an epoxy prime coating prior to application of polyvinyl chloride and urethane coatings.

C. Female ends shall have a plastic sleeve extending a minimum of 1 pipe diameter or 2 inch, whichever is less beyond the opening. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.

D. Standards

1. ANSI C80.1

2. NEMA RN-1

2.04 RIGID POLYVINYL CHLORIDE CONDUIT (PVC)

A. Acceptable Manufacturers

1. Allied Tube and Conduit Corporation

2. Carlon

3. Cantex

B. PVC shall be either Schedule 40 or Schedule-80. The polyvinyl-chloride plastic compound shall meet, as a minimum, ASTM D1784 cell classification PVC 12233-A, B, or C. PVC shall be rated for direct sunlight exposure, 90°C wire, and fire retardant with low smoke emission.

C. Schedule 40 PVC conduit shall be installed in concrete encased underground conduit installations. Schedule 80 PVC conduit shall be installed in direct buried installations.

D. Standards

1. ANSI C33.91

2. NEMA TC-2

3. UL 651

2.05 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Acceptable Manufacturers

1. Anamet, Inc.

2. Electri-Flex Company

3. International Metal Hose Company

B. LFMC shall have a core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked, contain an interwoven copper strip suitable as a grounding means, and have an extruded vapor and liquid tight polyvinyl chloride outer jacket positively locked to the steel core.

C. Standard

1. UL 360

2.06 WIREWAY

A. Acceptable Manufacturers

1. E.M. Wiegmann and Company, Inc.

2. Hoffman Engineering Company

3. Stahlin

4. Square D

B. Wireway shall have a minimum wall thickness of 0.040 inch, be furnished without knockouts, be designed for continuous grounding, and suitable for lay-in conductors. Provide Solid and non-removable covers when passing through partitions and solid hinged covers with captive screw fasteners when accessible.

C. Wireway shall not be smaller than 4-inch x 4-inch unless otherwise indicated on the Contract Drawings.

D. Types

1. NEMA-1: Wireway shall be steel, finished with rust inhibiting phosphatizing coating and gray baked enamel finish on interior and exterior surfaces.

2. NEMA-3/3R/12: Wireway shall be steel, finished with rust inhibiting phosphatizing coating and gray baked enamel finish on interior and exterior surfaces. Cover shall be fully gasketed and provided with captive clamp type latches.

3. NEMA- 4/4X: Wireway shall be type 304 stainless steel for interior or exterior corrosive areas. Cover shall be fully gasketed and provided with captive external screw type clamps.

4. NEMA- 4/4X: Fiberglass or PVC may be utilized for interior corrosive areas only where specifically shown on the Contract Drawings.

E. Standards

1. NFPA 79

2. UL 870

2.07 CONDUIT FITTINGS AND ACCESSORIES

A. Acceptable Manufacturers

1. Appleton

2. Carlon

3. Crouse-Hinds

4. Killark

5. OZ Gedney Company

6. Perma-Cote

7. RACO

8. Rob-Roy Ind.

9. Steel City

10. Thomas and Betts

11. Western Plastics Company

B. Fittings for Use with RAC

1. Materials: Following minimum requirements unless otherwise noted.

   a) Body: Copper-free aluminum with aluminum lacquer or aluminum enamel finish.

   b) Covers: Copper-free aluminum and gasketed.

   c) Gaskets: Neoprene or PVC.

   d) Insulators-phenolic, thermosetting: minimum 105 Deg C UL rating.

   e) Grounding saddles tin-plated copper or bronze suitable for use with copper and aluminum conductors.

   f) Bonding jumpers: Tinned copper flexible braid.

   g) Locknuts: Malleable iron, zinc plated.

2. All fittings: Threaded unless otherwise noted.

3. Conduit Hubs shall be cast aluminum with insulated throat.

4. Straight couplings: Same material and finish as the conduit with which they are used.

5. Mogul pulling elbows and tees:

   a) Die cast copper free aluminum

   b) Rain tight

6. Conduit seals

   a) Drain and breather: Stainless steel or brass

   b) Fiber and sealing compound: UL listed for use with the sealing fitting

7. Standards

   a) UL 467

   b) UL 514B

C. Fittings for Use with PVC

1. Fittings shall be of the same material, thickness, and construction as the conduits with which they are used.

   a) Standards

      1) UL 651

      2) NEMA TC-2-1978

2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.

   a) Shall not be more than 1 year past date of manufacture.

   b) Standard: ASTM D2564

D. Fittings for Use with LFMC

1. Fittings shall meet the following minimum requirements unless otherwise noted:

   a) Body: Malleable iron, zinc-plated

   b) Ferrule: Steel, zinc-plated

   c) Locknuts and compression nuts: Malleable iron, zinc-plated

   d) Sealing ring: Neoprene

2. Fittings shall be compression type

3. Standard: UL 514

2.08 STRUT CHANNEL SUPPORT SYSTEMS

A. Acceptable manufacturers:

1. Allied Power-Strut Products

2. B-Line Systems

3. Rob-Roy Industries

4. Thomas & Betts

5. Unistrut Building Systems

B. All strut-channel, clamps, fittings and fastener materials shall conform to the following unless otherwise noted on the Contract Drawings.

1. Indoor Wet/Dry Areas:

a) Aluminum 6063-T6

2. Indoor Corrosive Areas:

a) Fiberglass (ASTM D-4385)

b) Stainless Steel Type-316 (ASTM A240)

c) PVC Coated Hot-Dipped Galvanized Steel (ASTM D1151, D2247)

3. Outdoor Wet Areas:

a) Stainless Steel Type-304 (ASTM A240)

b) Aluminum 6063-T6

4. Outdoor Corrosive Areas:

a) Stainless Steel Type-316 (ASTM A240)

b) PVC Coated Hot-Dipped Galvanized Steel (ASTM D1151, D2247)

C. Strut-channel shall not be bent, drilled, cut or otherwise modified to produce fittings, braces or brackets for conduit and equipment supports.

D. Manufactured strut-channel braces, brackets, fittings and post-bases shall be provided and installed with

associated hardware and fasteners as a complete system for conduit and equipment supports.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. All conduit, raceway, wireway and associated fittings shall be stored in accordance with the manufacturer recommendations and shall not be stored exposed to sunlight or other UV rays.

3.02 INSTALLATION

A. The Contractor shall plan the layout of conduit and raceway systems so that when the work is complete it will exhibit good workmanship practices in accordance with NECA-1.

B. Routing of Conduits and Raceways

1. Conduit and Raceway runs, where shown, indicate the preferred location. Site conditions may affect actual routing. Contractor shall coordinate routing and measurement with other trades and with equipment suppliers.

2. Shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.

3. Wherever possible avoid routing conduits and raceways through areas of high ambient temperature or radiant heat.

C. Size of Conduits and Raceways

1. The size of conduits and raceways are normally shown on the Contract Drawings. If a size is not shown on the Contract Drawings, or if a minimum size is not stated in the Specifications, then the size of conduits and raceways shall be in accordance with the NEC.

2. Conduits shall not be smaller than 1 inch for underground installations and 3/4 inch elsewhere, unless otherwise shown on the Contract Drawings.

D. Types of Conduits and Raceways

1. Shall be installed as defined in the Contract Drawings.

2. As required by NFPA.

3. Flexible Conduit

   a) Install as the final conduit to motors, electrically operated valves, primary elements (instrumentation), and electrical equipment that is liable to vibrate.

   b) Shall not be used as a conduit run:

   c) Maximum length shall not exceed:

      (1) 36 inch to motors.

      (2) 24 inch to all other equipment.

4. PVC-RGS

   a) Contractor shall use tools, clamps, dies, equipment, etc. designed specifically for the cutting, bending and threading of PVC-RGS.

   b) Contractor shall follow the recommendations and methods of the manufacturer for installing PVC-RGS.

E. Provide openings in walls, floors, and ceilings for all required raceway penetrations.

1. Sleeves and block outs: Set in masonry walls during erection.

2. Sleeves and block outs: Set in concrete during forming.

   a) Material: Not harmful to the concrete.

   b) Not considered to replace structurally the displaced concrete.

F. Conduit Runs

1. All conduits within a structure shall be installed concealed unless otherwise noted on the Contract Drawings.

2. Total of Bends in a Conduit Run

a) Less than 270 degrees.

b) Provide pull boxes, conduits, or pulling elbows or tees as needed.

3. Run in straight lines parallel to or at right angles to structural members or building lines.

4. Maintain minimum 2-inch separation between all conduits.

5. Maintain minimum 6-inch separation between instrumentation and power conduits.

6. Maintain minimum 12-inch separation from process, gas, air and water pipes.

7. Conduits and accessories embedded in concrete:

a) Shall not be larger in outside diameter than one-third the thickness of the slab, column or beam.

b) Place conduit and accessories after reinforcing steel has been laid.

c) Shall not displace the reinforcement steel.

d) Provide a minimum of 1-1/2 inches of concrete cover around conduit.

e) Do not run against reinforcing steel.

f) Provide 2 inch minimum of spacing between conduits.

g) Install expansion/deflection fittings wherever conduit spans structural or expansion joint.

G. Field Bending of Conduits

1. Utilize tools, equipment, methods and recommendations by the manufacturer to make all field bends.

2. The internal diameter of conduit shall not be reduced or distorted.

H. Field Cutting and Threading Conduits

1. Utilize tools, equipment, methods and recommendations by the manufacturer to field cut and thread conduit.

2. All field cut conduit shall be smooth and evenly chamfered on the inside.

3. All field threaded conduit shall be clean and degreased before applying a zinc rich paint.

I. Terminating Conduits

1. NEMA 1 enclosures

a) Top: Locknuts and insulated bushings.

b) Side: Locknuts and insulated bushings.

c) Bottom: Locknuts and insulated bushings.

2. NEMA 2/12/12K enclosures

a) Top: Sealing locknuts and insulated bushings.

b) Side: Locknuts and insulated bushings.

c) Bottom: Locknuts and insulated bushings.

3. NEMA 3/3R/3S/13 enclosures

a) Top: Threaded conduit hubs with insulated throats.

b) Side: Sealing locknuts and insulated bushings.

c) Bottom: Locknuts and insulated bushings.

4. NEMA 4/4X enclosures

a) Top: Threaded conduit hubs with insulated throats or approved cable gland fittings.

b) Side: Threaded conduit hubs with insulated throats or approved cable gland fittings.

c) Bottom: Threaded conduit hubs with insulated throats or approved cable gland fittings.

5. NEMA 5 enclosures

a) Top: Sealing locknuts with insulated throats.

b) Side: Sealing locknuts and insulated bushings.

c) Bottom: Locknuts and insulated bushings.

6. NEMA 6/6P enclosures

a) Top: Threaded conduit hubs with insulated throats or approved cable gland fittings.

b) Side: Threaded conduit hubs with insulated throats or approved cable gland fittings.

c) Bottom: Threaded conduit hubs with insulated throats or approved cable gland fittings.

7. NEMA 7/8/9 enclosures

a) Enclosures shall be provided with integral conduit hubs

J. Conduit Seal Installation

1. In each conduit entering or leaving a Class I area.

2. In each conduit in a Class I Division 1 area entering or leaving an enclosure containing switches, circuit breakers, fuses, relays, resistors or other apparatus which may produce arcs, sparks or high temperature.

3. In each conduit 2-inch or larger in a Class I Division 1 area entering or leaving an enclosure containing terminals, splices and taps.

4. In each conduit in a Class I Division 2 area entering or leaving an enclosure required to be approved for use in Class I environments.

5. In each conduit in a Class II location between an enclosure required to be dust ignition-proof and an enclosure that is not required to be dust ignition-proof.

6. In each conduit in a corrosive area entering or leaving that area and entering or leaving an electrical equipment enclosure in that area.

7. So that the filler plug and drain is accessible.

8. Complete with approved sealing fiber and compound.

K. Conduit Moisture Sealing

1. All conduits terminated into enclosures located outdoors or routed from interior to exterior locations shall have non-hardening conduit sealing putty packed into and around conductors within each conduit opening.

L. Conduit Coatings

1. The protective coating of metallic conduits, fittings, and accessories shall be maintained.

   a) Repair PVC-RGS utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit.

      (1) The total nominal thickness: 40 MIL.

   b) Repair surfaces that will be inaccessible after installation prior to installation.

2. All metallic raceways installed in direct contact with concrete, masonry or soils shall be:

   a) PVC-RGS

   b) Installed with 40 MIL minimum coating of cured coal-tar bitumastic paint.

3. All metallic raceway transitions through concrete, masonry or soils shall be:

   a) PVC-RGS

   b) Installed with heavy-wall heat-shrink polyolefin tubing extending 6-inch minimum on each side of transition.

   c) Installed with 40 MIL minimum coating of cured coal-tar bitumastic paint.

M. Power Cable Pulling Preparation

1. Remove water and debris from conduit prior to installation of power cables.

2. Pull mandrel with diameter nominally 1/4 inches smaller than the interior of the conduit, to ensure circular cross-section and removal of obstructions.

3. Swab conduit by pulling a clean, tight-fitting rag through the conduit.

4. Tightly plug ends of conduit with manufactured pipe plugs or plastic conduit inserts until power cables are pulled.

5. Only nylon or polyethylene rope shall be used to pull power cables in rigid non-metallic conduit systems.

END OF SECTION

SECTION 16115

UNDERGROUND CONDUIT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes manholes; handholes; pull-boxes; and underground power, control, and instrumentation conduits and ductbanks.

B. In addition to the requirements specified in this section, the requirements of specification Section 16010 – Electrical, Basic Requirements and the sections referenced therein shall be applied.

1.02 QUALITY ASSURANCE

A. Referenced Standards

1. American Association of State Highway & Transportation Officials (AASHTO).

2. American Society for Testing Materials (ASTM):

a) A536, Standard Specification for Ductile Iron Castings.

3. National Fire Protection Association (NFPA):

a) NFPA 70, National Electrical Code (NEC), 2008 Edition.

B. Miscellaneous

1. Contract Drawings indicate the intended location of manholes, handholes and pull-boxes; and routing of ductbanks and direct buried conduit. Field conditions may affect actual routing.

1.03 DEFINITIONS

A. Direct-buried conduit means individual (single) underground conduits without concrete encasement.

B. Direct-buried ductbank means multiple underground conduits, in a common trench, without concrete encasement.

C. Concrete encased ductbank means any underground conduit or combination of underground conduits encased in a common concrete envelope.

1.04 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples and 16010 - Electrical Basic Requirements.

B. Fabrication and layout drawings

1. Provide cross-sectioned sketch of each ductbank.

a) Dimension spacing between conduits

b) Dimension concrete envelope and reinforcing, where applicable

2. Provide ductbank and direct-buried conduit profile.

a) Dimension from grade to ductbank and direct buried conduit

b) Dimension from ductbank and direct buried conduit to other utilities in the route

3. Certifications

4. Test reports

C. Operation and Maintenance Manuals

1. Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 - Operating and Maintenance Data.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Precast manholes, handholes and pull-boxes

a) Carolina Precast Concrete, Inc.
b) Oldcastle Precast
c) Utility Vault Co.

2. Manhole and handhole covers

a) Neenah
b) Utility Vault Co.

3. Cable racks

a) Unistrut
b) B-Line
c) Condux International, Inc.
d) Underground Devices, Inc.

4. Cable pulling irons

a) Condux International, Inc.

5. Ground rods and grounding equipment

a) See Section 16450 - Grounding and Bonding

6. Ground wire

a) See Section 16450 - Grounding and Bonding

7. Duct terminators

a) Carlon
b) Condux International, Inc.

8. Conduit

a) See Section 16111 - Conduit and Raceway

9. Duct spacers

a) Underground Devices, Inc.
b) Condux International, Inc.

10. Warning Tape

a) W. H. Brady Company
b) Seton Nameplate Company

2.02 MATERIALS

A. Handholes and Pull-Boxes

1. Pre-Cast steel reinforced concrete

a) Boxes are required to meet ASTM C 858 with 4,000 PSI minimum compressive strength concrete and designed for AASHTO H-20 loading unless otherwise noted on the Contract Drawings.

b) Tongue-and-grove double sealed joints on mating edges of pre-cast components. The joints shall firmly interlock adjoining components and provide waterproof junctions and adequate shear transfer. Joints shall be sealed with approved watertight joint sealant as prescribed in the manufacturer's installation specifications and conforming to AASHTO M198, Type B. Sealing material shall be installed in strict accordance with manufacturer's printed instructions.

c) Knockout panels or pre-cast individual conduit openings may be used. Blockout panels are not acceptable.

d) Cover

(1) Heavy-duty type frames and covers made of cast iron, suitable for H-20 loading, and having machined bearing surfaces shall be used.

(2) The covers shall be of indented type with solid top design.

(3) The upper side of each cover shall have the letters "Electrical", "Control", or "Communication" cast in integral letters no less than 2-inches high as indicated on the Contract Drawings.

2. Cast-In-Place

a) Comply with Section 03300 - Cast-In-Place Concrete unless otherwise specified herein.

b) Constructed as detailed on the Contract Drawings.

c) Cover

(1) Heavy-duty type frames and covers made of cast iron, suitable for H-20 loading, and having machined bearing surfaces shall be used.

(2) The covers shall be of indented type with solid top design.

(3) The upper side of each cover shall have the letters “Electrical”, “Control”, or “Communication” cast in integral letters no less than 2-inches high as indicated on the Contract Drawings.

d) Shall have an AASHTO live load rating of H-20, unless otherwise noted in the Contract Drawings or Specifications.

B. Manholes

1. Pre-Cast Steel Reinforced Concrete

a) Boxes are required to meet ASTM C 858 with 4,000 PSI minimum compressive strength concrete and designed for AASHTO H-20 loading unless otherwise noted on the Contract Drawings.

b) Tongue-and-grove double sealed joints on mating edges of pre-cast components. The joints shall firmly interlock adjoining components and provide waterproof junctions and adequate shear transfer. Joints shall be sealed with approved watertight joint sealant as prescribed in the manufacturer’s installation specifications and conforming to AASHTO M198, Type B. Sealing material shall be installed in strict accordance with manufacturer’s printed instructions.

c) Knockout panels or pre-cast individual conduit openings may be used. Blockout panels are not acceptable.

d) Minimum interior dimensions shall be 4 feet wide x 4 feet long x 6 feet tall

e) Cover

(1) Minimum access opening dimensions

(a) Rectangular 26-inch x 22-inch

(b) Round 26-inch Diameter

(2) Heavy-duty type frames and covers made of cast iron, suitable for H-20 loading, and having machined bearing surfaces shall be used.

(3) The covers shall be of indented type with solid top design.

(4) The upper side of each cover shall have the letters “Electrical”, “Control”, or “Communication” cast in integral letters no less than 2-inch high as indicated on the Contract Drawings.

2. Cast-In-Place

a) Comply with Section 03300 - Cast-In-Place Concrete unless otherwise specified herein.

b) Constructed as detailed on the Contract Drawings.

c) Shall have an AASHTO live load rating of H-20, unless otherwise noted on the Drawings.

d) Minimum interior dimensions shall be 4-feet wide x 4-feet long x 6-feet tall.

e) Cover

(1) Minimum access opening dimensions

(a) Rectangular 26-inch x 22-inch

(b) Round 26-inch Diameter

(2) Heavy-duty type frames and covers made of cast iron, suitable for H-20 loading, and having machined bearing surfaces shall be used.

(3) The covers shall be of indented type with solid top design.

(4) The upper side of each cover shall have the letters “Electrical”, “Control”, or “Communication” cast in integral letters no less than 2-inches high as indicated on the Contract Drawings.

f) Cable Racks

(1) Hot-dipped galvanized hot-rolled steel; or Lexan.

(2) 120 Lbs. minimum loading capacity.

(3) Three-point locking to resist twisting.

g) Cable Pulling Irons

(1) Hot-dipped galvanized steel

(2) 6,000 Lbs. minimum pulling load

h) Ground Rods and Grounding Equipment

(1) See Section 16450 - Grounding and Bonding

i) Ground Wire

(1) See Section 16120 - Wire and Cable: 600 Volt and Below

j) Duct Terminators

(1) Window type

(2) ABS plastic

(3) Provide for conduit entrance

(4) Designed for installation into manhole, handhole or pull-box walls for a watertight seal.

(5) Sufficient space between terminator walls to allow for placement of rebar and concrete.

k) Conduit

(1) See Section 16111 - Conduit and Raceway

l) Duct Spacers

(1) High density polyethylene or high impact polystyrene.

(2) Interlocking

(3) Provide 2-inch minimum spacing between conduits.

m) Warning Tape

(1) Material: Polyethylene

(2) Thickness: 3.5 MIL

(3) Tensile strength: 1,750 PSI

(4) Size: 6-inches wide (minimum)

(5) Legend: Preprinted and permanently imbedded:

(a) Message continuously printed.

PART 3 EXECUTION

3.01 INSTALLATION

A. General

1. Install products in accordance with manufacturer's instructions.

2. Comply with Section 16050 - Materials and Methods for trenching, backfilling and compacting.

3. Buried conductor warning tape

a) See Section 16010 - Electrical Basic Requirements.

B. Manholes, Handholes and Pull-Boxes

1. Shape: Manholes, handholes and pull-boxes may be either square or rectangular.

2. Size

a) Manholes shall have minimum interior dimensions of 48-inch x 48-inch with a minimum interior height of 72-inches unless other dimensions are detailed on the Contract Drawings.

b) Handholds shall be sized for the number of conduits entering unless other dimensions are detailed on the Contract Drawings.

(1) Minimum interior dimensions shall be 24-inch x 17-inch with a minimum depth of 36-inches.

c) Pull-Boxes shall be sized for the number of conduits entering unless other dimensions are detailed on the Contract Drawings.

3. Precast or Cast-In-Place

a) Optional unless otherwise noted in the Contract Drawings or Specifications.

4. Precast manholes, handholes and pull-boxes shall be installed in accordance with the manufacturer's instructions for "subject to occasional heavy vehicles."

5. For cast-in-place construction, comply with Section 03300-Cast-In-Place Concrete.

6. Provide minimum 12-inches of tamped crushed rock or gravel prior to setting manhole, handhole or pull box.

7. Construct manholes, handholes and pull-boxes approximately where shown on the Contract Drawings. Determine the exact locations after careful consideration has been given to location of other utilities, grading, and paving.

   a) Locations are to be approved by the Engineer prior to excavation and construction of manholes, handholes and pull-boxes.

8. Grout or seal all joints

   a) For precast construction, comply with the manufacturer's instructions.

   b) For cast-in-place construction, comply with Section 03300 - Cast-In-Place Concrete.

9. Set frames and covers

   a) For manholes, handholes and pull-boxes located in roadways, paint with two coats asphaltic paint before setting and set top of covers flush with finished surface of paving.

   b) For manholes, handholes and pull-boxes not located in roadways, set top of covers 2-inches above finished grade. Slope surrounding grade away from edge to insure water drains away from opening.

   c) Install sufficient number of concrete extensions between top of manhole, handhole or pull-box frame as required to elevate cover to existing grade level.

10. Support cables on walls by cable racks

    a) Equip cable racks with adjustable hooks

        (1) Quantity of hooks as required by the number of conductors

        (2) Minimum of two (2) cable hooks per rack

    b) Install a minimum of two (2) racks on each wall in each manhole, handhole and pull-box.

    c) Space cable racks so that both ends of cable splices will be supported horizontally.

    d) In manholes, install one (1) spare hook on each rack.

    e) Install a cable-pulling iron in each wall opposite each ductbank entrance.

11. Grounding: In each manhole, drive copper ground rod into the earth and extend ground rod approximately 6-inches above finished floor.

    a) In precast structures, drill openings in floor for ground rod.

    b) Connect all metallic conduits, racks, and other metallic components to ground rod by means of #8AWG minimum tinned copper wire and approved grounding clamps.

12. Provide an 18-inch diameter sump in the bottom of each manhole and handhole.

13. After installation is complete, backfill and compact soil around manholes and handholes.

C. Underground Conduits

1. Concrete encased ductbank

    a) Provide electrical duct system consisting of conduits completely encased in a minimum of 2-inches of concrete.

    b) For circuits 600V and below, install so that top of concrete encased duct, at any point, is not less than the minimum depths established by the NEC (Table 300-5 and exceptions):

(1) RGS conduit: 24-inch

(2) PVC sch-40 conduit: 24-inch

(3) Under areas subject to vehicular traffic

(a) All applications: 24-inch

(4) Unless a greater depth is detailed on the Contract Drawings.

c) Under traffic areas (roadways, parking lots, etc.) and for a distance 10 feet either side of the traffic area, and elsewhere as defined on the Contract Drawings or specified, the concrete shall be reinforced in accordance with Section 03300-Cast-In-Place Concrete.

2. Direct-buried ductbank

a) Provide electrical duct system consisting of conduits directly buried in earth.

(1) Lay conduits on minimum 2-inch sand base completely encased by 2-inch of selected backfill containing no stones or other hard material larger than 1/2-inch diameter.

b) For circuits 600V and below, install so that the top selected backfill at any point, is not less than the minimum depths established by the NEC (Table 300-5 and exceptions).

(1) RGS conduit: 24-inch

(2) PVC sch-80 conduit: 24-inch

(3) Under areas subject to vehicular traffic

(a) All applications: 24-inch

(4) Unless a greater depth is detailed on the Contract Drawings.

3. Direct-buried conduit

a) Provide electrical duct system consisting of conduits directly buried in earth.

(1) Lay conduit on minimum 2-inch sand base completely encased by 2-inches of

selected backfill containing no stones or other hard material larger than 1/2-inch diameter.

b) For circuits 600V and below, install so that top of the selective backfill, at any point, is not less than the minimum depths established by the NEC (Table 300-5 and exceptions).

(1) RGS conduit: 24-inch

(2) PVC sch-80 conduit: 24-inch

(3) Under areas subject to vehicular traffic

(a) All applications: 24-inch

(4) Unless a greater depth is detailed on the Contract Drawings.

4. Underground conduits and ductbanks shall comply with the following:

a) Minimum grade shall be 4-inches per 100 feet or as detailed on the Contract Drawings.

(1) Low point shall be at one end of the conduit run.

b) During construction and after conduit installation is complete; plug the ends of all conduits.

c) Provide conduit supports and separators of concrete, plastic, or other suitable nonmetallic, non-decaying material designed for that purpose.

(1) Concrete encasement supports shall provide a uniform minimum clearance of 2 inches between the bottom of the trench and the bottom row of conduit.

(2) Separators shall provide a uniform minimum clearance of 2-inches between conduits.

(3) Place supports and separators for PVC conduit on maximum centers as indicated for the following trade sizes:

(a) 1 inches and less: 2 feet

(b) 1-1/4 to 3 inches: 4 feet

(c) 3-1/2 to 6 inches: 6 feet

(4) Place supports and separators for RGS conduit on maximum centers as indicated for the following trade sizes:

(a) 1-inch and less: 8 feet

(b) 1-1/4 to 2-1/2 inches: 10 feet

(c) 3-inches and larger: 12 feet

(5) Securely anchor conduits to supports and separators to prevent movement during placement of concrete or soil.

(6) Do not place concrete or soil until conduits have been observed by the Engineer.

d) Stagger conduit joints at intervals of 6-inches horizontally.

e) Make conduit joints watertight and in accordance with manufacturer's recommendations.

(1) Make plastic conduit joints by uniformly brushing a plastic solvent cement on inside of plastic coupling fitting and outside of conduit ends. Slip conduit and fitting together with a quick one-quarter turn twist to set joint tightly.

(2) Accomplish changes in direction of runs exceeding a total of 5 degrees by long sweep bends having a minimum radius of 25-inches.

(3) Sweep bends shall be made up of one curved section.

f) Furnish manufactured bends at end of runs.

(1) Minimum radius of 18-inches for conduits less than 3-inch trade size and 36-inches for conduits 3-inch trade size and larger.

g) After the conduit run has been completed, pull a standard flexible mandrel having a length of not less than 12-inches and a diameter approximately 1/4-inch less than the inside diameter of the conduit through each conduit. Then pull a brush with stiff bristles through each conduit to remove any foreign material left in conduit.

h) Pneumatic rodding may be used to draw in pull-cords.

(1) Install a 1/8-inch polypropylene pull-cord free of kinks and splices in all unused new ducts.

(2) Extend pull-cord 3-feet beyond ends of conduit and fasten to prevent loss of pull-cord in conduits.

i) Transition from PVC to RGS conduit with a minimum of 3-feet prior to entering a structure or going above ground.

(1) Unless otherwise indicated on the Contract Drawings.

(2) PVC conduit may be extended directly to pull, junction and transformer boxes; manholes and handholes.

j) Where conduits enter transformer boxes; manholes and handholes:

(1) Terminate PVC conduits in end bells.

(2) Terminate RGS conduits in insulated bushings.

B. Warning Tape

1. Place warning tape in trench directly over ductbanks, direct-buried conduit, and direct-buried wire and cable.

a) 6-inches below finished grade where conduit or ductbank is 12-inches or more below finished grade.

b) 3-inches below finished grade where conduit or ductbank is less than 12-inches below finished grade.

2. Provide warning tape as follows:

a) Electrical trenches and ductbanks or directly buried conduit

(1) Legend: “CAUTION CAUTION CAUTION” (1st line), “BURIED ELECTRIC LINE” (2nd line).

(2) Letters: 1-1/4-inch minimum

(3) Interval: Continuous

(4) Color: Red and black letters.

b) Trenches and direct-buried or conduit encased telephone lines:

(1) Legend: “CAUTION CAUTION CAUTION” (1st line), “BURIED TELEPHONE LINE” (2nd line).

(2) Letters: 1-1/4-inch minimum

(3) Interval: Continuous

(4) Color: Orange with black letters

c) Trenches with direct-buried or conduit encased computer or SCADA system communications lines:

(1) Legend: “CAUTION CAUTION CAUTION” (1st line), “BURIED COMPUTER LINE” (2nd line).

(2) Letters: 1-1/4-inch minimum

(3) Interval: Continuous

(4) Color: Orange with black letters

3.02 MAINTENANCE

A. Provide the Owner with two (2) sets of manhole cover, underground pull-box cover or precast cable trench cover removal tools.

END OF SECTION

SECTION 16120

WIRE AND CABLE: 600 VOLT AND BELOW

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, connect, test, and place in satisfactory operating condition, ready for service, all cables and wires indicated on the Contract Drawings and as specified herein or required for proper operation of the installation, with the exception of internal wiring provided by electrical equipment manufacturers. The work of connecting cables to equipment, machinery, and devices shall be considered a part of this Section. All hardware, junction boxes, bolts, clamps, insulators, and fittings required for the installation of cable and wires system shall be furnished and installed by the Contractor

B. The Contractor shall submit Shop Drawings and other material required to substantiate conformance with the requirements set forth on the Contract Drawings and in Section 16010 – Electrical Basic Requirements, and Section 01340 - Shop Drawings, Project Data and Samples. Shop drawings shall include, but not be limited to, detailed specifications and product data sheets for the power, control, and instrumentation cable required for this project.

C. The wire and cable to be furnished and installed for this project shall be the product of manufacturers who have been in the business of manufacturing wire and cable for a minimum of ten (10) years.

D. Reference Section 16010 – Electrical Basic Requirements.

1.02 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples, the Contractor shall obtain from the wire and cable manufacturer and submit the following:

1. Shop Drawings

2. Reports of Certified Shop and Field Tests

3. Wiring Identification Methods.

Each submittal shall be identified by the applicable specification section.

1.03 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed material's compliance with the Contract Documents.

B. Partial, incomplete, or illegible Submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Material specifications and product data sheets identifying all materials used and methods of fabrication

2. Cable and wire identification methods and materials

1.04 IDENTIFICATION

A. Each cable or wire shall be identified as specified in Section 16010 – Electrical Basic Requirements.

PART 2 PRODUCTS

2.01 600V POWER WIRE AND CABLE

A. All 600V rated power wire and cable shall consist of stranded, copper conductor with insulation type XHHW-2, 90°C.

B. Circuits within the interior spaces of buildings may utilize 600V rated insulation, type THHN/THWN, 75°C.

C. Conductors shall be stranded copper per ASTM-B8, B-33 and B-189, Class B or C stranding contingent on the size unless otherwise specified. Minimum size wire shall be #12AWG.

D. 600V rated individual or multi-conductor power wire and cable shall be manufactured by the Okonite Company, BICC Industrial Cable Company or approved equal.

2.02 600V CONTROL CABLE

A. All 600V rated control cable shall consist of stranded, copper conductor with insulation type XHHW-2, 90°C.

B. Control circuits within the interior spaces of buildings may utilize 600V rated insulation, type THHN/THWN, 75°C.

C. The individual conductors of the multiple conductor cable shall be color coded for proper identification. Color coding shall be equal to ICEA S-68-514, Table K-1. Cables shall meet requirements of IEEE-383.

D. Conductors shall be stranded copper per ASTM B-8, B-33 and B-189, Class B or C stranding contingent on the size unless otherwise specified. Minimum wire size shall be #14AWG.

E. 600V rated individual or multi-conductor control wire shall be manufactured by the Okonite Company, BICC Industrial Cable Company or approved equal.

2.03 600V SHIELDED MOTOR POWER CABLE FOR VARIABLE FREQUENCY DRIVES

A. Where indicated on the Contract Drawings, the power connection between the variable frequency drive (VFD) and the associated motor shall utilize a shielded three-conductor plus ground conductor VFD output cable.

B. Shielded motor power cables with #2AWG and smaller conductors shall have an overall polyvinyl chloride jacket, utilize XLPE conductor insulation with 100 percent rated ground conductor, overall foil shield, 85% TC braid and drain wire.

C. Shielded motor power cables with #1AWG and larger conductors shall have an overall polyvinyl chloride jacket, utilize XLPE conductor insulation with three-symmetrical BC grounds, two spiral copper tape shields.

D. Shielded Motor cable shall meet the following requirements:

1. Utilize high-strand tined copper conductors

2. Lower capacitance suitable for longer runs

3. Sunlight and oil resistant

4. Suitable for Class I and II; Division 2 hazardous locations

5. Rated for 90°C temperature for wet or dry locations

6. Pass UL 1685 vertical tray flame test

E. All VFD cables shall be terminated with approved VFD cable connectors and/or termination kits.

F. 600V rated shielded motor power cable shall be:

1. Belden: 29500 Series Cable

2. General Cable: CVTC VFD Cable

3. Service Wire Company: ServiceDrive ASD/VFD Cable

4. Southwire Armor-X VFD Cable

5. Approved equal

2.04 LIGHTING AND RECEPTACLE WIRE AND CABLE

A. All exterior lighting and receptacle branch circuit wire and cable shall consist of stranded, copper conductors with 600v rated insulation, type XHHW-2, 90°C.

B. Interior lighting and receptacle branch circuit wire and cable may utilize stranded, copper conductors with 600v rated insulation, type THHN/THWN 75°C.

C. Conductors shall be stranded copper per ASTM-B8, B-33 and B-189, Class B or C stranding contingent on the size unless otherwise specified. Minimum size wire shall be #12AWG.

D. Lighting and receptacle cables and wire shall be manufactured by the General Cable Company, Southwire Cable Company or approved equal.

2.05 INSTRUMENTATION SIGNAL CABLE (STP)

A. The instrumentation cable for analog signals shall be individually shielded twisted pair cable (STP) or individually shielded twisted multi-pair cable (M#STP, where # = number of pairs). Conductors shall be tin or alloy coated, soft, annealed copper, #16AWG minimum with a minimum of 19 strands with 600V rated insulation for 75°C. Pairs shall have 100% coverage foil shields with a #18AWG tinned copper drain wire. Outer jackets shall be chromed polyvinyl chloride.

B. The instrumentation cable shall be Belden, Okonite or approved equal for single and multiple pair applications or approved equal.

C. Instrumentation cables shown on the Contract Drawings to be direct buried shall be UL labeled for direct buried service.

2.06 TELEPHONE/DATA CABLE (CAT-6)

A. All interior telephone/data cables shall be ANSI/TIA/EIA 568 (Category 6e), #24AWG copper, plenum rated and ETL Type-CMP.

PART 3 EXECUTION

3.01 600V CABLE INSTALLATION

A. The cable and wires shall be installed as specified herein and shown on the Contract Drawings.

B. The cables shall be terminated in accordance with the cable and/or termination product manufacturer's instructions for the particular type of cable.

C. To minimize oxidation and corrosion, wire and cable shall be terminated using an oxide-inhibiting joint compound recommended for "copper-to-copper" connections. The compound shall be Penetrox E as manufactured by Burndy Electrical, or approved equal.

D. Splices are normally not permitted in the underground duct, manhole and handhole systems. If splices are required, the Contractor shall obtain approval in writing from the Engineer prior to splicing.

1. Splicing material shall be a two-part insulating and encapsulating resin.

B. Cable and Wire Sizes

1. The sizes of cable and wire shall be as shown on the Contract Drawings, or if not shown, as approved by the Engineer. If required due to field routing, the size of conductors and respective conduit shall be shall be coordinated with and approved by the Engineer.

2. Minimum wire size within control panels, motor control centers, switchboards and similar equipment shall be #12AWG for power and #14AWG for control.

C. Number of Wires

1. The number of wires indicated on the Contract Drawings for the various control, indication, and metering circuits were determined for general schemes of control and for particular indication and metering systems.

2. The actual number of wires installed for each circuit shall, in no case, be less than the number required; however, the Contractor shall add as many wires as may be required for control and indication of the actual equipment selected for installation at no additional cost to the Owner. The addition of conductors shall be coordinated with and approved by the Engineer.

D. Wiring Identification

1. Wiring Identification shall meet the requirements of Section 16010 – Electrical Basic Requirements.

E. Cable Installation

1. All interior cable not protected by a compartment enclosure shall be run in conduit.

F. Training of Cable

1. The Contractor shall furnish all labor and material required to train cables around cable vaults within buildings and in manholes in the outdoor underground duct system. Sufficient length of cable shall be provided in each manhole and vault so that the cable can be trained and racked in an approved manner. In training or racking, the radius of bend of any cable shall be not less than the manufacturer's recommendation. All manhole cables shall be arc and fire-proofed. The training shall be done in such a manner as to minimize chaffing.

G. Connections at Control Panels, Limit Switches, and Similar Devices

1. Where stranded wires are terminated at panels, and/or devices, connections shall be made by solderless lug, crimp type ferrule or solder dipped.

2. Where enclosure sizes and sizes of terminals at limit switches, solenoid valves, float switches,

pressure switches, temperature switches, and other devices make 7-strand, #12AWG, wire terminations impractical, the Contractor shall terminate external circuits in an adjacent junction box of proper size and shall install #14AWG stranded wires from the device to the junction box in a conduit. The #12 AWG field wiring shall also be terminated in the same junction box to complete the circuit.

H. Pulling Temperature

1. Cable shall not be flexed or pulled when the temperature of the insulation or of the jacket is such that damage will occur due to low temperature embrittlement. When cable will be pulled with an ambient temperature within a three day period prior to pulling of 40°F or lower, cable reels shall be stored during the three day period prior to pulling in a protected storage area with an ambient temperature not lower than 55°F and pulling shall be completed during the work day for which the cable is removed from the protected storage.

I. Color Coding

1. Unless otherwise noted on the Contract Drawings, conductor insulation shall be color coded as follows:

a) 480V AC Power

(1) Phase A - BROWN

(2) Phase B - ORANGE

(3) Phase C - YELLOW

(4) Neutral – GREY

b) 120/208V or 120/240V AC Power

(1) Phase A - BLACK

(2) Phase B - RED

(3) Phase C - BLUE

(4) Neutral – WHITE

c) 120VAC Control

(1) Ungrounded conductors – RED

(2) Ungrounded conductors, foreign source - YELLOW.

d) 24VAC Control

(1) All wiring – ORANGE

e) 24VDC Power

(1) Positive Lead – RED

(2) Negative Lead – BLACK

f) 24VDC Control

(1) Ungrounded conductors – BLUE

(2) Grounded conductors – BLUE w/WHITE stripe

g) Equipment Grounding Conductor:

(1) All wiring – GREEN

2. Conductors #4AWG and smaller shall be factory color coded with a separate color for each phase and neutral, which shall be used consistently throughout the system. Larger cables shall be coded by the use of colored tape.

3.02 INSTRUMENTATION / TELEPHONE / DATA CABLE INSTALLATION

A. Grounding of cable shield shall be accomplished at one end point only.

B. Raceways exceeding 5 feet and containing instrumentation / telephone / data cable shall be installed to provide the following clearances:

1. Raceway installed parallel to raceway conductors energized at 480 through 208V shall be 18 inch and 208/120V shall be 12 inch.

2. Raceway installed at right angles to conductors energized at 480V or 120/208V shall be 6 inch.

C. Where practical, raceways containing instrumentation / telephone / data cable shall cross raceway containing conductors of other systems at right angles.

D. Where instrumentation / telephone / data cables are installed in panels, etc., the Contractor shall arrange wiring to provide maximum clearance between cables and other conductors. Instrumentation / telephone / data cables shall not be installed in same bundle with conductors of other circuits.

E. Additional pullboxes shall be furnished and installed for ease of cable pulling and the cable manufacturer's recommended conduit fill factor shall be followed.

F. All cable, insulation and jacket shall have adequate strength to allow for it to be pulled through the conduit systems. Sufficient conductors shall be installed to provide space and serve future equipment where shown and specified. All conductors shall be color coded and all wires shall be suitably tagged with permanent markers at each end.

3.03 TESTING

A. All testing shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Shop Test

a) Prior to the first shipment of each size of power, control, and telephone / data cable to be furnished and installed under this Contract, samples of each size of cable shall be subjected to complete physical and electrical factory production tests at the manufacturer's plant. Other cable and wiring shall be tested in accordance with the applicable ICEA Standards. Six copies of certified test data sheets shall be submitted to the Engineer for approval prior to installation at the site. Subsequent shipment of each size of wire shall be covered by certificates of compliance which shall list Contractor's name, point of delivery, reel numbers, size of wire, length of wire, and date of shipment. Certificates shall attest the wires and cables comply with specification requirements and that wires and cables are equal in every respect to wires and cables which have been successfully tested.

b) All test data or certificates shall be notarized and submitted.

2. Field Tests

a) Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and Section 16010–Electrical-Basic Requirements.

b) After installation, all wires and cables shall be tested for insulation levels and continuity. Insulation resistance between conductors of the same circuit and between conductor and ground shall be tested. Testing for insulation levels shall be as follows:

(1) For 600V rated power and control cable, apply 1,000VDC from a Megaohmeter for all 600V wires and cables installed in lighting, control, power, indication, alarm and motor feeder circuits. Testing for continuity shall be "test light" or "buzzer".

(2) 600V rated instrumentation signal cable shall be tested from conductor to conductor, conductor to shield, and conductor to ground using a 260 volt-ohmmeter, or approved equal. The resistance value shall be 200 megaohms or greater.

B. Low voltage wires and cables shall be tested before being connected to motors, devices or terminal blocks.

C. Voltage tests shall be made successively between each conductor of a circuit and all other conductors of the circuit grounded.

D. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner.

E. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment.

END OF SECTION

SECTION 16130

OUTLET PULL AND JUNCTION BOXES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Outlet pull and junction boxes

B. Related Sections include but are not necessarily limited to:

1. Contract and Bidding Requirements

2. Section 16010 - Electrical Basic Requirements

1.02 QUALITY ASSURANCE

A. Referenced Standards

1. Refer to Section 16010 - Electrical Basic Requirements

1.03 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples, Shop Drawings

B. Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 – Operation and Maintenance Data.

1.04 DELIVERY, STORAGE, AND HANDLING

A. see Section 16010 - Electrical Basic Requirements

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Galvanized Steel Boxes

(a) Appleton Electric Co.

(b) Steel City

(c) Raco

2. Corrosion-Resistant Boxes

(a) Hoffman Engineering Co.

(b) Crouse-Hinds

3. Hazardous Location Boxes (Class I, II & III)

(a) Appleton Electric Co.

(b) Crouse-Hinds

(c) Killark

(d) O-Z/Gedney

4. Raintight and Watertight Boxes

(a) Appleton Electric Co.

(b) Crouse-Hinds

5. Terminal Boxes

(a) Hoffman Engineering Co.

6. Exposed Switch and Receptacle Boxes

(a) Appleton Electric Co.

(b) Crouse-Hinds

(c) Killark

2.02 MATERIALS

A. Pull and Junction Boxes (smaller than 100 cubic inch)

1. Wet Areas

(a) Material: Malleable-Iron or 14 gage steel with polyester powder coating inside and out over phosphatized surfaces.

(b) 14 gage steel

(1) Continuously welded seams, ground smooth, no conduit punch-outs

(2) Stainless steel clamps on four sides

(3) Flat cover with oil resistant gasket

(4) NEMA 4 classification

(5) UL listed

2. Corrosive Areas:

(a) Material: Nylon, PVC or fiberglass reinforced polyester material.

(1) Neoprene door gasket

(2) Grounding bushing(s)

(3) NEMA 4X classification

(4) UL listed

3. Hazardous Areas

(a) Material: Cast gray iron alloy or copper-free cast aluminum

(b) Drilled and tapped openings or tapered threaded hub equipped

(c) Flat bolted-down or threaded cover with neoprene gasket

(d) Stainless steel hex head screws

(e) Explosion-proof, UL listed for Class 1 Groups C and D

B. Large Pull and Junction Boxes (100CU-IN and larger)

1. Wet and Corrosive areas

(a) NEMA 4X with stainless steel screws

(1) Type 304 L welded stainless steel

(2) Continuously welded seams, ground smooth, no conduit punch-outs

(3) Rolled lip around all sides

(b) Termination Boxes

(1) Galvanized 16 GA steel box provided with plain blank screw cover, subpanel, and terminal points.

(2) Terminal blocks shall be screw-cage barrier-type with white marker strip.

(3) Refer to Contract Drawings for dimensions, number of terminals and ratings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Use listed and labeled boxes with threaded conduit hubs for use in hazardous areas.

C. Use malleable iron Type FS and FD boxes in wet areas and where exposed rigid steel conduit is required.

D. Use stainless steel, fiberglass, nylon or PVC boxes for corrosive areas.

E. Fill unused punched, tapped, or threaded hub openings with insert plugs of like material to maintain enclosure NEMA rating.

F. Use boxes sized to accommodate the quantity of conductors and devices enclosed.

G. Set all outlet pull and junction boxes plumb and vertical to the finish floor or grade.

H. Provide and install pull boxes or junction boxes in conduit runs as required to facilitate pulling of wires or making connections.

I. Make covers of boxes accessible.

J. Install pull boxes or junction boxes rated for the area classification.

K. Install all conduits squarely into all outlet pull and junction boxes.

L. Terminate all conduits as required in Specification **Section 16111-Conduit and Raceway**.

M. Large pull and junction boxes shall NOT be mounted to hand-rail or safety rail.

N. Do not install “back-to-back” boxes anywhere within this Project.

O. Support outlet boxes for lighting fixtures and other ceiling-mounted devices in lay-in acoustical tile ceilings by bar hangers anchored to ceiling construction members which do not interfere with tile removal.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Light switches, receptacles, device plates, dimmers, plug-in strips.

B. Related Sections include but are not necessarily limited to:

1. Division 1 - General Requirements

2. Section 16010 - Electrical Basic Requirements

1.02 QUALITY ASSURANCE

A. Referenced Standards

1. Refer to Section 16010 - Electrical Basic Requirements

1.03 SUBMITTALS

A. Shop Drawings

1. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples and 16010 - Electrical Basic Requirements.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Light switches (except explosion-proof)

a) Hubbell

b) Slater

c) P&S

d) Arrow Hart

e) General Electric

f) Leviton

2. Explosion-proof light switches

a) Crouse-Hinds

b) Appleton Electric Co.

c) Killark

3. Door switches

a) General Electric

b) Slater

c) P&S

d) Arrow Hart

e) Micro-switch

4. Receptacles (except explosion-proof)

a) Hubbell

b) Slater

c) P&S

d) Arrow Hart

e) General Electric

f) Leviton

5. Explosion-proof Receptacles

a) Crouse-Hinds

b) Appleton Electric Co.

c) Killark

6. Dimmers

a) Lutron

b) General Electric

c) P&S

7. Plug-in Strip

a) Wiremold

b) Walker

2.02 MATERIALS

A. Light Switches for Unclassified Areas

1. Toggle type, quiet action, and specification grade with grounding terminal

2. Back and side wired

3. Solid silver cadmium oxide contacts

4. One-piece switch arm rated 20A, 120/277VAC

5. UL listed

6. Color: Ivory

7. Wall plate: Type 304 stainless steel

8. Type: As indicated on Contract Drawings

B. Receptacles for Unclassified Areas

1. Straight blade, grounding type, specification grade

2. Back and side wired with Wrap-around Bridge

3. Rated 20A, 125 VAC

4. UL listed

5. Color

a) For use on normal power: IVORY

b) For use on UPS systems: RED

c) For use on isolated ground systems: ORANGE

6. Wall plate: Type 304 stainless steel

7. Type: As indicated on Contract Drawings

C. Light Switches for Wet Areas

1. Press-switch type, quiet action, specification grade, with grounding terminal

2. Back and side wired

3. Solid silver cadmium oxide contacts

4. One-piece switch arm rated 20A, 120/277VAC

5. UL listed

6. Color: IVORY

7. Wall plate: GREY weatherproof press-switch type

8. Type: As indicated on Contract Drawings

D. Receptacles for Outdoor and Wet Areas

1. Straight blade, grounding type, GFIC specification grade

2. Back and side wired with wrap around bridge

3. Rated 20A, 125VAC

4. UL listed

5. Color: IVORY

6. Wall plate: Weatherproof, cast aluminum, UL listed “IN USE” cover

7. Type: As indicated on Contract Drawings

E. Ground Fault Circuit Interrupter (GFCI) Receptacles

1. Straight blade, grounding type, specification grade

2. Rated 20A, 125VAC

3. UL listed

4. Test and reset buttons

5. Wall plate: Indoor or weatherproof “IN USE” as required

6. Feed-thru type

F. Light Switches for Corrosive Areas

1. Corrosion-resistant NEMA 4X enclosure with switch consisting of:

a) Fiberglass reinforced polyester enclosure

b) Fiberglass reinforced polyester gasketed wall plate with built-in toggle lever switch with stainless steel shaft

c) Grounding bushing

d) Rated 20A, 125VAC

e) UL listed

f) Type: As indicated on Contract Drawings

g) Color: YELLOW

2. Optional: Corrosion-resistant enclosure and switch consisting of:

a) Cast copper-free aluminum "FS" or "FD" ridge type hub box

b) Toggle type, quiet action, and specification grade with grounding terminal

c) Rated 20A, 125VAC with solid silver cadmium oxide contacts

d) UL listed

e) Neoprene gasket

f) Cast aluminum cover with stainless steel screws and lever to activate switch

g) Type: As indicated on Contract Drawings

h) Color: YELLOW

G. Receptacles for Corrosive Areas

1. Corrosion-resistant straight blade, grounding type, specification grade

2. Back and side wired with Wrap-around Bridge

3. Rated 20A, 125VAC

4. UL listed

5. Color: YELLOW

6. Box: "FS" or "FD" ridge type cast hub box of copper-free aluminum

7. Gasket: Neoprene

8. Wall plate: Weatherproof, cast aluminum, UL listed “IN USE” cover

9. Type: As indicated on Contract Drawings

H. Explosion-proof Light Switches for Use in Hazardous Areas:

1. Explosion-proof, UL listed for Class I, Division 1 and 2, Groups B, C, and D; and Class II, Division 1 and 2 areas, Groups E, F, and G.

2. EDS factory sealed

3. Malleable iron body and cover

4. Aluminum sealing chamber

5. Front operated handle with stainless steel shaft

6. Rated 20A, 125VAC

7. With grounding screw

8. Type: As indicated on Contract Drawings

I. Explosion-proof Receptacles for Use in Hazardous Areas

1. Explosion-proof, UL listed for Class I, Division 1 and 2, Groups B, C, and D; and Class II, Division 1 and 2, Groups F and G

2. Factory-sealed malleable iron receptacle with spring-loaded cover

3. Malleable iron mounting box

4. Rated 20A, 125VAC

5. "Dead-front" construction requiring plug to be inserted and rotated to activate receptacle

6. Type: As indicated on Contract Drawings

J. Plug-In Strip: Surface steel raceway plug-in strip with single 15A, 125VAC, 3 wire grounding-type receptacles spaced 18 inch on center.

1. Pre-wired with two #12 TW and one #12 TW green insulated ground

2. Minimum 1-1/4 inch wide x 3/4 inch deep

3. Suitable fittings and snap-in cover

4. Finish

a) Stainless steel

5. Receptacle color

a) For use on normal power: Ivory

b) For use on UPS systems: Red

c) For use on isolated ground systems: ORANGE

K. Door Switches

1. Rated 5A, 120VAC

2. Mode of operation: Door open - lights on

3. UL listed

L. Lighting Dimmers

1. Electronic solid state type, rated for load, 120 and 277VAC

2. Circuit design: Silicon symmetrical gate to provide full wave dimming and withstand current and inverse voltage surges

3. Controls: Linear slide with positive off

4. Provide built-in filter to minimize noise interference in nearby audio lines

5. Rated 100^{o}F maximum, ambient

6. UL listed

7. Finish: IVORY or WHITE

M. Pedestal-Type Floor-Mounted or Counter-Mounted Duplex Receptacles

1. Straight blade, grounding type, specification grade

2. Back and side wired with Wrap-around Bridge

3. Rated 15A, 125VAC

4. Horizontal design housing with threaded conduit fittings in base with satin chromium finish

5. Install on adjustable 4-inch flush floor box

6. Color

a) For use on normal power: IVORY

b) For use on UPS systems: RED

c) For use on isolated ground systems: ORANGE

N. Thermostats

1. Contacts close on falling temperature to cycle unit heater on rising temperature to cycle exhaust fan motor

2. Rated 20A, 120VAC

3. Range: 46-84 Degrees F scale.

4. Switch: AUTO/OFF/ON

5. Provide sub-base and mounting plate.

6. Provide standard outlet box for mounting thermostat

PART 3 EXECUTION

A. Installation

1. Install products in accordance with manufacturer's instructions.

2. Mount devices where indicated on the Contract Drawings.

3. Surface-mount receptacles and light switches in concrete construction.

4. In masonry and metal stud construction, recess-mount receptacles and light switches unless device precludes recessed mounting or unless otherwise noted on the Contract Drawings.

5. Where more than one receptacle is installed in a room, they shall be symmetrically arranged.

6. Set all wiring devices including covers plumb and vertical to the floor.

7. Set recess-mounted switches and receptacles flush with face of walls.

8. Do not connect dimmers to loads in excess of 80 percent of the rating of the dimmer.

9. Provide blank plates for empty outlets.

10. Securely attach top to ceiling grid and base to mating surface.

END OF SECTION

SECTION 16150

MOTORS

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, materials, tools and equipment necessary for furnishing, installing, connecting, testing and placing into service all Motors as specified herein and indicated on the Contract Drawings.

B. All Motors shall be sufficient size for the duty to be performed and shall not exceed their full rated load when the driven equipment is operating at specified capacity. Unless otherwise noted, motors driving pumps shall not be overloaded at any head or discharge condition of the pump.

1.02 CODES AND STANDARDS

A. Motors shall comply with the following applicable codes and standards as well as any others within the Specifications and Contract Drawings. In the event of any conflict between these codes, regulations, standards, and Contract Documents, the most restrictive shall apply.

1. American National Standards Institute (ANSI/NEMA)

   a) MG1-2006, REV 1 2007 – Motors and Generators

2. National Fire Protection Association (NFPA)

   a) 70, National Electric Code (NEC)
   b) 79, Electrical Standard for Industrial Machinery

1.03 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

B. The Motor manufacturer shall submit to the Engineer certified dimensional drawings showing nameplate data and outline dimensions.

C. Guarantee: All motors and associated equipment furnished and installed under this Section shall be guaranteed

against defects of workmanship, materials and improper installation for a period of three years from date of acceptance. All such motors, equipment or parts proven defective, due to the above noted causes, shall be replaced and installed by the Contractor at no expense to the Owner.

D. Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 – Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 RATINGS

A. All three-phase motors shall be "premium efficiency" type.

B. Unless otherwise noted, all Motors shall be of the low voltage type (600V or less). All Motors 2HP through 100HP shall be rated 230/460VAC, 3-PH, 60Hz. All Motors 125HP through 300HP shall be rated 460VAC, 3-PH, 60Hz. Motors below 2HP shall be rated 115/230VAC, 1-PH, 60Hz.

C. All Motors controlled by a Variable Frequency Drive (VFD) shall indicate on the motor nameplate that it is suitable for the intended application (inverter duty rated) and shall be provided with an integral temperature switch that opens on high temperature. All Motors operated by a VFD shall meet the requirements of ANSI/NEMA MG1 Class II Part 32.

2.02 CONSTRUCTION

A. General

1. Unless otherwise noted in these Specifications, all motors shall be totally enclosed fan cooled (TEFC).

2. TEFC motors shall be provided with condensate drain hole and epoxy coated motor windings to protect against moisture.

3. All motors shall have 1.15 service factor unless otherwise noted.

4. The output shaft shall be suitable for mechanical connection as required.

5. Space heaters shall be provided on motors 25 HP and larger for moisture control. Space heaters shall

operate at 120 VAC, single-phase with leads brought out to terminal blocks enclosed within a NEMA-12 accessory box. Motors shall be provided with a metallic or plastic warning plaque, permanently fixed to motor casing, with red background and white letters which has the following legend:

WARNING-ELECTRICAL SHOCK HAZARD
Motor Equipped with Strip-Heaters
Strip-Heater remains Energized when Local
Disconnect is OFF

B. Three-Phase Motors

1. Motors shall be of the squirrel-cage induction type, NEMA design B. Horizontal, vertical solid shaft, vertical hollow shaft, normal thrust and high thrust types shall be furnished as specified herein. All Motors shall be built in accordance with current NEMA, IEEE, ANSI and AFBMA standards where applicable. Motors shall be of the type and quality described by these Specifications, fully capable of performing in accordance with manufacturer's nameplate rating, and free from defective material and workmanship.

2. Motors shall have normal or high starting torque (as required), low starting current (not to exceed 600 percent full load current), and low slip.

3. Motors shall have a Class B non-hygroscopic insulation system. Class F insulation may be used but shall be limited to Class B temperature rise.

4. All machine surfaces shall be coated with rust inhibitor for easy disassembly.

5. All Motors shall have a final coating of chemical resistant corrosion and fungus protective epoxy fortified enamel finish sprayed over red primer over all interior and exterior surfaces. Stator bore and rotor of all motors shall be epoxy coated.

6. Motors installed outdoors shall be mill and chemical duty suitable for operation in moist air with hydrogen sulfide gas present.

7. All fittings, bolts, nuts, and screws shall be 316 stainless steel. Bolts and nuts shall have hex heads.

8. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts shall be supplied on all frames 254T and larger. Enclosures will have stainless steel screen and motors shall be protected for corrosion, fungus and insects.

9. Conduit boxes shall be gasketed. Lead wires between motor frame and conduit box shall be gasketed.

10. Three-Phase Motors shall be manufactured by Baldor, General Electric, U.S. Motors, Westinghouse or approved equal.

C. Fractional Horsepower Motors

1. Fractional Horsepower Motors shall be rigid, welded-steel, designed to maintain accurate alignment of Motor components and provide adequate protection. End shields shall be reinforced, lightweight die-cast aluminum. Windings shall be of varnish-insulated wire with slot insulation of polyester film, baked-on bonding treatment to make the stator winding strongly resistant to heat, aging, moisture, electrical stresses and other hazards.

2. Motor shaft shall be made from high-grade, cold-rolled shaft steel with drive-shaft extensions carefully machined to standard NEMA dimensions for the particular drive connection.

3. For light to moderate loading, bearings shall be quiet all-angle sleeve type with large oil reservoir that prevents leakage and permits motor operation in any position.

4. For heavy loading, bearings shall be carefully selected precision ball bearings with extra quality, long-life grease, and large reservoir providing 10 years' normal operation without relubrication.

D. Integral Horsepower Motors

1. Motor frames and end shields shall be cast iron or heavy fabricated steel of such design and proportions as to hold all Motor components rigidly in proper position and provide adequate protection for the type of enclosure employed.

2. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations.

3. The shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in Motors of the particular rating. Bearing journals shall be ground and polished.

4. Rotors shall be made from high-grade steel laminations adequately fastened together, and to the shaft. Rotor squirrel-cage windings may be copper or bar-type construction with brazed end rings.

5. Motors shall be equipped with vacuum-degassed antifriction bearings made to AFBMA Standards, and be of ample capacity for the Motor rating. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent lubrication, but facilities shall be provided for adding new lubricant and draining out old lubricant without Motor disassembly. The bearing housing shall have long, tight, running fits or rotating seals to protect against the entrance of foreign matter into the bearings, or leakage of lubricant out of the bearing cavity.

6. Bearings of high thrust Motors will be locked for momentary upthrust of 30% downthrust. All bearings shall have a minimum B10 life rating of 100,000 hours in accordance with AFBMA life and thrust values.

7. Vertical hollow-shaft motors will have non-reverse ratchets to prevent backspin.

E. Single-Phase Motors

1. Single-Phase Motors shall be split-phase and capacitor-start induction types rated for continuous horsepower at the RPM as called for on the Contract Drawings. Motors shall be rated 115/230VAC, 1-PH, 60Hz, TEFC with temperature rise in accordance with NEMA Standards for Class B insulation.

2. TEFC Motors shall be designed for severe-duty.

3. Motors shall have corrosion and fungus protective

finish on internal and external surfaces. All fittings shall have corrosion-protective plating.

4. Mechanical characteristics shall be the same as specified for Fractional Horsepower Motors.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. All Motors and associated equipment shall be stored in accordance with the manufacturer recommendations and shall not be stored exposed to weather.

3.02 INSTALLATION

A. The Contractor shall plan the layout of the raceway systems so that when the work is complete it will exhibit good workmanship practices.

B. All Motors and their peripheral devices shall be connected to the raceway system by means of a short section of flexible conduit, 18IN minimum and 60-inch maximum, unless otherwise indicated on the Contract Drawings.

C. The Contractor shall install a grounding conductor in the conduit and terminate at the Motor Controller with an approved grounding clamp for all motor connections.

D. Connection to Motor leads shall be made with high-compression type lugs with heat-shrinkable insulating boots.

E. Phase rotation corrections shall be made within the Motor connection box.

3.03 TESTING

A. The Contractor shall check each Motor for correct clearances and alignment and for correct lubrication, and shall lubricate, if required, in accordance with manufacturer's instructions.

B. The Contractor shall utilize a 1000V meg-ohmmeter to test each Motor winding before energizing the Motor. If the Motor insulation resistance is at or below the manufacturer’s allowable limit, the Contractor shall notify the Engineer and shall not energize the Motor. The Contractor shall confirm the direction of rotation of all Motors with a phase rotation meter and reverse the

connections, as required, at the Motor connection box.

END OF SECTION

SECTION 16163

DISTRIBUTION SWITCHBOARDS

PART 1 GENERAL

1.01 SCOPE

A. Work covered by this section includes furnishing all labor, equipment, and materials required to install or Modify distribution switchboards where indicated. Distribution switchboards shall be dead front type, completely metal enclosed, self-supporting structures independent of wall supports.

1.02 SHOP DRAWINGS AND ENGINEERING DATA

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

1.03 STORAGE AND PROTECTION

A. The Contractor shall store and protect switchboards in accordance with the manufacturer's recommendations.

1.05 OPERATION AND MAINTENANCE MANUALS

A. Operations and Maintenance Manuals shall be submitted as outlined in Specification 01730 – Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 GENERAL

A. Voltage rating shall be as indicated on the drawings. Switchboards shall consist of the required number of vertical sections bolted together to form one rigid unit. The sides and rear shall be covered with removable screw-on plates. All edges of front covers or hinged front panels shall be formed.

B. Equipment shall comply with the latest applicable standards of NEMA PB2 & U.L. 891. Equipment shall be UL labeled and Service Entrance shall be labeled where required.

C. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required.

All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips.

D. Switchboard shall be provided with adequate lifting means and shall be capable of being rolled or moved into installation position and provided with contractor supplied floor sills to be set level.

E. Furnish cable pull sections or top cable pull boxes where shown of the drawings complete with cable tie-down supports. Where cable pull section or pull boxes contain utility service cables provide utility acceptable sealing means.

F. Switchboard shall be manufactured by Square D, Cutler-Hammer, or GE.

2.02 BUSSING

A. All bus bars shall be plated copper with bolted connections at joints. The switchboard(s) shall bear a UL integrated equipment rating as shown on the drawings. Main horizontal bus bars shall be mounted with all 3 phases arranged in the same vertical plane. Provide full capacity neutral where a neutral is indicated on the drawings.

B. A ground bus shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard. An incoming ground lug shall be furnished. Other ground lugs for feeder circuits shall also be supplied as shown in the schedules on the drawings.

C. All hardware used on conductors shall be high-tensile strength and zinc plated. All terminals shall be of the anti-turn solderless type suitable for CU or AL cable of sizes indicated.

2.03 SWITCHBOARD TYPE

A. Front Accessible Panel Mounted Feeder Devices

1. All sections of the switchboard shall be 24-inches deep or greater. All sections of the switchboard shall align so that the back of the complete structure may be placed flush against a wall.

2. Construction shall allow maintenance of incoming line terminations, main device connections and all

main bus bolted connections to be performed without rear access. The feeder or branch devices shall be removable from the front and shall be panel mounted with the necessary device line and load connection front accessible.

2.04 OVERCURRENT DEVICES

A. Feeder protective devices shall be molded case circuit breaker type with frame and trip ratings as shown on the drawings and have additional characteristics as specified.

B. Devices shall be manually operated (MO), unless electrically operated (EO) is indicated on the Drawings.

2.05 SPECIFIC OVERCURRENT DEVICE SPECIFICATIONS

A. The following specification paragraphs elaborate on the devices selected and determined by the notes and comments in the schedules and on the contract drawings.

1. Molded Case Breakers

a) Protective devices as shown shall be molded case circuit breakers, built, tested and UL labeled per UL 489.

b) Breakers 100-ampere through 400-ampere frame shall be thermal-magnetic trip with inverse time current characteristics. Breakers 225-ampere through 400-ampere shall have continuously adjustable magnetic pick-ups of approximately five to ten times trip rating.

c) Breakers 600-ampere frame and above shall be complete with built-in current transformers, trip unit and flux transfer shunt trip. Breakers shall have trip rating plugs with ratings as indicated on the drawings. Rating plugs shall be interlocked so they are not interchangeable between frames and interlocked such that a breaker cannot be latched with the rating plug removed.

Breakers shall have built-in test points for testing long delay, instantaneous and ground fault functions of the breaker by means of a test kit.

d) Supply where shown on the drawings, limiters or current limiting mechanisms.

2. Nameplates: Engraved nameplates shall be furnished for all mains and feeder circuits including control fuses and also for all indicating lights and instruments. Nameplates shall give item designation and circuit number as well as frame size and appropriate trip rating. Furnish Master Nameplate giving switchboard designation, voltage, ampere rating, short circuit rating, manufacturer's name, general order number and item number.

3. Finish: All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be manufacturer's standard and use the manufacturer's standard process.

4. Indoor Enclosure

a) Panel or group-mounted device structures shall have hinged wireway covers allowing easy access to load terminations.

b) Individually mounted feeder devices shall have bolted covers providing a dead front cover, yet allowing the device operating mechanism to extend through the cover for visual trip indication and operation.

PART 3 EXECUTION

3.01 TESTS

A. After assembly, the manufacturer's standard tests, including any NEMA standard tests, shall be performed. Witnessed tests shall be carried out when specified on the data sheet or purchase order.

B. A functional test shall be performed on all metering, control, and protective relay circuits and devices. This shall be accomplished by introducing operating and tripping currents and voltages at the secondary terminals of the instrument transformers. The purchaser shall be notified before this test is performed.

3.02 MARKING AND SHIPPING

A. Each separate component of the equipment shall be identified by the purchaser's requisition sheet number and item number by means of a metal tag securely wired to the component.

B. Each housing enclosure for equipment such as circuit breakers, switches, and motor starters shall be provided with a permanently attached nameplate of laminated bakelite or a similar approved material. The name plate shall indicate the tagging or nomenclature shown in the equipment list, and shall be permanently mounted on the face of the enclosure where it will be clearly visible. Lettering shall be white on a black background and shall be at least ¼ inch high.

C. Equipment shall be packed to prevent damage to it during shipment. Movable parts such as contactors, relays, etc. shall be wedged to prevent movement. Small parts shall be shipped, bagged, boxed or otherwise protected against damage or loss.

D. Each package, case, etc. as shipped shall, in addition to the address, be marked with the purchaser's requisition sheet and item number. Containers shall be marked to show the contents thereof.

3.03 REJECTION

A. Equipment or parts thereof and material entering therein, indicating irremediable or injurious defects, improper fabrication, excessive repairs, or that it is not in accordance with the requirements of this specification, shall be subject to rejection. They shall also be subject to rejection if such conditions are discovered after acceptance of the item at the manufacturer's plant.

END OF SECTION

SECTION 16450

GROUNDING AND BONDING

PART 1 GENERAL

1.01 THE REQUIREMENTS

A. The Contractor shall furnish and install grounding systems complete in accordance with the minimum requirements established by Article 250 of the NEC. Article 250 of the NEC shall be considered as a minimum requirement for compliance with this Specification.

B. Grounding of all instrumentation and control systems shall be furnished and installed in accordance with the manufacturer/system requirements and IEEE 1100-92, Powering and Grounding of Sensitive Electronic Equipment. Conflicts shall be promptly brought to the attention of the Engineer.

C. In addition to the NEC requirements, building structural steel columns shall be permanently and effectively grounded.

D. Reference Section 16010 – Electrical Basic Requirements.

E. Additional requirements for grounding are shown on the Contract Drawings.

1.02 CODES AND STANDARDS

A. All grounding components and the completed system shall comply with the following codes and standards as well as within the Specifications or as shown on the Contract Drawings:

1. American National Standards Institute (ANSI/IEEE)

   a) C2, National Electrical Safety Code (NESC)

2. Institute of Electrical and Electronic Engineers (IEEE)

   a) IEEE 81, Guide for Measuring Earth Resistivity.

   b) IEEE 142, Recommended Practice for Grounding of Industrial and Commercial Power Systems.

3. National Fire Protection Association (NFPA)

a) NFPA 70, National Electric Code (NEC)

4. Underwriters Laboratories Inc (UL)

a) 588, Grounding Equipment

1.03 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

B. In accordance with the procedures and requirements set forth in the General Conditions and Division 1, the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Reports of certified field tests. Each submittal shall be identified by the applicable Specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Equipment specifications and product data sheets identifying all materials used and methods of fabrication.

2. Drawings and written description of how the Contractor intends to furnish and install the grounding system.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by these specifications shall be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings.

2.02 GROUNDING CONDUCTOR

A. A green, insulated equipment grounding conductor, which shall be separate from the electrical system neutral conductor, shall be furnished and installed for all circuits. Equipment grounding conductors shall be furnished and installed in all conduits. Use of conduits as the NEC required equipment grounding conductor is not acceptable.

B. Where specified or shown a 3-inch strap shall be furnished and installed as the grounding conductor.

2.03 EQUIPMENT GROUND CONDUCTOR

A. Equipment ground conductors shall be solid and continuous from a connection at earth to all distribution panelboards. Ground connections at panelboards, outlets, equipment, and apparatus shall be made in an approved and permanent manner.

2.04 BONDING FITTINGS

A. Grounding connections to equipment shall be bolted. Cable end connections may be made by use of the crucible weld process or bolted type connectors. Bolted type connectors for this application shall consist of corrosion resistant copper alloy with silicone bronze bolts, nuts and lock-washers which are designed for this purpose.

2.05 GROUND RODS

A. Ground rods shall be rolled to a commercially round shape from copper-clad steel manufactured by the molten-welding process or by the electro-formed process (molecularly bonded). They shall have an ultimate tensile strength of 75,000 PSI and an elastic limit of 49,000 PSI. The rods shall be not less than 3/4-inch diameter by 20 feet in length; and the proportion of copper shall be uniform throughout the length of the rod. The copper shall have a minimum wall thickness of 0.013 inch at any point on the rod.

B. The maximum resistance to ground of a driven ground rod shall not exceed 10-OHM under normally dry conditions. Where the resistance obtained with one (1) ground rod exceeds 10-OHM, additional ground rods shall be coupled, by exothermic welds. Except where specifically indicated otherwise, all exposed non current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductors in nonmetallic raceways and neutral conductors of wiring systems shall be grounded.

The ground connection shall be made at the main service equipment and shall be extended to the point of entrance of the metallic water service. Connection to the water pipe shall be made by a suitable ground clamp or lug connection to a plugged tee. If flanged pipes are encountered, connection shall be made with the lug bolted to the street side of the flanged connection. If there is not suitable metallic water service to the facility, the ground connection shall be made to the driven ground rods on the exterior of the building.

Where ground fault protection is employed, care shall be taken so that the connection of the ground and neutral does not interfere with the correct operation of the ground fault protection system.

2.06 GROUNDING GRID

A grounding grid shall be provided for each structure and interconnected between structures. The grounding grid shall be installed such that the ground resistance does not exceed 5-OHM. The grounding grid shall be interconnected by bare copper conductors sized to the largest service entrance ground, spliced and connected to ground rods by exothermic welds. The grounding conductors shall be installed after the excavations for the building have been completed and prior to the pouring of concrete for the footings, mats, etc. Copper "pigtails" shall be connected to the grounding grid system; shall enter the buildings and structure from the outside; and shall be connected to steel structures and equipment as described in this Section and as shown on the Contract Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Metal surfaces where grounding connections are to be made shall be clean and dry. Steel surfaces shall be ground or filed to remove all scale, rust, grease, and dirt.

Copper and galvanized steel shall be cleaned with emery cloth to remove oxide before making connections.

B. Grounding conductors shall be continuous between points of connection; splices shall not be permitted.

C. Where conductors are exposed and subject to damage from personnel, traffic, etc., conductors shall be installed in PVC sch-80 raceway.

D. Mechanical connections shall be permitted to ground rods in “Ground Test Wells” and shall be exposed to permit maintenance and inspection for continuity and effectiveness of grounding system.

E. Where subsurface conditions do not permit use of driven ground rods to obtain proper ground resistance, rods shall be installed in a trench or plate electrodes shall be provided, as applicable and necessary to obtain proper values of resistance.

F. Conduit

1. Conduit that enters equipment such as motor control centers, switchboards, switchgear, variable frequency drives, instrument and control panels, and similar equipment shall be bonded to the ground bus, where provided, and as otherwise required by the NEC.

3.02 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests: None required

2. Field Tests

a) Ground resistance shall be measured with a three-point, fall of potential instrument.

b) All ground rods shall be tested after being driven and prior to connection to the grounding system. Where test results show resistance-to-ground is greater-than 10-OHM, additional ground rods shall be driven by coupling with exothermic welds. The compliance shall be demonstrated by retesting ground rod.

c) Upon completion of installation of the grounding and bonding system, the entire system shall be tested at the ground test well(s), as indicated on the Contract Drawings. The completed system shall have less-than 5-OHM of ground resistance.

3. Documentation

a) All tests shall be completely documented indicating time of day, date, temperature, weather conditions, measuring instrument and all pertinent test information.

b) All required documentation of readings indicating non-compliance, shall be submitted to the Engineer prior to and required for final acceptance of the project.

END OF SECTION

SECTION 16460

DRY TYPE TRANSFORMERS

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install, and test transformers for power and lighting distribution systems as described herein, as shown on the Contract Drawings, and as required to complete the electrical installations.

B. All equipment specified in this Section shall be furnished by the transformer manufacturer who shall be responsible for the suitability and compatibility of all included equipment.

C. Reference Section 16010 - Electrical Basic Requirements, and Section 09900 - Painting and Coatings.

1.02 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests: None required

2. Certified Shop Tests

a) The transformers shall be given routine factory tests in accordance with the requirements of the ANSI and NEMA standards. Temperature rises may be certified from basic design.

b) As a minimum, the following tests shall be made on all transformers:

(1) Ratio tests on the rated voltage connection and on all tap connections

(2) Polarity and phase-relation tests on the rated voltage connection

(3) Polarity and phase-relation tests on the rated voltage connection

(4) Applied potential tests

(5) Induced potential tests

(6) No-load and excitation current at rated voltage on the rated voltage connection

3. Field Tests

a) Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and Section 16010 - Electrical Basic Requirements.

b) After installation, the transformers shall be subjected to routine insulation resistance tests. The tests shall be made by the Contractor who shall also furnish the required testing equipment.

1.03 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples. The Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings
2. Operation and Maintenance Manuals
3. Spare Parts List
4. Special Tools List
5. Reports of Certified Shop Tests

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein, and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Equipment specifications and product data sheets identifying all materials used and methods of fabrication

2. Drawings showing clearly marked dimensions for each transformer

3. Sample equipment nameplate diagram

D. The submittal information shall reflect the specific equipment identification number as indicated on the Contract Drawings.

E. The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these Specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items that the Contractor intends to provide are acceptable and shall be submitted.

1.05 OPERATION AND MAINTENANCE MANUALS

A. Operations and Maintenance Manuals shall be submitted as outlined in Specification 01730 – Operation and Maintenance Data.

1.06 TOOLS, SUPPLIES AND SPARE PARTS

A. The transformers shall be furnished with all special tools necessary to disassemble, service, repair and adjust the equipment. All spare parts as recommended by the equipment manufacturer shall be furnished to the Owner by the Contractor.

B. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

C. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size shall have the same parts number.

1.07 IDENTIFICATION

A. Each transformer shall be identified with the equipment tag number indicated on the Contract Drawings and the accepted shop drawings. A nameplate shall be securely affixed in a conspicuous place on each transformer. Nameplates shall be as specified in Section 16010 - Electrical Basic Requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings.

B. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Square-D
2. Cutler-Hammer
3. General Electric
4. Siemens-ITE
5. Virginia Transformer

2.02 DRY TYPE TRANSFORMERS

A. Furnish and install single-phase and three-phase general purpose, dry-type transformers, as specified herein and indicated on the Contract Drawings. The transformers shall be 60Hz, self-cooled, quiet-design insulated of the two winding type.

B. The transformers shall be Underwriters Laboratories, Inc. listed and shall bear the UL label.

C. The primary windings shall be rated 480VAC for use on 3-phase, 3-wire systems and connected delta unless indicated otherwise on the Contract Drawings. KVA ratings shall be as shown on the Contract Drawings. Furnish taps for transformers as follows:

1. 1 PH, 25 KVA and below: Two 5% FCBN

2. 3 PH, 15 KVA and below: Two 5% FCBN

3. 3 PH, 30 KVA and above: Two 2.5% FCAN and four 2.5% FCBN

D. All taps shall be full capacity rated.

E. The ratings of the secondary windings shall be as indicated on the Contract Drawings.

F. Transformers shall be designed for continuous operation at rated KVA, 24 hours a day, 365 days a year, with normal life expectancy as defined in IEEE 65 and ANSI C57.96. This performance shall be obtainable without exceeding 150 degrees Celsius average temperature rise by resistance or 180 degrees Celsius hot spot temperature rise in a 40 degrees Celsius maximum ambient and 30 degrees Celsius average ambient. The maximum coil hot spot temperature shall not exceed 220 degrees Celsius. All insulating materials shall be flame retardant and shall not support combustion as defined in ASTM Standard Test Method D 635. All insulating materials shall be in accordance with NEMA ST 20 Standard for a 220 degrees Celsius UL component recognized insulation system.

G. Transformer coils shall be of the continuous wound copper construction and shall be impregnated with nonhydroscopic, thermosetting varnish.

H. Transformers shall have copper windings.

I. All cores are to be constructed of high grade, nonaging, grain-oriented silicon steel with high magnetic permeability and low hysteresis and eddy current loses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be tightly clamped and compressed with structural steel angles. The completed core and coil shall then be bolted to the base by means of vibration-absorbing mounts to minimize sound transmission. There shall be no metal-to-metal contact between the core and coil assembly and the enclosure.

J. Indoor non-classified enclosures shall be made of heavy gauge steel and shall be degreased, cleaned, primed, and finished with a baked, weather-resistant enamel. See painting requirements specified in this section. Outdoor enclosures or enclosures within a corrosive area shall be constructed of stainless steel and rated NEMA 4X.

K. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90 degrees Celsius. Transformers shall be furnished with lugs of the size and quantity required and suitable for termination of the field wiring.

L. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable NEMA, IEEE, and ANSI standards.

M. Transformers shall be mounted on neoprene-rubber isolation pads. The transformers shall not exceed the following ANSI sound levels:

1.	0	to	9 kVA	40dB
2.	10	to	50kVA	45dB
3.	51	to	150kVA	50dB
4.	151	to	300kVA	55dB
5.	301	to	500kVA	60dB
6.	501	to	700kVA	62dB
7.	701	to	1000kVA	64dB
8.	1001	to	1.5MVA	65dB

2.03 PAINTING

A. The exteriors of the transformer enclosures shall be painted as follows:

1. Factory painting: Surfaces shall be cleaned carefully and given a priming basic lead chromate. This shall be followed by two coats of an approved paint applied by brushing.

2. Field painting: After delivery and installation, but before transformers are placed in service, all factory-painted surfaces shall be carefully cleaned and all abrasions shall be repaired.

PART 3 EXECUTION

3.01 INSTALLATION

A. The transformers shall be furnished and installed as shown on the Contract Drawings and as recommended by the equipment manufacturer.

B. Conduit routed to and from the transformer shall be arranged for easy removal of the transformer.

END OF SECTION

SECTION 16470

PANELBOARDS

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install panelboards of voltage and current ratings as shown on the Contract Drawings. Panelboards shall be furnished with circuit breaker ratings, number of breakers, number of poles and locations conforming to the panelboard schedules on the Contract Drawings.

B. Reference Section 16010 – Electrical Basic Requirements.

1.02 STANDARDS

A. Panelboards shall conform to all applicable Federal, UL, and NEMA standards. Materials and components shall be new and conform to grades, qualities and standards as specified herein and shown on the Contract Drawings.

B. Panelboards shall comply with the following industry standards:

1. UL Listing/ Approval

2. Standards

   a) UL 50 – Cabinets and Boxes

   b) UL 67 – Panelboards

   c) NEMA – PB1

   d) NFPA 70 – National Electrical Code

1.03 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests: None Required

2. Field Tests:

   a) Field testing shall be done in accordance with the requirements specified in the General

Conditions, Division 1, and Section 16010 – Electrical Basic Requirements.

1.04 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340-Shop Drawings, Project Data and Samples. The Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Reports of Certified Shop Tests

3. Spare Parts List

4. Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 – Operation and Maintenance Data.

B. Each submittal shall be identified by the applicable specification section.

1.05 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Material specifications and product data sheets identifying all materials used and methods of fabrication.

2. Complete assembly, layout, and installation drawings with clearly marked dimensions for each panelboard.

3. Complete panelboard schedules indicating circuit designations and connected loads as shown on the Contract Drawings for each panelboard.

D. The submittal information shall reflect the specific equipment identification as indicated on the Contract Drawings.

1.06 TOOLS, SUPPLIES AND SPARE PARTS

A. The panelboards and accessories shall be furnished with all special tools necessary to disassemble, service, repair, and adjust the equipment. For each panelboard, the Contractor shall furnish to the Owner all spare parts as recommended by the equipment manufacturer including two (2) molded case circuit breakers of each type, size, and rating used.

B. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

C. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size shall have the same parts number.

1.07 IDENTIFICATION

A. Each panelboard shall be identified with the identification tag number indicated on the Contract Drawings and the accepted shop drawings. A nameplate shall be securely affixed in a conspicuous place on each panelboard.

PART 2 PRODUCTS

2.01 GENERAL

A. The Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings.

2.02 CONDUCTORS (MAIN BUS AND BRANCH CONNECTORS)

A. All main bus shall be copper sized in accordance with UL standards to limit the temperature rise on any current carrying part to a maximum of 50 degrees C above a maximum ambient temperature of 40 degrees C.

2.03 LIGHTING PANELBOARDS

A. General

1. The Lighting Panelboards, as defined by NEC or noted on the Contract Drawings, shall be dead-front type with automatic trip-free, non-adjustable, thermal-overload, branch circuit breakers. Panelboards shall be of the configuration and rating as specified herein and indicated on the Contract Drawings. Panelboards shall be listed and labeled by Underwriter's Laboratories, Inc.

2. The Lighting Panelboards shall be equipped with a main breaker or main lugs complete with branch circuit breakers, as shown on the Contract Drawings. The panelboards shall be enclosed in a cabinet suitable for flush or surface mounting. Some panelboards shall be furnished and installed within motor control center structures as shown on the Contract Drawings.

3. Lighting Panelboards shall be fully rated and shall have a short circuit rating of 22kA symmetrical, minimum. In the event the results of the Contractor's short circuit fault analysis, as accepted by the Engineer, indicate that a higher short circuit rating of the panelboards is required, furnish complete panelboards with that higher rating.

4. Lighting Panelboards shall be furnished with transient voltage surge suppression (TVSS) and filtering equipment as required in Specification Section 16671-Transient voltage Surge Suppression and indicated on the Contract Drawings. The TVSS devices shall be UL labeled.

5. Subject to compliance with specifications Lighting Panelboards shall be:

   a) Square-D Company

   b) Eaton/Cutler-Hammer Electric Corporation

   c) General Electric

   d) Approved equal

B. Cabinets

1. Except for lighting panelboards installed in motor control centers, the cabinet shall be NEMA 12

(minimum) constructed of #12 U.S.S. code gauge galvanized steel. The door shall be fastened to the cabinet with concealed brass hinges and shall be equipped with flush-type catches and locks. All locks shall be keyed alike. The cabinet shall have wiring gutters on sides and shall be at least 20-inches wide and 5-3/4-inches deep. The Contractor shall provide an engraved nameplate for the panelboard. The nameplate shall include the panelboard designation, voltage, phase, wires, and bus rating.

2. An Underwriter's Laboratories, Inc. inspection label shall appear on the interior of the cabinet.

C. Bus Work

1. Main bus bars shall be of ample size so that a current density of not more than 1000A per square inch of cross section will be attained. This current density shall be based on the application of the full load connected to the panel plus approximately 25% of the full load for spare capacity. The main bus shall be full capacity as based on the preceding for the entire length of the panel so as to provide full flexibility of circuit arrangement.

2. Solid neutral bus bars are required. Ratings shall be in accordance with applicable standards.

3. A separate ground bus shall be provided with lugs for termination of equipment grounding conductors.

4. Branch bus work shall be rated to match the maximum branch circuit breaker which may be installed in the standard space.

5. All bus shall be plated copper.

D. Circuit Breakers

1. Circuit breakers shall be bolt-on, molded-case type conforming to NEMA Standard AB 1. Trip elements of circuit breakers shall be 20A unless otherwise shown on the Contract Drawings. Minimum branch circuit breaker shall be 100A frame for 60A and above except where shown otherwise on the Drawings or where a larger frame size is standard for the continuous current rating required. Breakers shall have an interrupting rating of 22kA symmetrical at

240VAC, minimum. All breakers shall have quick-make, quick-break, toggle mechanism for manual as well as automatic operation. Tandem or half-size breakers are not acceptable.

2. Where indicated, or where required by Code, circuit breakers for receptacle circuits shall be equipped with integrally mounted ground fault interrupters complete with "TEST" push button and shall be of a type which fit standard panelboard spaces for the breaker continuous current rating required.

3. Instrument power panel branch circuit breakers set for control instrumentation, telephone, data, fire alarm or auxiliary equipment circuits requiring continuous operation shall be provided with a lock-on device.

4. Circuit breakers used for fluorescent lighting circuit switching shall be approved for the purpose and shall be marked "SWD". Circuit breakers used for high intensity discharge lighting circuit switching shall be approved for the purpose and shall be marked "HID". Where required by Article 440 of the NEC, circuit breakers installed for air conditioning units shall be HACR type.

E. Directories

1. Approved directories with glass or noncombustible plastic cover and with typewritten designations of each branch circuit, shall be furnished and installed in each panelboard. The Contractor shall maintain in each panel, during the duration of the Contract, a handwritten directory clearly indicating the circuit breakers in service. This directory shall be updated as work progresses, and final, typewritten directories, as specified above, shall be installed at the end of the project. Designations and circuit locations shall conform to the panelboard schedules on the Contract Drawings, except as otherwise authorized by the Engineer.

2. The Contractor shall provide directories identifying panelboards and indicating the size of the feeder (cable and conduit) serving the panel, circuit numbers, and a description of associated branch circuits including branch circuit trip and connected load for each circuit.

2.04 POWER DISTRIBUTION PANELBOARDS

A. General

1. The Power Distribution Panelboards, as defined by NEC or noted on drawings, shall be of the configuration and rated as shown on the Contract Drawings. The panelboards shall be dead-front type with automatic trip-free, non-adjustable, thermal overload branch circuit breakers. Circuit breakers shall be bolt-on molded case type conforming to NEMA Standard AB1. Trip elements of the circuit breakers shall be rated 20A unless otherwise shown on the Contract Drawings. The bus ratings shall be as shown on the Contract Drawings. Panelboards shall be listed and labeled by Underwriter's Laboratories, Inc.

2. Power distribution panelboards shall be fully rated and shall have a short circuit rating of 25kA symmetrical, minimum. In the event the results of the Contractor's short circuit fault analysis, as accepted by the Engineer, indicate that a higher short circuit rating of the panelboards is required, furnish complete panelboards with that higher rating.

3. Power Distribution Panelboards shall be furnished with transient voltage surge suppression (TVSS) and filtering equipment as required in Section 16671 – Transient Voltage Surge Suppression (TVSS) 1kV or Less, and as indicated on the Contract Drawings. The TVSS devices shall be UL labeled.

4. Subject to compliance with specifications Power Distribution Panelboards shall be:

   a) Square-D Company

   b) Eaton/Cutler-Hammer Electric Corp.

   c) General Electric

   d) Approved equal

B. Cabinets

1. Except for power panelboards installed in motor control centers, the cabinets shall be NEMA 12 (minimum) constructed of #12 U.S.S. code gauge galvanized steel. The door shall be fastened to the cabinet with concealed brass hinges and shall be equipped with flush-type catches and locks. All

locks shall be keyed alike. The cabinet shall have wiring gutters on sides and shall be at least 20-inch wide and 5-3/4-inches deep. The Contractor shall provide nameplates for each panelboard. The nameplate shall include the panelboard designation, voltage, phase, wires, and bus rating.

2. An Underwriter's Laboratories, Inc. inspection label shall appear on the interior of the cabinet.

C. Bus Work

1. Main bus bars shall be of ample size so that a current density of not more than 1,000A per square inch of cross section will be attained. This current density shall be based on the application of the full load connected to the panel plus approximately 25% of the full load for spare capacity. The main bus shall be full capacity as based on the preceding for the entire length of the panel so as to provide full flexibility of circuit arrangement.

2. Solid neutral bus bars, where required, shall be provided. Ratings shall be in accordance with applicable standards.

3. A separate ground bus shall be provided with lugs for termination of equipment grounding conductors.

4. Branch bus work shall be rated to match the maximum branch circuit breaker which may be installed in the standard space.

5. All bus shall be plated copper.

D. Circuit Breakers

1. Circuit breakers shall be bolt-on, molded-case type conforming to NEMA Standard AB 1. Trip elements of circuit breakers shall be 20A unless otherwise shown on the Contract Drawings. Minimum branch circuit breaker shall be 100A frame for 60A and above except where shown otherwise on the Contract Drawings or where a larger frame size is standard for the continuous current rating required. Breakers shall have an interrupting rating of 25kA symmetrical at 480VAC, minimum. All breakers shall have quick-make, quick-break, toggle mechanism for manual as well as automatic operation. Tandem or half-size breakers are not acceptable.

E. Directories

1. Approved directories with glass or noncombustible plastic cover, and with typewritten designations of each branch circuit, shall be provided in each panel. The Contractor shall maintain in each panel, during the duration of the Contract, a handwritten directory clearly indicating the circuit breakers in service. This directory shall be updated as work progresses, and final, typewritten directories, as specified above, shall be installed at the end of the project. Designations and circuit locations shall conform to the panelboard schedules on the Contract Drawings, except as otherwise authorized by the Engineer.

2. The Contractor shall provide directories identifying panelboards and indicating the size of the feeder (cable and conduit) serving the panel, circuit numbers, and a description of associated branch circuits including branch circuit trip and connected load for each circuit.

2.05 PAINTING

A. All metal surfaces of the panelboard enclosures shall be thoroughly cleaned and given one prime of zinc chromate primer. All interior surfaces shall then be given one shop finishing coat of a lacquer of the nitro-cellulose enamel variety. All exterior surfaces shall be given three coats of the same lacquer. The color of finishing coats shall be light gray ANSI #61.

B. Prior to final completion of the work, all metal surfaces of the equipment shall be cleaned thoroughly, and all scratches and abrasions shall be retouched with the same lacquer as used for shop finishing coats.

PART 3 EXECUTION

3.01 MOUNTING

A. The lighting panelboards, power distribution panelboards, and combination power units shall be furnished and installed as shown on the Contract Drawings and as recommended by the equipment manufacturer.

B. Panelboards shall be set true and plumb in all locations as shown on the Contract Drawings. The top of panelboard enclosure shall not exceed 6 feet above finished floor elevation.

C. Panelboards installed outdoors shall NOT be mounted to hand-rail or safety rail.

D. Enclosures shall not be fastened to concrete or masonry surfaces with wooden plugs, conical plastic anchors. Appropriate cadmium plated or galvanized steel bolts shall be used with expansion shields or other metallic type concrete insert for mounting on concrete or solid masonry walls. Cadmium plated or galvanized steel toggle bolts shall be used for mounting on concrete block or other hollow masonry walls. Bolt diameter shall be as required considering the size and weight of the completed panelboard and enclosure to provide adequate structural support.

E. The Contractor shall not use factory furnished knockouts with surface back boxes. The Contractor shall punch or drill required openings during installation and shall equip flush back boxes with manufacturer's standard pattern of knockouts. The Contractor shall equip cabinet doors exceeding 40-inches height with vertical bolt three point locking mechanism.

F. The Contractor shall install cabinets (and other enclosure products) in plumb with the building construction. Flush enclosures shall be installed so that the trim will rest against the surrounding surface material and around the entire perimeter of the enclosure.

END OF SECTION

SECTION 16475

SAFETY DISCONNECT SWITCHES

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install separately mounted, individual disconnect switches as specified herein and indicated on the Contract Drawings.

B. 16010 – Electrical Basic Requirements.

C. 16111 – Conduit and Raceway

1.02 TESTING

A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:

1. Witnessed Shop Tests: None required.

2. Field Tests: Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and Section 16010 – Electrical Basic Requirements.

1.03 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples and the Contractor shall obtain from the equipment manufacturer and submit the following:

1. Shop Drawings

2. Spare Parts List

B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

B. Partial, incomplete or illegible submittals will be returned to the Contractor without review for resubmittal.

C. Shop drawings shall include but not be limited to:

1. Equipment specifications and product data sheets identifying all materials used and methods of fabrication.

2. Complete layout and installation drawings with clearly marked dimensions for each type/size/rating of disconnect switch.

3. Assembled weight of each unit.

D. The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these Specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items that the Contractor intends to provide are acceptable and shall be submitted.

1.05 TOOLS, SUPPLIES, AND SPARE PARTS

A. The equipment shall be furnished with all special tools necessary to disassemble, service, repair, and adjust the equipment, and with all spare parts as recommended by the equipment manufacturer.

B. One complete set of spare fuses for each ampere rating installed shall be furnished and delivered to the Owner at the time of final inspection.

C. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

D. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size shall have the same parts number.

1.06 IDENTIFICATION

A. Each equipment item shall be identified with a nameplate. The nameplate shall be engraved indicating the operating voltage, panel and circuit number of the power source and the equipment name with which it is associated.

1.07 OPERATIONS AND MAINTENANCE MANUALS

A. Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 – Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings.

B. Disconnect switches shall be manufactured by:

1. Square-D
2. Eaton/Cutler-Hammer
3. General Electric
4. Allen-Bradley
5. Siemens
6. Approved equal

2.02 DISCONNECT SWITCHES

A. Disconnect switches shall be heavy-duty type and/or as specified in these Specifications. Switches shall be furnished and installed as shown on the Contract Drawings and as required by the NEC. Handles shall be lockable.

B. Disconnect switches shall be NEMA Type HD, single throw, externally operated, non-fused, fused or provided with circuit breakers as required. Disconnect switches shall have the poles, voltage, and ampere ratings as shown on the Contract Drawings.

C. Disconnect Switches shall be provided in NEMA 4X stainless steel enclosures.

D. Disconnect switches shall be quick-make, quick-break and with an interlocked cover which cannot be opened when switch is in the "ON" position and capable of being locked in the "OPEN" position.

E. Disconnect switches shall be quick-make, quick-break and with an interlocked cover which cannot be opened when switch is in the "ON" position and capable of being locked in the "OPEN" position.

F. A complete set of fuses for all switches shall be furnished and installed as required. Time-current characteristic curves of fuses serving motors or connected in series with circuit breakers shall be coordinated for proper operation. Fuses shall have voltage rating not less than the circuit voltage.

PART 3 EXECUTION

3.01 INSTALLATION

A. All disconnect switches to be mounted 60-inches above the floor, at the equipment height where appropriate, or as shown on the Contract Drawings.

B. Disconnect switches shall NOT be mounted to any hand-rail or safety rail.

C. The Contractor shall furnish and install fuses or circuit breakers as required or shown on the Contract Drawings.

END OF SECTION

SECTION 16481

MOTOR CONTROL CENTERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Motor control centers, separately mounted motor starters (including those supplied with equipment), manual motor starters, control equipment.
2. Modifications to existing Westinghouse (Eaton) Series 2100 MCCs. As shown on the Contract Documents.

B. Related Sections include but are not necessarily limited to:

1. Division 1 – General Requirements

2. Section 16010 - Electrical Basic Requirements

1.02 QUALITY ASSURANCE

A. Referenced Standards:

1. American National Standards Institute (ANSI)

   a) C62.41, Guide for Surge Voltages in Low Voltage AC Power Circuits

2. Canadian Standards Association (CSA)

3. Institute of Electrical and Electronics Engineers (IEEE)

4. National Electrical Manufacturers Association (NEMA)

   a) ICS 2, Industrial Control Devices, Controllers, and Assemblies

   b) 250, Enclosures for Electrical Equipment (1000 Volt Maximum)

5. National Fire Protection Association (NFPA)

   a) 70, National Electrical Code (NEC)

6. Underwriters Laboratories, Inc (UL)

   a) 845, Electric Motor Control Centers

B. Miscellaneous

1. Verify motor horsepower loads, other equipment loads and controls from approved shop drawings and notify Engineer of any discrepancies.

2. Verify the required instrumentation and control wiring for a complete system and notify Engineer of any discrepancies.

1.03 SUBMITTALS

A. Shop Drawings:

1. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples and Section 16010 – Electrical Basic Requirements.

2. MCC elevation drawings and complete description of units in the MCC

3. Typical MCC unit wiring diagrams

4. Typical wiring diagrams for all control equipment

1.04 OPERATIONS AND MAINTENANCE MANUALS

A. Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 – Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Motor control centers:

1. Square D

2. Cutler Hammer

3. General Electric

4. Allen—Bradley

B. Separately mounted motor starters:
1. Square D

2. Cutler Hammer
3. General Electric

4. Allen—Bradley

C. Control relays:

1. Square D

2. Cutler Hammer

3. General Electric

4. Allen—Bradley

D. Programmable controllers:

1. Refer to Division 13

E. Manual motor starters:

1. Square D

2. Cutler Hammer

3. General Electric

4. Allen-Bradley

F. Submit requests for substitution in accordance with Specification Section 01600 — Material and Equipment.

2.02 COMPONENTS

A. Motor Control Centers:

1. Design:

a) Service voltage: 480 V, 3 PH, 4 W, 60 HZ, unless otherwise indicated on the Drawings.

b) Main horizontal bus: 800 A

1) Unless otherwise indicated on the Drawings

c) Vertical bus: 300 A

1) Unless otherwise indicated on the Drawings

d) Short circuit withstand rating: 65,000 AIC symmetrical

1) Unless otherwise indicated on the Drawings

e) Provide main horizontal bus in each structure; full capacity, full-length, with provisions for extension.

1) Bus bars:

(a) Plated copper

(b) Rectangular cross section

(c) Support in each structure by means of bus supports

f) Provide each structure with full-length vertical bus to distribute incoming power to each circuit breaker and starter in structure:

1) Starters NEMA size 5 and larger and certain other components may be cable connected to the main bus with the approval of the Engineer.

2) Vertical bus shall be extended to spaces provided for future equipment.

g) Provide ground bus:

1) Continuous

2) 14″ x 2″ copper

3) Solidly grounded to each structure

4) Locate near bottom of structure

5) Provide for lug connection of equipment ground wires

h) Provide guides for supporting and aligning starters

2. Construction:

a) NEMA Class I, Type B

b) NEMA 1G, free standing

c) Unit structures:

1) Totally enclosed

2) Joined together to form one (1) assembly:

(a) Each unit structure will be nominal 20″ wide, 20″ deep, and 90″ high, unless otherwise indicated on the Drawings.

d) Fabricate of not less than 14 GA steel with 16 GA steel doors in standardized units

e) Provide each structure with two (2) horizontal wiring spaces.

1) One (1) at top

2) One (1) at bottom

3) Spaces will line up with adjacent units to form convenient wiring raceway entire length of control center.

f) Provide each structure with one (1) vertical wireway for unit wiring.

1) With cable tie supports to hold wiring in place

2) With a separate door

g) Bottom shall have ample unrestricted space for conduit entry.

h) Doors:

1) Formed round corners and rolled edges

2) Gasketed

3) Minimum of two (2) heavy—duty hinges or continuous piano hinge

4) Held closed by means of captive fasteners.

i) Fabricate doors to be a part of the structure and not part of the starter.

j) Cubicles:

1) Totally enclosed

2) Effectively baffled to isolate any ionized gases which may occur within unit starter.

k) Assemblies effectively ventilated, to allow relocation of starters and other components:

1) Within the assembly and with the same load.

2) Without having to compensate for changes in location.

3. Combination full voltage magnetic starters mounted in MCC:

a) Circuit breaker:

1) Motor circuit protector (MCP) type.

b) Contactor NEMA rated.

c) Line plug-in, pull—out, lock-out type

1) Except starters NEMA size 5 and larger

(a) Fixed mounted with the approval of the Engineer.

2) Provide guides in structure for supporting and aligning unit starter during removal or replacement.

3) Plug-in units:

(a) Silver—plated

(b) Pressure type line disconnecting stabs

(c) High—strength copper alloy

4) Lock—out latch to padlock unit in “pull-out” position and at same time isolate stubs and entire unit from bus. Hold each unit in place by means of quick—captive fasteners.

d) Operating handle shall clearly indicate whether circuit breaker is ON, OFF or TRIPPED.

1) Provide means to lock each circuit breaker handle in OFF position with cover closed by means of up to three (3) padlocks. Interlock so that circuit breaker must be in OFF position before door can be opened:

(a) Provide defeater mechanism for use by authorized personnel.

e) Provide starter unit with ambient compensated, external manually reset table, three (3) bimetallic type overload relays. Coordinate size with actual motor full load current.

1) For motors with power factor correction capacitors, size heater elements to compensate for the capacitors effect on load current.

f) Provide heavy-duty devices:

1) NEMA 4K 30mm selector switches

2) NENA 4K 30mm pushbuttons

3) NEMA 4X 30mm pilot lights:

(a) Push-to-test type
(b) LED Lamps

4) Other devices as indicated on the Drawings

5) Devices will be accessible with the door closed

g) Provide each starter with two (2) extra field reversible N.O. auxiliary contacts for future use.

h) Provide each starter with bus voltage to 120 V control power transformer:

1) 480/120 V

2) Fused on primary and secondary sides

3) Rated for minimum of one hundred forty percent (140%) of required load suitable for operating controls and power motor winding space heaters as per the drawings and specifications.

4) For all motor starters

i) Provide six—digit readout elapsed time meter

j) Starter units will have the same fault current withstand rating as the main bus fault current withstands rating.

k) Provide each starter with the following status signals, wired to terminal boards:

1) Motor run contact (N.O.)

2) Motor stop contact (N.C.)

3) Auxiliary overload relay contact (N.O.)

B. Main and Feeder Circuit Breakers in MCC and Separately Mounted:

1. Molded case thermal magnetic or solid-state trip type, with minimum interrupting rating equal to the main bus fault current rating:

2. Circuit breaker frame sizes 150 A and less:

a) Non-interchangeable, non—adjustable thermal magnetic trip units.

3. Circuit breaker frame sizes 225 A and higher:

a) Interchangeable and adjustable thermal magnetic trip units.

4. Circuit breaker frame sizes 600 A and greater:

a) Solid state trip units, unless otherwise noted on the Drawings.

b) Current sensor or rating plug.

c) Adjustable current setting: Minimum range seventy to one hundred percent (70% — 100%) of current sensor or rating plug.

d) Adjustable instantaneous pickup: Minimum range three (3) to eight (8) times.

e) On circuit breakers 1000 A and larger provide ground fault protector.

1) Adjustable pick-up

2) Adjustable delay

5. Provide main circuit breaker with service entrance label.

6. All circuit breakers to be provided with padlocking provision in the OFF position for up to three padlocks.

7. Circuit breakers rated 400 A or above: One hundred percent (100%) rated.

C. Provide ambient compensated devices

D. Manual Starters with Thermal Element:
1. Quick—make, quick—break toggle mechanism

2. Trip free

3. Clearly indicate ON, OFF and TRIPPED position.

4. NEMA rated enclosure per area classification unless otherwise indicated on the Drawings.

E. Separately Mounted Starters:

1. Circuit breaker shall be motor circuit protector (MCP) type.

2. Contactor shall be NENA rated.

a) One—half (1/2) size and IEC sized starters not permitted.

3. Operating handle shall clearly indicate whether circuit breaker is ON, OFF, or TRIPPED.

a) Provide means to lock each circuit breaker handle in OFF position with cover closed by means of up to three padlocks.

b) Interlock so that circuit breaker must be in OFF position before door can be opened. Provide defeater mechanism for use by authorized personnel.

4. Provide starter unit with ambient compensated, external manually resettable, three (3) bimetallic type overload relays. Coordinate size with actual motor full load current.

a) For motors with power factor correction capacitors size heater elements to compensate for the capacitors effect on load current.

5. Provide heavy-duty oil tight selector switches, pushbuttons, push-to-test pilot lights with LED lamps, or other devices as indicated on the Drawings. These devices will be accessible with the door closed.

6. Provide each starter with two (2) extra field reversible NO auxiliary contacts for future use.

7. Provide each starter with 480/120 V control power transformer fused on secondary side and rated for a minimum of one hundred forty percent (140%) of required load suitable for operating controls and motor winding space heaters as per the drawings and specifications.

8. Provide six—digit readout elapsed time meter.

9. Starter units will have the same fault current withstand rating as the MCC main bus fault current withstand rating from which they are fed.

10. Provide each starter with the following status signals, wired to terminal boards.

    a) Motor run contact (N.O.)

    b) Motor stop contact (N.C.)

    c) Auxiliary overload relay contact (N.O.)

F. Selector Switches, Indicating Lights, and Pushbuttons:

1. NEMA 4X for all areas

2. NEMA 4X/7 and 4X/9 for Class I, Division I Groups C and D; and Class II, Division I, Groups E, F, and G hazardous locations.

3. Selector switches shall have standard gloved operator.

4. Pushbuttons shall have standard flush operator.

5. Provide switch positions and contacts:

    a) As specified on Contract Drawings or as necessary for proper control.

6. Switch contacts shall be NEMA A600 rated.

7. Indicating lights with LED lamps, unless specified otherwise.

8. Provide fifty percent (50%) replacement lamps for indicating lights.

9. Provide ten percent (10%) percent replacement caps for indicating lights.

G. Alarm Horns

1. Siren type
2. Sheet metal housing

   a) Primer and finish coat of paint shall be suitable for use in corrosive areas.

3. Adjustable mounting bracket

4. For use on 120 V AC

5. Universal motor

6. Nominal 106 dE at 10’ from source

7. Federal Signal Model ATT or approved equal

H. Control Relays:

1. Provide industrial control relays as specified on the Drawings and as required for proper operation and control of supplied equipment.

2. All control relays shall have 120 V coils capable of operating on line voltage fluctuations of plus or minus ten percent (+/— 10%) unless specified otherwise.

3. Relays shall be provided with NEMA A600 rated contacts, and shall be capable of supporting a minimum of eight contacts.

4. Provide relays with all N.O. contacts unless otherwise specified.

a) Contacts shall be field reversible.

5. Provide contacts for all required control plus two (2) spares.

I. Remote Operator Stations:

1. NEMA 12 for unclassified areas unless specified otherwise.

2. NEMA 4X for wet areas, outdoors or equipment specified WP, and control panel enclosures not covered under Div 11.

3. NEMA 4X for corrosive areas.
4. NEMA 7 and 9 for Class I, Division I, Groups C and D; and Class II, Division I, Groups E, F, and G hazardous locations.

5. Construction and installation shall be in accordance with NEC Article 373.

6. Provide barrier—type terminal strips for termination of all control and 120 V power field wiring plus twenty percent (20%) spare for all control panels.

7. Control panel construction:

a) 14 GA steel

b) Continuously welded seams

c) Manufacturer’s standard gray

J. Time Delay Relays:

1. Provide time delay relays with delayed pickup or release as specified on Drawings.

2. All time delay relays shall operate at 115 V AC plus or minus ten percent (+/— 10%)

3. Heavy duty, solid-state construction

4. Contact rating: 10 amps.

5. Provide external adjust dial with 0—9.99/99.9/999 second selectable range unless specified otherwise.

6. Operating temperature ranges: -18 to +50 °C

7. Repeat accuracy: plus or minus three percent (+/- 3%) plus ±lOms over specified voltage range.

8. Provide all required contacts plus two (2) N.O. spares.

9. Provide auxiliary relays as required to perform functions specified on Drawings.

K. Terminal Strips:

1. 600 V

2. Full size

3. Rated for 20 A continuous current

L. Enclosures and Control Panels:

1. NEMA 12 for unclassified areas

2. NEMA 4X for outdoor or wet areas

a) Except MCCs, which shall be NEMA 3R non-walk-in type

3. NEMA 4X for corrosive areas

4. NEMA 7 for Class I hazardous locations

PART 3 EXECUTION

3.01 INSTALLATION

A. Install as indicated and in accordance with manufacturer’s recommendations and instructions.

B. Mount MCC on 4” high concrete pad:

1. Install two (2) 4” wide channel sills flush in pads to support and maintain alignment of the MCC.

2. Align front of MCC with top edge of pad chamfer.

C. Mount other equipment as scheduled in Section 16010 — Electrical Basic Requirements.

3.02 FIELD QUALITY CONTROL

A. Field—test and verify operation of the equipment.

END OF SECTION

SECTION 16500

LIGHTING

PART 1 GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish all labor, materials, tools and equipment necessary for furnishing, installing, connecting, testing and placing into satisfactory operation all lighting fixtures, lamps, contactors, controls, supports, etc. as required for a complete and operational lighting system as specified herein and indicated on the Contract Drawings.

B. Lighting shall be in accordance with the latest requirements of the Illuminating Engineering Society, and all lighting fixtures shall have the Underwriters Laboratories, Inc. label of approval.

C. All wiring shall be placed in conduit and shall comply with the Specifications for conduit, outlet boxes, pull and junction boxes, wires and cables, grounding, and other Sections as set forth in these Specifications and as noted herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Specification Section 16010 – Electrical Basic Requirements.

1.03 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples. The Contractor shall provide submittals to include the following:

1. Equipment specifications and product data sheets identifying all materials used and methods of fabrication.

2. Catalog cuts for each lighting fixture type showing performance and construction details of standard lighting fixtures, and complete working drawings showing all proposed construction details of special or modified standard lighting fixtures.

3. Photometric curves

4. Photometric plans shall be provided if substitutions are made from the equipment shown or

specified. Data shall be submitted electronically in an approved Engineer format.

5. Lamp data

6. Ballast information

7. Catalog data including applicable coefficients of utilization tables, isolux chart of illumination on a horizontal plane, beam efficiency, horizontal and vertical beam spread, and beam lumens.

8. Wind-load calculations for light poles

1.04 OPERATONS AND MAINTENANCE MANUALS

A. Operations and Maintenance Manuals shall be submitted as outlined in Specification 01730 – Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable firms regularly engaged in the manufacturing of lighting equipment, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings.

B. Manufacturer's catalog number and description in the lighting fixture schedule on the Contract Drawings establishes a level of quality, style, finish, etc. The use of a catalog number describing the various types of light fixtures shall be used as a guide only, and does not exclude all the required accessories or hardware that may be required for a complete installation.

C. All products shall be UL listed and meet the requirements of the National Electrical Code (NEC). Electrical components shall be listed and labeled by U.L.

2.02 TOOLS, SUPPLIES, AND SPARE PARTS:

A. The Contractor shall provide to the Owner, for each equipment item, the following:

1. Special tools necessary to disassemble, service, repair and adjust the equipment.

2. All spare parts as recommended by the equipment manufacturer.

3. A minimum two (2) or one (1) ballast for every ten (10) ballasts (of the same type) installed; whichever is greater.

4. A minimum of one (1) lamp for every five (5) lamps (of the same type) installed; whichever is greater.

2.03 LIGHTING CONTROLS

A. The lighting systems shall be controlled as specified herein and indicated on the Contract Drawings.

B. Lighting contactors shall be furnished and installed for specific lighting control applications as specified herein and indicated on the Contract Drawings.

2.04 EXTERNALLY MOUNTED PHOTOCELL SWITCHES

A. Hermetically sealed cadmium sulfide cell with single-throw contacts rated for 277V for 1800VA. The photocell switch shall be housed within a die-cast, vandal and impact resistant enclosure. Designed to turn on at level below 3 footcandles and off at 3 to 10 footcandles. A 15 second time delay to prevent switching from transient light sources. Directional lens, mounted in front of cell, to prevent fixed light sources from turning unit off. Temperature range -40F to +170F. Power consumption less than 1.4W average.

2.05 LIGHT FIXTURES

A. Light fixture leads shall be as required by the NEC.

B. All glassware shall be high quality, homogeneous in texture, uniform in quality, free from defects, of uniform thickness throughout and properly annealed. Edges shall be well rounded and free from chips or rough edges.

C. Refer to the lighting fixture schedule on the Contract Drawings.

2.06 BALLASTS

A. Where available, ballasts shall be as manufactured by the lighting fixture manufacturer. Ballasts for fluorescent light fixtures shall be rapid-start, high

efficiency and high power factor, with certification by ETL, CBM and Underwriters Laboratories, Inc. Ballasts shall have copper windings. All ballasts for indoor fluorescent light fixtures shall be equipped with an internal, thermally actuated automatic reclosing protection device. Ballasts shall be guaranteed against service failure for a period of two (2) years. Ballasts shall be rated "Class P" to agree with requirements of 410-73 (e) and other applicable articles of the NEC, to conform to the time schedule for this requirement, and shall be Class A sound rated.

B. Ballasts for HID light fixtures shall have copper windings and shall be high power factor, constant wattage autotransformer (CWA) (i.e. lead type for high pressure sodium or peak lead type for metal halide), or constant wattage (CW) with certification by ETL, CBM and Underwriters Laboratories, Inc. All ballasts for HID light fixtures shall be Class "H" insulated, encapsulated for quiet operation, and shall have an integral thermal protector.

C. All outdoor light fixtures and lighting fixtures located in unheated areas shall be furnished and installed with ballasts rated for outdoor installation.

D. Light fixtures shown or specified to be controlled by dimmers shall be furnished with suitable dimming ballasts.

E. Ballasts shall be as manufactured by Holophane, Universal, Advance, or equal.

2.07 LAMPS

A. The Contractor shall furnish and install lamps in all light fixtures. Lamps shall be of the following types:

1. Compact Fluorescent: 120VAC

2. Fluorescent: Rapid-Start, Low Level Mercury

3. HID: High Pressure Sodium, or Metal Halide

B. Lamps shall be as manufactured by:

1. General Electric Company

2. Sylvania Lighting Equipment

3. Phillips Lighting Company

4. Approved equal

2.08 LIGHT POLES

A. Pole mounted light fixtures shall be mounted on light poles as designated in the lighting fixture schedule or as indicated on the Contract Drawings. Light poles shall be designed for wind loading in accordance with the latest edition of the Florida Building Code for 3 second gust wind speeds per specific site location.

B. The Contractor shall furnish and install a concrete foundation for all light poles as required or as indicated on the Contract Drawings. All anchor bolts and nuts shall be stainless steel and provided by the light pole manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Lighting fixtures shall be located symmetrically with architectural lines and landscape features as shown on the Contract Drawings. The Contractor shall furnish and install the light fixtures to allow "convenient" access for maintenance such as cleaning, relamping, and other activities. The light fixtures shall be installed to be accessed by a 25FT ladder. Where light fixtures are shown in locations on the Contract Drawings where maintenance would be difficult, the Contractor shall notify the Engineer.

B. The Contractor shall provide and install all inserts, conduit, structural supports, lamps, ballasts, poles, wiring, and any other items as required for a complete system. Contractor shall properly adjust and test, to the satisfaction of the Engineer, the entire lighting system.

C. The Contractor shall furnish and install all pendant trapezes and pendant stem hangers with durable swivel or equivalent trapeze hanger permitting normal light fixture motion and self-alignment. Light fixture pendants shall be type UNJ ball type flexible hanger at the light fixture and supports from a JBLX junction box with JBLX hub cover, or approved equal. Pendant lengths shall be adequate and adjusted to provide uniformity of installation heights above the reference datum. Stems shall be one-piece, with matching canopies and fittings.

D. Light fixtures located on the exterior of the building shall be provided with neoprene gasket and non-ferrous metal screws finished to match the light fixtures.

E. The finish or exposed metal parts of light fixtures and finish trims of all recessed light fixtures shall be as directed by the Engineer.

F. The Contractor shall furnish and install recessed light fixtures with a separate junction box concealed and located as to be accessible when the light fixture is removed.

G. The Contractor shall furnish and install all boxes for light fixtures such that the box is not the sole support of the light fixture. The boxes shall be offset to allow maintenance such that access to wiring within the box can be attained without having to consider supporting the light fixture.

H. All lighting units, when installed, shall be set true and be free of light leaks, warps, dents, and other irregularities. All hangers, cables, supports, channels, and brackets of all kinds for safely erecting this equipment in place, shall be furnished and erected in place by the Contractor.

I. The Contractor shall install light fixtures at mounting heights indicated on the Contract Drawings or the Engineer. In areas with exposed ducts and/or piping, installation of light fixtures shall be adapted to field conditions as determined by the Engineer.

J. The Contractor shall support each light fixture securely. Each light fixture shall be secured to the building structure. The Contractor shall not secure light fixtures to the work of other trades, unless specified or noted otherwise, and shall not support light fixtures to plaster. The Contractor shall furnish and install all steel members and supports as required to fasten and suspended light fixtures from the structure.

K. In all mechanical equipment areas, the Contractor shall install light fixtures on the ceiling after all piping and equipment therein has been installed. Exact locations for such light fixtures may be determined by the Engineer on the site during the course of the work.

L. Upon completion of work, and after indoor areas are cleaned, all lighting fixtures shall be made clean and free of dust and all other foreign matter both on visible surfaces, and on surfaces that affect the lighting performance of the light fixture including diffusers, lenses, louvers, reflectors, and lamps.

M. All light fixtures that require physical adjustment shall be so adjusted in accordance with the directions of the Engineer. The Contractor shall also adjust angular direction of light fixtures and/or lamps, as directed.

N. Relamping access shall require no special tools. All optical control surfaces such as lenses and reflectors shall be safely and securely attached to lighting fixtures and shall be easily and quickly removed and replaced for cleaning without the use of tools. No light fixture part that may be removed, for maintenance, shall be held in place by metal tabs that must be bent to remove said part.

O. Pole mounted light fixtures shall be mounted on poles as designated in the lighting fixture schedule or as indicated on the Contract Drawings. All metal poles shall be bonded to the site grounding system. Poles shall have adequate handholes and weatherproof receptacles where indicated.

P. The Contractor shall furnish and install switches as indicated on the Contract Drawings. Switches shall be installed in accordance Specification Section 16140 - Wiring Devices.

Q. The Contractor shall furnish and install time switches or photocells as specified herein or indicated on the Contract Drawings

R. All exterior light fixtures mounted on concrete or masonry shall be caulked with approved color matching compounds.

S. The Contractor shall protect all light fixtures and light poles at all times. Before final acceptance, by the Engineer, all light fixtures, light poles and associated devices shall be:

1. Operating condition

2. Free of any scraps, dents or chips in the finish

3. Cleaned of all dust, dirt or other material

4. Fully lamped

END OF SECTION

SECTION 16671

TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) 1kV OR LESS

PART 1 GENERAL

1.01 THE REQUIRMENT

A. The Contractor shall furnish and install the Transient Voltage Surge Suppression (TVSS) equipment having the electrical characteristics, ratings and modifications as specified herein and as shown on the Contract Drawings.

B. The TVSS equipment shall provide effective high-energy protection against transient surges, temporary over voltages, voltage swells and high-frequency noise attenuation for power, control and telephone/data circuits 1kV or less and as shown on the Contract Drawings.

C. The TVSS units and all components shall be designed, manufactured and tested in accordance with the latest applicable UL standards.

D. The TVSS equipment installation shall conform to local code requirements and the National Electric Code (NEC).

E. All materials and workmanship shall be of the highest quality.

1.02 DEFINITIONS

A. EMI: ElectroMagnetic Interference

B. NTRL: Nationally Recognized Testing Laboratory

C. SCCR: Short Circuit Current Rating

D. SPD: Surge Protection Device

1. Type-I: Permanently connected between the secondary of the utility transformer and the line or load side of the service entrance overcurrent device and intended to be installed without an external overcurrent device.

2. Type-II: Permanently connected to the load side of the service entrance overcurrent device including branch circuit panels.

3. Type-III: Connected from the electrical service panel to the point of utilization with a minimum conductor length of 30 FT.

4. Type-IV: Component and/or component assemblies.

E. SVR: Suppressed Voltage Rating

F. TOV: Temporary Over Voltage

G. TVSS: Transient Voltage Surge Suppressor

1.03 QUALITY ASSURANCE

A. Referenced Standards:

1. Institute of Electrical and Electronics Engineers (IEEE):

a) C62.41, IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits.

b) C62.43, IEEE Certified by NRTL as “Secondary Surge Arrestor”

c) C62.45, IEEE Guide for Surge Testing for Equipment Connected to Low-Voltage AC Power.

2. International Electrotechincal Commission (IEC):

a) 61024, Protection of Structures against Lightning.

3. National Electrical Manufacturers Association (NEMA):

a) LS-1 (1992), Low Voltage Surge Protection Devices

4. National Fire Protection Association (NFPA):

a) NFPA 70, National Electrical Code (NEC) Article 285.

5. Underwriters Laboratories, Inc (UL):

a) 1283, Electromagnetic Interference Filters

b) 1449, Transient Voltage Surge Suppressors

1.04 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

B. Product Data: For each type of product indicated, include unit dimensions, weights, installation instructions, wiring details, rated capacities, operating characteristics, furnish specialties and accessories. Include the following documents:

1. Suppressed Voltage Rating

2. Symmetrical Fault Current Withstand Ratings

3. Provide independent third-party testing lab report indicating device is capable of surviving the specified number of 8x20 micro-second waveforms.

4. Spectrum Analysis based on MIL-STD-220A test procedures between 50 kHz and 200 kHz verifying the device noise attenuation equals or exceeds 50 dB at 100 kHz.

5. Survivability of multiple TOV events for Type-I and Type-II devices.

C. Product Certificates: For TVSS/SPD devices, signed by third-party NRTL testing agencies certifying compliance with the following standards:

1. UL 1283

2. UL 1449 Second Edition 2005 Revision

3. IEEE C62.34 Secondary Surge Arrestor

4. NEMA LS-1 (1992) Low Voltage Surge Protective Devices

D. Qualification Data: Third-Party testing lab or U.S. Department of Labor/OSHA approved NRTL.

E. Field Quality-Control test reports, including the following:

1. Test procedures used. Include single impulse testing data that matches label rating, including fuses or upstream breaker.

2. Test results that comply with requirements.

3. Failed test results and corrective actions taken to achieve requirements.

F. Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 – Operation and Maintenance Data. For each type or series of TVSS/SPD devices to include emergency, operation and maintenance manuals.

G. Warranties: The manufacturer shall provide a full ten (10) year warranty from the date of installation against any TVSS/SPD device part failure when installed in compliance with manufacturer's written instructions and any applicable national or local codes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following manufacturers:

1. Advanced Protection Technologies Inc.

2. Current Technology

3. Eaton/ Cutler Hammer

4. Innovative Technology

5. General Electric

6. Square-D

7. Approved Equivalent

2.02 SERVICE ENTRANCE SPD (TYPE-I)

A. Surge Protection Device Description: Modular design with field-replaceable module with EMI filtering and the following features:

1. The SPD unit tested at 200kA interrupting capacity (AIC).

2. The SPD unit shall provide overvoltage protection as follows:

a) >1800 cycles at 180% of rated voltage to 0.7 OHM load

b) Test Report included

3. Fabrication using bolted compression lugs for internal wiring.

4. Utilizing copper bus bars, wire connections and bolted connections to phase buses, neutral bus and ground bus.

5. Integral disconnect switch capable of passing full rated surge current.

6. Multiple suppression circuits with current sharing.

7. LED indicator lights for power and protection status.

8. Monitoring system capable of the following:

   a) Number of transient surges, overvoltages and undervoltages

   b) Neutral-to-ground voltage and current

   c) EMI filter status

   d) Percentage of protection available

9. Audible alarm with silencing switch to indicate when protection has failed.

10. Dual set of dry contacts rated at 5A and 250VAC for remote monitoring of protection status.

11. Field testable with test data from factory provided comparison.

12. Field replaceable surge protection modules.

B. Peak Single-Impulse Surge Current Rating of 200kA per mode.

C. Connection Means: Permanent

D. Protection modes and UL 1449 SVR for voltages of 480/277V, 3-Phase, 4-Wire, grounded wye circuits shall be as follows:

1. Line to Neutral: 800V

2. Line to Ground: 1000V

3. Neutral to Ground: 900V

E. EMI noise rejection or attenuation values shall be in compliance with test and evaluation procedures outlined in NEMA LS-1 1992.

2.03 MOTOR CONTROL CENTER (MCC) SPD (TYPE-II)

A. Surge Protection Device Description: Modular design with field-replaceable module mounted externally to the MCC with EMI filtering and the following features:

1. Supplied with fuses rated at 200kA interrupting capacity (AIC).

2. Fabrication using bolted compression lugs for internal wiring.

3. Utilizing wire connections to phase buses, neutral bus and ground bus.

4. Multiple suppression circuits with current sharing.

5. LED indicator lights for power and protection status.

6. Monitoring system capable of the following

   a) Number of transient surges, overvoltages and undervoltages

   b) Neutral-to-ground voltage and current

   c) Percentage of protection available

7. Audible alarm with silencing switch to indicate when protection has failed.

8. Dual set of dry contacts rated at 5A and 250VAC for remote monitoring of protection status.

9. Field testable with test data from factory provided comparison.

10. Field replaceable surge protection modules.

B. Peak Single-Impulse Surge Current Rating of 100kA per mode.

C. Connection Means: Permanent

D. Protection modes and UL 1449 SVR for voltages of 480/277V, 3-Phase, 4-Wire, grounded wye circuits shall be as follows:

1. Line to Neutral: 900V

2. Line to Ground: 900V

3. Neutral to Ground: 900V

E. EMI noise rejection or attenuation values shall be in compliance with test and evaluation procedures outlined in NEMA LS-1 1992.

2.04 LIGHTING PANELBOARD SPD (TYPE-II)

A. Surge Protection Device Description: Modular design with field-replaceable module mounted externally to the panelboard with EMI filtering and the following features:

1. Supplied with fuses rated at 200kA interrupting capacity (AIC).

2. Fabrication using bolted compression lugs for internal wiring.

3. Utilizing wire connections to phase buses, neutral bus and ground bus.

4. Multiple suppression circuits with current sharing.

5. LED indicator lights for power and protection status.

6. Monitoring system capable of the following

a) Number of transient surges, overvoltages and undervoltages

b) Neutral-to-ground voltage and current

c) Percentage of protection available

7. Audible alarm with silencing switch to indicate when protection has failed.

8. Field testable with test data from factory provided comparison.

9. Field replaceable surge protection modules.

B. Peak Single-Impulse Surge Current Rating of 80kA per mode.

C. Connection Means: Permanent

D. Protection modes and UL 1449 SVR for voltages of 208/120V, 3-Phase, 4-Wire, grounded wye circuits shall be as follows:

1. Line to Neutral: 400V

2. Line to Ground: 500V

3. Neutral to Ground: 500V

E. EMI noise rejection or attenuation values shall be in compliance with test and evaluation procedures outlined in NEMA LS-1 1992.

PART 3 EXECUTION

3.01 INSTALLATION OF SURGE PROTECTION DEVICE (SPD)

A. For Dual Rated Surge Protection (listed as both Surge Arrestor and SPD) for service entrance, product can be placed on either Line or Load side of the Service Entrance Equipment.

1. Provide and install circuit breakers or fuses as shown on the Contract Drawings.

B. For all remaining SPD devices:

1. Provide and install circuit breakers or fuses as shown on the Contract Drawings.

C. Install SPD devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do NOT exceed manufacturer’s recommended lead length. Do NOT connect neutral and ground leads together.

D. SPD devices shall NOT be integrated with Switchgear or Panelboards as recommended by IEEE-1100, Section 8.4.2.5.

E. All SPD devices shall have the raceway between the SPD and the switchgear enclosure sealed with approved fire sealant. The sealant shall prevent vapors from entering the switchgear enclosure.

3.02 PLACING EQUIPMENT INTO SERVICE

A. Do not energize or connect service entrance equipment, panelboards, control panels or telephone/data equipment to their sources until surge protection devices are installed and connected.

3.03 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Contractor shall engage a factory-authorized service representative to perform inspections, field tests and adjustments to the equipment including all connections. Service Representative shall report results in writing to the Engineer.

1. Verify that the electrical wiring installation complies with manufacturer’s written installation instructions and requirements.

2. After installation of SPD devices but before circuitry has been energized, test for compliance with requirements.

3. Complete installation checks according to manufacturer’s written instructions.

4. Remove and replace malfunctioning SPD devices and retest as specified as above.

END OF SECTION

SECTION 16960

ELECTRICAL EQUIPMENT TESTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions (if included), and Division 1 Specifications Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Electrical equipment test reports.

1.03 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 – Shop Drawings, Project Data and Samples.

B. All testing shall be performed by a third party independent testing company certified by the International Electrical Testing Association (NETA).

C. Motor Circuit Test Reports: Complete Motor Circuit Test Report for each three-phase motor 5 HP and above.

D. Low Voltage Feeder Insulation Test Reports: Complete the Low Voltage Feeder Insulation Test Report for each single-phase and three-phase feeder rated 100 amperes and above.

E. Ground Resistance Test Reports: Complete the Ground Resistance Test Report for each structure that receives a service or a feeder.

F. Medium and High Voltage Feeder Insulation Test Reports: Complete the Medium and High Voltage Feeder Insulation Test Report for each medium and high voltage feeder and motor circuit.

G. Manufacturer’s insulation testing instructions for medium and high voltage cable.

1.04 OPERATION AND MAINTENANCE MANUALS

A. Operations and Maintenance Manuals shall be submitted as outlined in Specification 01730 – Operation and Maintenance Data.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Use an ohmmeter for motor winding resistance testing. Perform in accordance with ohmmeter manufacturer’s instructions.

B. Use a ground resistance test instrument for ground resistance testing. Perform testing in accordance with test instrument manufacturer’s instructions. Perform test in normally dry weather, not less than 48 hours after rainfall.

C. Use a 1000 VDC megohms meter for low voltage insulation testing. Perform testing in accordance with megohms meter manufacturer’s instructions.

D. Use suitable test instruments for medium and high voltage insulation testing. Perform testing in accordance with test instrument manufacturer’s instructions.

1. Individually test each conductor with all other conductors and all shields grounded.

2. Provide proper corona suppression at each termination using a guard ring or other suitable method.

3. Apply DC hypotential in at least eight equal increments until maximum test voltage is reached. Record the DC leakage current at each step after a constant stabilization time consistent with system charging current decay.

4. Hold the test voltage at the maximum level for 10 minutes. Record the DC leakage current every 30 seconds for the first 2 minutes, and then every minute thereafter.

5. Reduce the test voltage to zero and apply ground to tested conductor for a period adequate to drain all potential stored in the insulation.

6. Make a graphic plot of the leakage current versus the test voltage at each step and continue plot with leakage current versus time based upon the recorded values.

7. Maximum Test Voltage: IEEE and manufacturer's stated levels.

8. Use an ohmmeter to test shield continuity and record values measured.

9. Replace conductors and cable which indicate poor insulation levels as determined by the ENGINEER. Do not splice as a means of repair.

10. Install additional ground rods as required to achieve specified ground resistance. See Section 16450 – Grounding and Bonding.

3.02 REPORT FORMS

A. Motor Circuit Test Report

Equipment _____ Location _____

Manufacturer _____ Frame _____

Horsepower _____ Phase _____ RPM _____ Service Voltage _____

Motor Overload _____ Manufacturer _____

Nameplate Volts* _____ Running Volts* _____

Nameplate Amperes* _____ Running Amperes* _____

Nameplate Locked Rotor Amps _____ Nameplate Power Factor _____ % Nameplate Efficiency _____ %

Insulation Class _____ Starting Code _____

Feeder runs from _____

Feeder Wire Size _____ Insulating Voltage Rating _____ Insulation Type _____

* Give armature/field for DC motors.

1. Motor Winding Resistance Test (multi-meter)

Winding	Resistance (ohms)
A to B	
B to C	
C to A	

2. Motor Feeder/Winding Insulation Test (Megohm Meter)

   a) Perform the following test AFTER connecting the feeder to the motor.

   b) Test from load side of motor controller.

   c) Readings must be greater than 50 Megohms.

Phase	Megohms at 1000 VCD
A to Ground	
B to Ground	
C to Ground	

Testing performed by _____ Date: _____

Testing Witnessed by _____

B. Feeder Insulation Test Report

1. Perform test BEFORE terminating feeder to equipment.

Feeder runs from _____

Feeder runs to _____

Wire Size _____ Insulation Voltage Rating _____ Insulation Type _____

Readings must be greater than 50 Megohms.

Phase	Megohms at 1000 VDC
A to Ground	
B to Ground	
C to Ground	

Testing performed by _____ Date: _____

Testing Witnessed by _____

COMMENTS

C. Grounding Test Report

Type of Ground _____
(Single Rod or Multiple Rod – Provide Quantity)

Location _____

Date Installed _____

Weather Conditions(Temp,Humidity) _____

Date of Last Rain _____

Ground Resistance(ohms) _____

Testing Performed by _____ Date: _____

Testing Witnessed by _____

COMMENTS

D. Hi-Pot Test Report

MEDIUM AND HIGH VOLTAGE DC CABLE TEST REPORT					
Project No.	Operating Voltage	GN ____ Y ____ Aerial ____ Magnetic Duct ____ UN-GN ____ Dry ____ Buried ____ Non-Magnetic Duct ____			
Insulation Material	Insulation Thickness	Voltage Rating	Jacket & Thickness	Shield Tap ____ Wire ____	Non-Shielded ____ Extruded ____
Cable Mfg.	Type of Termination & Mfg.				Indoor ____ Outdoor ____
Weather Conditions				Temperature	
Cable Testing Company			Signature of Operator		

10% Voltage Steps				Max. Voltage for 10 min.				Remarks
DC kV	Micro-amps			Time @ kV	Æ1	Æ2	Æ3	
	Æ1	Æ2	Æ3	0				
				15 sec.				
				30 sec.				
				1 min.				
				2 min.				
				3 min.				
				4 min.				
				5 min.				
				6 min.				
				7 min.				
				8 min.				
				9 min.				
				10 min.				

Current Leakage Plot

Leakage vs. Step Voltage | Leakage vs. Time

20%	40%	60%	80%	Max kV	2	4	6	8
Test Voltage @ 10% Steps				Time @ Max. Voltage				

END OF SECTION

APPENDIX A

REPORT OF THE GEOTECHNICAL INVESTIGATION

NORTH WASTEWATER RECLAMATION FACILITY EXPANSION MANATEE COUNTY, FLORIDA

DRIGGERS ENGINEERING SERVICES INCORPORATED
Geotechnical Engineering & Construction Materials Testing

DRIGGERS ENGINEERING SERVICES INCORPORATED
Geotechnical Engineering & Construction Materials Testing

McKim & Creed, Inc.
1365 Hamlet Avenue
Clearwater, Florida 33756

January 30, 2009

Attention: Mr. Philip J. Locke, P.E.

RE: Report of the Geotechnical Investigation
North Wastewater Reclamation Facility Expansion
Manatee County, Florida
Our File: DES 086271

Dear Phil:

Pursuant to your authorization, **DRIGGERS ENGINEERING SERVICES, INC.** has completed our geotechnical investigation for the plant expansion. This report includes results of our field and laboratory studies and our geotechnical recommendations for the planned construction.

PROJECT DESCRIPTION

Information provided to us indicates that the proposed expansion will include a new Anoxic/Aeration Basin structure, new Return Activated Sludge (RAS) and Waste Activated Sludge (WAS) Pump Stations and an Electrical-Generator Building. Details of each structure, as provided to us, are summarized as follows.

Anoxic/Aeration Basins	100' x 350' x 25' high, with a bottom slab close to existing grade.
RAS/WAS Pump Stations	Lightly loaded, single story masonry buildings with thickened reinforced concrete slabs on grade.

Electrical-Generator Building Lightly loaded, single story masonry buildings with thickened reinforced concrete slabs on grade.

Based upon the above structure details, we have estimated that the Anoxic/Aeration Basins will have a gross contact pressure in the range of about 1500 to 2000 psf. Wall and column loads for the pump station and electrical-generator buildings are anticipated to be on the order of 3 kips per foot and 100 kips, respectively.

Two (2) stormwater ponds will be constructed. In addition, shallow borings were conducted around the existing pond to check soil and groundwater conditions and allow an estimation of normal seasonal high groundwater levels.

GEOTECHNICAL INVESTIGATION PROGRAM

FIELD INVESTIGATION - Fifteen (15) borings and two (2) Double Ring Infiltration (DRI) tests were requested and conducted for our investigation. Ten (10) of these borings were in planned structure areas and were performed as Standard Penetration Test (SPT) borings. The SPT borings were advanced to nominal depths of 35 to 50 feet beneath present grades to secure core samples for visual classification and laboratory testing and to develop Standard Penetration resistance data reflective of the strength and bearing capability of the soils penetrated. A brief description of this method of sampling is appended for your review.

Five (5) of the borings (B-10 through B-12, DRI-1 and DRI-2) were manually advanced utilizing hand auger equipment to depths of 6 to 10.5 feet. The purpose of these borings was to examine shallow soil and groundwater conditions and allow an estimate of normal seasonal high groundwater levels.

Logs of the Standard Penetration and hand auger borings are presented in the report attachments indicating visual and estimated Unified Soil Classification versus depth and groundwater information. Penetration resistances are also shown at the appropriate depths on the SPT logs. The boring locations are illustrated on the attached Plate I. The boring locations were positioned in the field by our geotechnician and subsequently survey located by the project surveyor, who also provided the ground surface elevations shown on the logs.

STORMWATER MANAGEMENT AREA - Within the planned stormwater pond areas, two (2) Double Ring Infiltration (DRI) tests were requested and conducted. The DRI test locations are shown on Plate I in the Appendix. The infiltration tests were performed at depths of 1.5 and 2.5 feet below grade near borings DRI-1 and DRI-2 which were advanced to nominal depths of 7 to 10 feet. Results of the DRI testing and logs of the borings are included in the report appendix.

LABORATORY TESTING - A limited laboratory testing program was also undertaken to aid in characterizing the engineering properties of the subsurface soils. Our laboratory tests primarily included grainsize analyses, Atterberg limits determinations and organic content tests. The results of our laboratory tests are included in the report attachments.

GENERALIZED SUBSURFACE CONDITIONS

SOIL CONDITIONS - Our geotechnical investigation has identified a surficial unit of fill, as much as about 3 to 3.5 feet in thickness, consisting principally of fine sands with variable silt, clay and organic fines. These surficial sands, which are classified as SP and SP-SM soils, were judged to be man placed fill based upon a buried zone of gray to dark gray fine sand which is typical for surficial native soils in the site vicinity.

Below the sandy fill, the borings generally identified fine sands with variable silt, clay and organic fines content to depths ranging from about 10 to 28 feet. Typically, the upper soils to depths of about 6 to 8 feet comprise the SP and SP-SM Unified classifications. The fines content typically increased below these depths, resulting in an SM and SC classification.

Underlying the generally sandy soils, the borings typically penetrated interbedded moderate to high plasticity clays, silty sands and clayey sands to the completion depths of the borings. Standard Penetration resistance values indicate that the sands are in a variably very loose to medium dense state of relative density, with occasional dense zones. The clays exhibited a firm to hard consistency.

GROUNDWATER - Groundwater was measured within a depth range of 3.7 to 7.5 feet below present grades at the boring locations during the course of our field investigation. The variations in groundwater levels are due principally to the differences in surface topography. Note that the borings were conducted in mid-October, 2008, which is near the end of the typical wet season. However, rainfall had been

somewhat blow normal near the end of the wet season. Based upon our studies, we would anticipate that typical wet season groundwater levels would generally occur somewhat higher than the measured levels, as summarized in Table I in the report attachments.

GEOTECHNICAL EVALUATION AND FOUNDATION RECOMMENDATIONS

ELECTRICAL-GENERATOR BUILDING AND RAS/WAS PUMP STATIONS

SHALLOW FOUNDATION DESIGN - Shallow foundations for the lightly loaded masonry Electrical-Generator Building and RAS/WAS Pump Stations supported near present grades may be designed based upon an allowable soil bearing pressure of up to 2,500 pounds per square foot. With proper subgrade and fill preparation, foundations proportioned in accordance with this allowable soil bearing pressure should experience maximum total settlements of less than 1 inch and differential settlements on the order of 0.5 inch or less. Since the principal source of the settlement is compression of loose sands, we anticipate that most of the settlement should occur with the application of the structural dead loads. While the settlements are not considered excessive, we suggest the incorporation of additional masonry wall reinforcement, perhaps in combination with top and bottom footing reinforcement to help minimize minor cosmetic cracking in masonry walls.

SLAB-ON-GRADE - Slab-on-grade construction may be utilized with proper site preparation, which would involve careful stripping of surface vegetation and other unsuitable materials followed by proofrolling of subgrade and effective compaction of fill lifts required to establish design grades. Also of importance is compaction of backfill soils in utility trenches and against stem walls prior to concrete placement. It is suggested that a modulus of subgrade reaction of K_s equal to 150 pounds per cubic inch be utilized in the analysis of slab-on-grade thickness requirements.

AERATION-ANOXIC BASINS

SHALLOW FOUNDATION DESIGN - We anticipate that the structure would be based on a mat foundation. Based upon the structure details provided to us, we have estimated a gross soil bearing pressure of less than about 2,000 pounds per square foot. Maximum total and differential settlements on the order of 1.5 inches and 0.75 inch, respectively, would be expected with the above loads due to compression of the loose fine sands identified in the borings. Since the principal source of the settlement is compression of loose sands, we anticipate that most of the settlement

should occur with the construction of the structure and the first filling of the basins. Based upon the foregoing, the structure may be designed on a mat foundation utilizing a suggested subgrade modulus of 11 pounds per cubic inch in design.

GENERAL REQUIREMENTS FOR SUBGRADE PREPARATION - Following stripping the surface vegetation and topsoil and careful examination and removal of any localized, unsuitable material, the exposed subgrade should be uniformly compacted utilizing a vibratory compactor. Excessive vibration should be avoided within about 75 feet of existing structures or buried piping. The compaction should consist of no less than eight (8) to ten (10) coverages throughout the construction areas so as to achieve a uniform density of no less than 95% of the Modified Proctor maximum dry density per ASTM D-1557. Appended are recommendations relative to proof-rolling and compaction of the subgrade soils and compaction of subsequent fill materials needed to establish design grades.

All foundation and slab areas should also be carefully inspected and probed by a representative of the geotechnical consultant prior to the placement of reinforcement and concrete. The purpose of this examination would be to identify any localized subgrade soil conditions that may not have been evidenced by the exploratory borings that would warrant removal and replacement with select compacted backfill. Careful examination is recommended, especially in any isolated column footing areas. The appended specifications also provide recommendations for quality assurance inspection and compaction testing during subgrade and fill preparation for the project.

Fill placed to develop proposed grades, backfill placed to re-establish grades around structures embedded below grade and fill utilized to construct the earth berms of the Reject Basins should consist of clean structural fill comprising the SP to SP-SM Unified Soil Classification or superior as approved by the project geotechnical engineer. Soils removed from the excavations should generally meet this requirement and may be re-used. The backfill material should be uniformly compacted so as to achieve a density of no less than 95% of the Modified Proctor maximum dry density per ASTM D-1557.

Depending upon groundwater levels at the time of construction and the depth of embedment, the subgrade soils at the bottom of the embedded mat foundation elevations may have excessive moisture which may be difficult to efficiently control to levels suitable for achieving proper compaction. Accordingly, consideration could be given to undercutting the subgrade on the order of 12 to 18 inches in order to place a compacted gravel working platform in lieu of achieving the recommended compaction requirement in the native subgrade soils. The gravel should be placed and compacted in a sufficient thickness so as to achieve a firm and non-yielding subgrade for placement of reinforcement and concrete for mat foundation

construction. If employed, the gravel working platform should consist of a hard durable aggregate such as hard limestone or granite, free of significant fines content that could result in a reduction in the drainage characteristics of the blanket. It is further suggested that the gravel working platform have a grading no coarser than an FDOT #57.

STORMWATER MANAGEMENT AREA DESIGN - The Soil Conservation Service Soil Survey of Manatee County indicates EauGallie soils at the project site. These soils typically have a normal seasonal high groundwater level between 05 and 1.5 feet below the ground surface. However, as mentioned, the site has been filled and developed. Therefore, the Soil Survey estimates for an undisturbed site may not be valid.

Soils penetrated by the drainage area borings (DRI-1 and DRI-2) consisted of relatively clean to slightly silty fine sands with some organic fines to the completion depths of the borings. Groundwater was measured at depths of 4.6 and 6.5 feet below grade at boring locations DRI-1 and DRI-2, respectively. Based upon results of our studies, and in consideration of the apparent fill in the area, we estimate that normal seasonal high groundwater levels may occur at about 2.5 to 3.0 feet below the present grade at boring locations DRI-1 and DRI-2, respectively. A more refined estimate of groundwater levels would necessitate installation of shallow piezometers followed by monitoring of groundwater levels during periods of increased precipitation.

Field infiltration testing indicates infiltration rates of 3.0 and 3.5 inches per hour at the test locations and depths. Care should certainly be exercised in the application of Double-Ring Infiltration and laboratory permeability test results to the design of drainage facilities. The analysis of seepage infiltration must include a careful assessment of hydraulic seepage boundary conditions and other factors which will influence pond operating characteristics.

DRIGGERS ENGINEERING SERVICES, INC. appreciates the opportunity to assist you and we trust, if you have any questions concerning our report or recommendations, you will not hesitate to contact the undersigned at your convenience.

Respectfully submitted,
DRIGGERS ENGINEERING SERVICES, INC.

Nicholas T. Korecki 2.3.09

Nicholas T. Korecki, P.E.
Senior Geotechnical Engineer
FL Registration No. 45529

F. Jaime Driggers, P.E.
President
FL Registration No. 16989

NTK-REP\086271
Copies submitted: (3)

APPENDIX

TABLE I
SUMMARY OF GROUNDWATER DATA

RECOMMENDATIONS FOR SUBGRADE PREPARATION AND FOUNDATION DESIGN

PLATE I - BORING LOCATION PLAN

STANDARD PENETRATION TEST BORING LOGS

HAND AUGER BORING LOGS

SUMMARY OF LABORATORY TEST RESULTS

GRAINSIZE ANALYSES

DOUBLE RING INFILTRATION TEST RESULTS

METHOD OF TESTING

TABLE I
SUMMARY OF GROUNDWATER DATA

TABLE I
SUMMARY OF GROUNDWATER DATA
NORTH WASTEWATER RECLAMATION FACILITY
MANATEE COUNTY, FLORIDA

BORING	GROUND ELEV. (FT.)	MEASURED GROUNDWATER DEPTH (FT)	MEASURED GROUNDWATER ELEV. (FT.)	ESTIMATED NORMAL SEASONAL HIGH GROUNDWATER DEPTH (FT.)	ESTIMATED NORMAL SEASONAL HIGH GROUNDWATER ELEV. (FT.)	APPROX. FILL THICKNESS MEASURED AT BORING LOCATION (FT.)
B-1	+28.9	6.0	+22.9	3.0	+25.9	2.0
B-2	+27.9	5.6	+22.3	1.5	+26.4	0.5
B-3	+28.8	6.0	+22.8	3.0	+25.8	1.3
B-4	+28.2	5.8	+22.4	3.0	+25.2	2.5
B-5	+27.7	7.3	+20.5	3.0	+24.7	3.5
B-6	+27.6	6.2	+21.4	3.0	+24.6	3.0
B-7	+30.0	6.5	+23.5	3.0	+26.0	3.5
B-8	+26.6	6.2	+20.4	3.0	+23.6	2.0
B-9	+27.2	6.1	+21.1	3.0	+24.3	3.0
B-10	+28.6	3.7	+24.9	1.5	+27.1	3.5
B-11	+32.8	7.5	+25.3	3.0	+29.8	1.2
B-12	+29.7	6.2	+25.3	3.0	+26.7	3.2
B-13	+28.0	5.9	+22.1	3.0	+25.0	1.5
DRI-1	+26.9	4.6	+22.3	2.5	+24.4	1.5
DRI-2	+31.5	6.5	+25.0	3.0	+28.5	1.9

RECOMMENDATIONS FOR SUBGRADE PREPARATION AND FOUNDATION DESIGN

RECOMMENDATIONS FOR SUBGRADE PREPARATION AND FOUNDATION DESIGN

SUBGRADE PREPARATION

1. The entire structure areas and for a distance of at least 5 feet beyond the outside footing perimeter should be stripped of all surface vegetation, pavements, highly organic soils, root concentrations, existing structures and other objectionable material. Exact depth of stripping should be determined by a representative of the soil engineer in the field. The exposed foundation areas, prior to filling, should be carefully inspected and probed to check for unsuitable subgrade conditions not identified during the field investigation. A qualified soils technician should be present during stripping operations and foundation inspection to delineate the plan limits and depth of removal of any unsuitable material identified during foundation inspection.

2. The exposed subgrade should be uniformly compacted using a vibratory roller having a maximum drum width of 36 inches. Excessive vibrations should be avoided in within about 75 feet of existing buried piping or structures, particularly those supported on shallow foundations. Subgrade compaction should consist of no less than ten (10) complete coverages in a criss-crossed pattern throughout the entire structure area, plus the 5 foot margin. Compaction should achieve a minimum density of no less than 95% of the Modified Proctor maximum dry density as established in ASTM D-1557.

3. A qualified engineer or technician should be present during initial compaction operations to check proper compactor performance and compaction procedures as well as evidence of any soft or compressible zones that would warrant removal and replacement. The compaction should be performed at a speed equivalent to that of a slow walking pace.

4. Density tests should be used to control subgrade compaction. At least one (1) density test should be performed for every 5,000 $ft.^2$ at the surface of compaction and at a depth of 12 inches.

5. Excavated column and continuous footing areas shall also be compacted with a hand-guided vibratory compactor having a minimum plate width of 24 inches or the footing width whichever is less. No fewer than ten (10) coverages shall be effected. Compaction tests shall be conducted to check that a density of not less than 95% of the Modified Proctor maximum dry density has been maintained.

FILL OR BACKFILL PLACEMENT

1. Fill or backfill required to develop proposed grade should be inorganic, clean to slightly silty fine sand, free of unsuitable debris. Soils with a Unified Soil Classification of SP to SP-SM are considered as select fill. Soils with a Unified Soil Classification of SM and SC may also be suitable provided they exhibit a Liquid Limit of less than 30 and a Plasticity Index of less than or equal to 10. However, SM and SC soils contain applicable silt and clay fines and will require more extensive processing to control moisture contents to levels suitable for compaction.

2. The fill or backfill should be placed in lift thicknesses not exceeding 12 inches with each lift compacted to a density of no less than 95% of the Modified Proctor maximum dry density. Moisture content within the fill soil should be controlled to within ±2% of optimum as established in ASTM D-1557 to help ensure development of both density and stability during compaction operations. No fewer than six (6) to eight (8) coverages should be made on each lift using the above specified vibratory roller.

3. Density tests should also be used to control fill placement. At least one (1) density test should be performed for each 5,000 ft.^{2} per fill lift.

4. Careful inspection and compaction tests should also be performed to confirm required uniformity of compaction prior to slab-on-grade construction.

FOUNDATION DESIGN

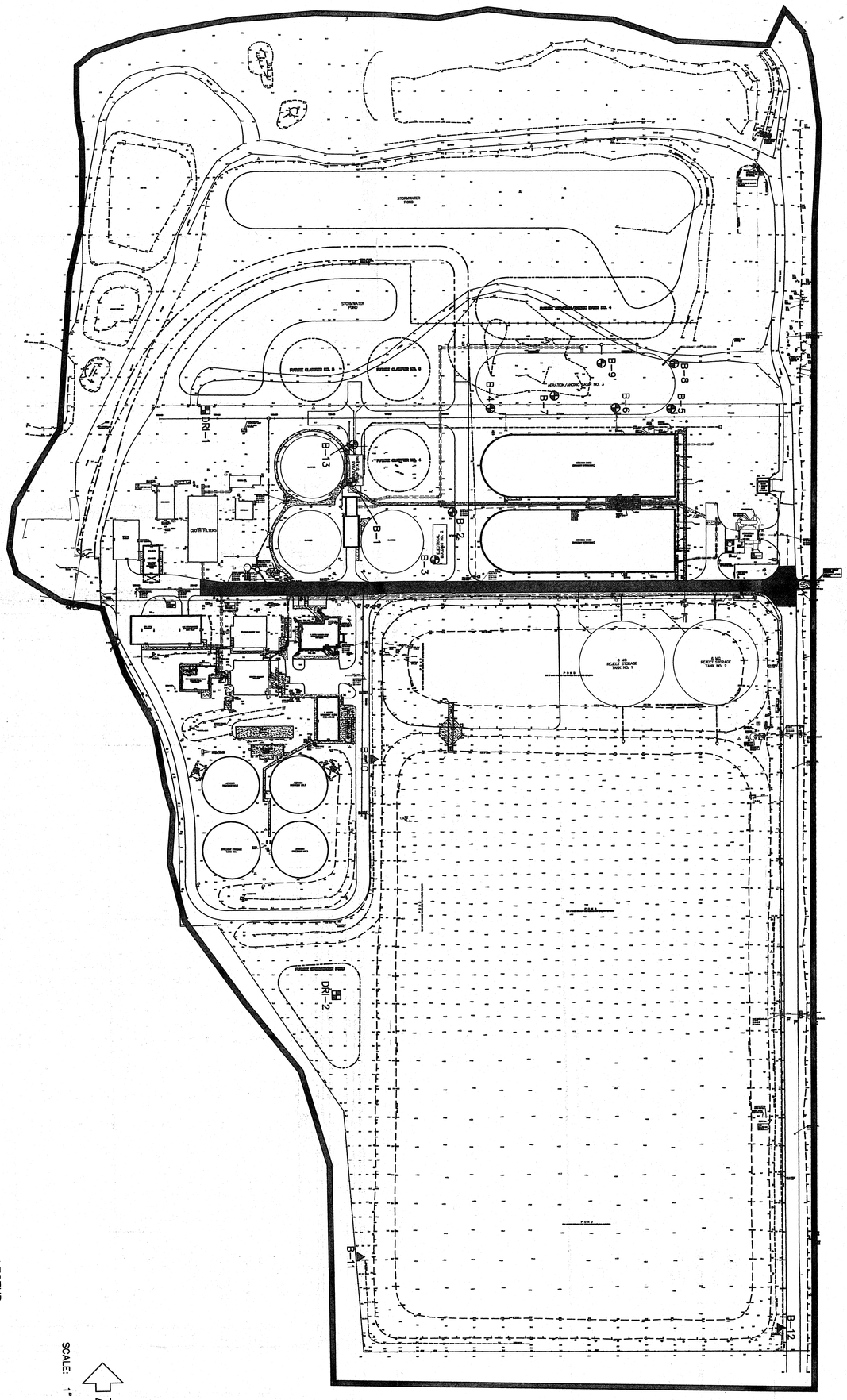
1. Shallow foundations for column and wall footings may be designed based upon an allowable soil bearing pressure of 2,500 pounds per square foot based upon dead plus live plus wind load requirements.

2. We recommend a footing embedment of no less than 16 inches below finished grade, but excessive embedment should be avoided to take advantage of the surficial compaction.

3. Slab-on-grade construction may be utilized. To maintain slab support, excavation for utilities and foundations should be backfilled and compacted in lifts with a small compactor. Before backfill is placed, all water and loose debris should be removed from the excavations.

4. A bearing wall footing width of no less than 16 inches and column width of no less than 3 feet is also recommended.

PLATE I - BORING LOCATION PLAN



SCALE: 1" = 100'

LEGEND:

▲ HAND AUGER BORING LOCATION

⊕ STANDARD PENETRATION TEST BORING LOCATION

■ DOUBLE-RING INFILTRATION TEST/ HAND AUGER BORING LOCATION

PLATE NO.	PLATE 1
SHEET NO.	
PROJECT NO.	DES 086271
DATE	1/28/09
CAD FILE:	N:\ACLTWN\PLATE1\NWRF-T-PLOT-086271.DWG

PROJECT NAME

NORTH WASTEWATER RECLAMATION FACILITY EXPANSION
MANATEE COUNTY, FLORIDA

SHEET TITLE

BORING LOCATION PLAN

PREPARED BY	CAD / ENGINEER
DRIGGERS ENGINEERING SERVICES, INCORPORATED	R.D.B. / N.T.K.

REVISIONS

STANDARD PENETRATION TEST BORING LOGS

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO. B-1**

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 36.5' **Date** 10/21/08 **Depth To Water** 6.0' **Time** _____ **Date** 10/21/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION SURF. EL: +28.9'	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP 10 20 40 60 80
0			Brown Fine SAND with trace of roots (SP)		
			Light brown Fine SAND (SP)		
			Dark gray Fine SAND (SP)		
			Reddish-brown Fine SAND (SP)		
5			Very loose light brown Fine SAND (SP)		
				2/2/1	
			Very loose to loose light brown to light brownish-gray and tan silty Fine SAND (SM)	1/1/1	
10			- light brownish-gray at depth 10.0'	2/3/4	
				2/1/2	
15			Loose gray phosphatic, silty Fine SAND (SM)	4/3/6	
			Firm green and light brown CLAY with seams of light brownish-gray Fine SAND (CH/SP)		
20				2/1/7	
			Medium dense brownish-gray phosphatic, silty Fine SAND with seams of green and light brown CLAY (SM/CH)		
25				2/6/7	
			Hard light brown calcareous, brittle CLAY (CL)		
30				20/30/26	
			Dense brownish-gray phosphatic, silty Fine SAND with trace of light brown calcareous, brittle CLAY (SM)		
			Medium dense dark greenish-gray (1)		

Remarks Borehole Grouted

(1) clayey Fine SAND (SC) **Casing Length** _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO.** B-1

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 36.5' **Date** 10/21/08 **Depth To Water** 6.0' **Time** _____ **Date** 10/21/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP
			SURF. EL: +28.9'		10 20 40 60 80
35			Medium dense dark greenish-gray clayey Fine SAND (SC)	5/5/8	
40					
45					
50					
55					
60					
65					

Remarks Borehole Grouted

Casing Length _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO. B-2**

Project North Water Reclamation Facility, Manatee County, Florida

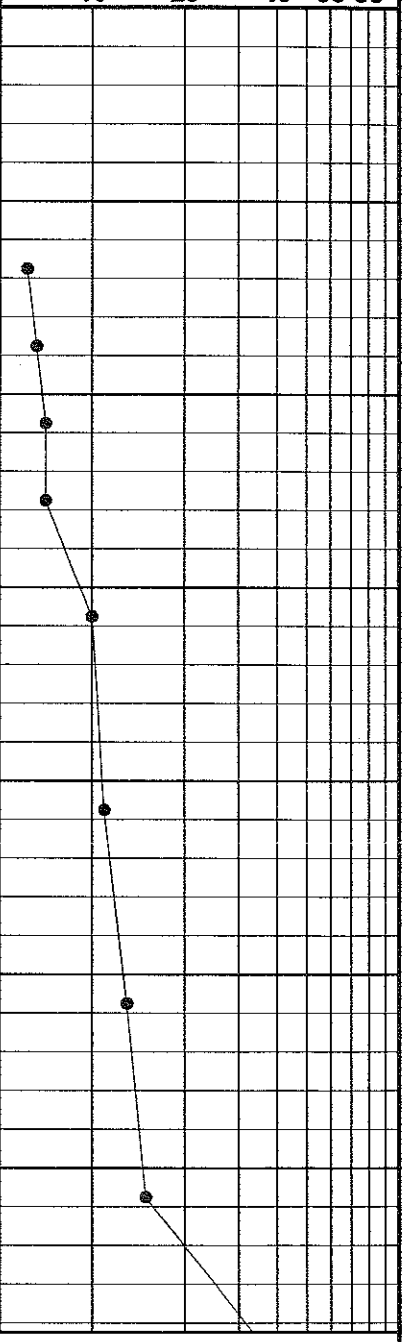
Location See Plate I **Foreman** J.R.

Completion Depth 36.5' **Date** 10/22/08 **Depth To Water** 5.6' **Time** **Date** 10/22/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.
			SURF. EL: +27.9'	
0			Grayish-brown Fine SAND with trace of roots (SP)	
			Gray Fine SAND (SP)	
			Dark brown Fine SAND with finely divided organic material (SP)	
5			Light brown Fine SAND (SP)	
			Very loose light brown silty Fine SAND (SM)	1/2/1
				2/1/3
10			Loose very light brownish-gray Fine SAND (SP)	1/3/2
			Loose light gray and tan slightly silty Fine SAND (SP-SM)	4/3/2
15			Loose light gray and tan phosphatic, silty Fine SAND (SM)	4/4/6
			Firm green and light brown CLAY (CH)	
20				2/3/8
			Medium dense light brownish-gray Fine SAND and stiff green CLAY (SP/CH)	
			Stiff green and light brown CLAY with medium dense brownish-gray Fine SAND (CH/SP)	
25				1/4/9
			Medium dense dark greenish-gray phosphatic, slightly silty Fine SAND (SP-SM)	
30				14/9/6
			Stiff green and light brown CLAY (CH)	
			Dense gray and tan clayey Fine SAND (SC)	

STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP

10 20 40 60 80



Remarks Borehole Grouted

Casing Length

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO.** B-2

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 36.5' **Date** 10/22/08 **Depth To Water** 5.6' **Time** _____ **Date** 10/22/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP
			SURF. EL: +27.9'		10 20 40 60 80
35			Dense gray and tan clayey Fine SAND (SC)	23/26/21	
40					
45					
50					
55					
60					
65					

Remarks Borehole Grouted

Casing Length _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO. B-3**

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 35.3' **Date** 10/22/08 **Depth To Water** 6.0' **Time** _____ **Date** 10/22/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION (SURF. EL: +28.8')	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP (10 20 40 60 80)
0			Brown Fine SAND with some roots (SP)		
			Dark gray Fine SAND (SP)		
5			Dark brown Fine SAND with finely divided organic material (SP)		
			Light brown Fine SAND (SP)		
			Very loose light brown and brown Fine SAND (SP)	2/1/1	
			Loose light brownish-gray weakly cemented, silty Fine SAND (SM)	4/4/3	
10			Loose light brownish-gray Fine SAND (SP)	2/2/3	
				2/4/6	
15			Loose gray and tan phosphatic, silty Fine SAND with thin seams of green CLAY (SM/CH)	3/3/5	
			Firm to stiff green and light brown CLAY with seams of brownish-gray Fine SAND (CH/SP)		
20				3/2/4	
25				2/3/10	
			Stiff green and light brown CLAY with seams of gray phosphatic, silty Fine SAND (CH/SM)		
30				2/6/8	
			Very stiff to hard light brown calcareous, brittle, sandy CLAY (CL)		

Remarks Borehole Grouted

Casing Length _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO.** B-3

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 35.3' **Date** 10/22/08 **Depth To Water** 6.0' **Time** _____ **Date** 10/22/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP
			SURF. EL: +28.8'		10 20 40 60 80
35			Very stiff to hard light brown calcareous, brittle, sandy CLAY (CL)	50*	* 0.3' Penetration
40					
45					
50					
55					
60					
65					

Remarks Borehole Grouted

Casing Length _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO. B-4**

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 51.5' **Date** 10/21/08 **Depth To Water** 5.8' **Time** **Date** 10/21/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION (SURF. EL: +28.2')	BLOWS ON SAMPLER PER 6" OR PEN. STR.
0			Brown Fine SAND with some roots (SP)	
			Light grayish-brown Fine SAND (SP)	
			Brown and light brown Fine SAND (SP)	
			Gray Fine SAND (SP)	
5			Dark brown Fine SAND with finely divided organic material (SP)	
			Light brown Fine SAND (SP)	2/3/3
			Loose light brown and brown slightly silty Fine SAND with pocket of clayey Fine SAND (SP-SM/SC)	0/0/0
10			Very loose light brown Fine SAND (SP)	
			Loose light brownish-gray and tan clayey Fine SAND (SC)	2/3/4
			Loose light brownish-gray and tan silty Fine SAND with pocket of green CLAY (SM/CH)	4/3/4
15			Loose light gray and tan phosphatic, slightly silty Fine SAND (SP-SM)	4/5/4
			Firm to very stiff green sandy CLAY and loose to medium dense brownish-gray Fine SAND (CH) and (SP)	
20				2/3/3
25				3/4/11
			Medium dense greenish-gray clayey Fine SAND (SC)	
30				3/4/7
			Very stiff dark greenish-gray CLAY (CH)	

STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP

10 20 40 60 80

Remarks Borehole Grouted

Casing Length

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO. B-4**

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 51.5' **Date** 10/21/08 **Depth To Water** 5.8' **Time** _____ **Date** 10/21/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP
			SURF. EL: +28.2'		10 20 40 60 80
35			Very stiff dark greenish-gray CLAY (CH)	6/6/9	
40			Stiff dark greenish-gray sandy CLAY (CH)	3/4/7	
45			Dense greenish-gray clayey Fine SAND (SC)	9/12/21	
50			Medium dense greenish-gray slightly clayey Fine SAND with trace of phosphate (SP-SM)	10/12/15	
55					
60					
65					

Remarks Borehole Grouted

Casing Length _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO.** B-5

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 51.5' **Date** 10/21/08 **Depth To Water** 7.3' **Time** **Date** 10/21/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION (SURF. EL: +27.7')	BLOWS ON SAMPLER PER 6" OR PEN. STR.
0			Brown Fine SAND (SP)	
			Light brown Fine SAND (SP)	
			Dark gray Fine SAND (SP)	
5			Brown Fine SAND (SP)	
			Dark brown Fine SAND with trace of finely divided organic material (SP)	3/3/2
			Loose light brown Fine SAND (SP)	
			Very loose light brown silty, slightly clayey Fine SAND (SM)	1/3/5
10			Loose to medium dense light brownish-gray Fine SAND (SP)	5/5/8
			Medium dense light brownish-gray slightly silty Fine SAND (SP-SM)	5/8/7
15			Medium dense light gray phosphatic, slightly silty Fine SAND (SP-SM)	6/7/7
			Stiff green and light brown CLAY with seams of light gray Fine SAND (CH/SP)	
20				5/5/9
			Dense light brownish-gray Fine SAND with thin seams of green CLAY (SP/CH)	
25				10/21/12
			Very stiff green and light brown CLAY with seams of light brownish-gray Fine SAND (CH/SP)	
			Medium dense light brown clayey Fine SAND with trace of green CLAY (SC)	
30				4/5/7
			Very stiff to stiff dark greenish-gray CLAY (CH)	

STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP

10 20 40 60 80

Remarks Borehole Grouted

Casing Length

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO. B-5**

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 51.5' **Date** 10/21/08 **Depth To Water** 7.3' **Time** _____ **Date** 10/21/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP
			SURF. EL: +27.7'		10 20 40 60 80
35			Very stiff to stiff dark greenish-gray CLAY (CH)	9/8/8	
40			Medium dense dark greenish-gray silty, slightly clayey Fine SAND (SM)	3/7/10	
45			Very stiff cream colored calcareous CLAY with seams of greenish-gray CLAY (CL/CH)	39/10/16	
50			Stiff dark greenish-gray sandy CLAY (CH)	3/3/6	
55					
60					
65					

Remarks Borehole Grouted

Casing Length _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO.** B-6

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 51.5' **Date** 10/21/08 **Depth To Water** 6.2' **Time** _____ **Date** 10/21/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP (10 20 40 60 80)
			SURF. EL: +27.6'		
0			Brown Fine SAND with trace of roots (SP)		
			Light brown Fine SAND (SP)		
			Brown and light brown Fine SAND (SP)		
			Gray Fine SAND (SP)		
5			Brown Fine SAND (SP)		
			Light brown Fine SAND (SP)		
			Very loose light grayish-brown Fine SAND (SP)	6/2/2	
			Loose light brownish-gray slightly silty Fine SAND with seams of brownish-gray silty, clayey Fine SAND (SP-SM/SM-SC)	2/5/5	
10			Loose light gray clayey Fine SAND (SC)	2/4/4	
			Loose light grayish-brown slightly silty Fine SAND (SP-SM)	4/5/4	
15			Medium dense light gray phosphatic, slightly silty Fine SAND (SP-SM)	6/8/7	
			Loose to medium dense light brownish-gray to greenish-gray phosphatic, silty Fine SAND (SM)	3/3/3	
20					
25				4/8/8	
			Medium dense light brown phosphatic, clayey Fine SAND (SC)		
30				3/6/6	
			Stiff green CLAY with seams (1)		

Remarks Borehole Grouted

(1) of brownish-gray Fine SAND (CH/SP) **Casing Length** _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO.** B-6

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 51.5' **Date** 10/21/08 **Depth To Water** 6.2' **Time** _____ **Date** 10/21/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP
			SURF. EL: +27.6'		10 20 40 60 80
35			Stiff green CLAY with seams of brownish-gray Fine SAND (CH/SP)	8/5/9	
			Very stiff dark greenish-gray CLAY with trace of Fine SAND (CH)		
			Very stiff greenish-gray and dark greenish-gray sandy CLAY (CH)		
40				10/9/13	
			Very stiff dark greenish-gray CLAY and medium dense greenish-gray clayey Fine SAND (CH/SC)		
			Hard light gray calcareous CLAY with seam of dark greenish-gray CLAY (CL/CH)		
45				14/19/20	
			Stiff dark greenish-gray CLAY with trace of Fine SAND (CH)		
50				3/5/6	
55					
60					
65					

Remarks Borehole Grouted

Casing Length _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO.** B-7

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 51.5' **Date** 10/22/08 **Depth To Water** 6.5' **Time** _____ **Date** 10/22/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP
			SURF. EL: +30.0'		10 20 40 60 80
0			Light brown weakly cemented, slightly silty Fine SAND (SP-SM)		
			Brown Fine SAND (SP)		
			Dark gray Fine SAND (SP)		
5			Dark brown Fine SAND with finely divided organic material (SP)		
			Loose tannish-brown Fine SAND (SP)	2/3/5	
			Medium dense light brown Fine SAND with seams of brown Fine SAND (SP)	4/6/5	
10			Loose grayish-brown and light brown weakly cemented, slightly silty Fine SAND (SP-SM)	2/3/3	
			Loose light grayish-brown slightly silty Fine SAND (SP-SM)	4/4/6	
15			Medium dense light gray clayey Fine SAND with orange veins (SC)		
			Loose light gray and tan silty Fine SAND (SP)	5/3/3	
			Very loose gray phosphatic, silty Fine SAND (SM)		
20				3/1/2	
			Very loose to medium dense greenish-gray to light greenish-brown phosphatic, clayey Fine SAND (SC)		
25				1/2/2	
30				4/7/13	
			Medium dense light greenish-brown (1)		

Remarks Borehole Grouted

(1) phosphatic, silty, slightly clayey Fine SAND (SM) **Casing Length** _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO.** B-7

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 51.5' **Date** 10/22/08 **Depth To Water** 6.5' **Time** _____ **Date** 10/22/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP
			SURF. EL: +30.0'		10 20 40 60 80
35			Medium dense light greenish-brown phosphatic, silty, slightly clayey Fine SAND (SM)	5/8/8	
			Stiff green to dark greenish-gray CLAY (CH)		
40				4/5/6	
			Stiff light greenish-gray calcareous CLAY (CL)		
45				2/5/7	
			Firm greenish-gray calcareous, sandy CLAY (CL)		
50				2/2/5	
55					
60					
65					

Remarks Borehole Grouted

Casing Length _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO.** B-8

Project North Water Reclamation Facility, Manatee County, Florida

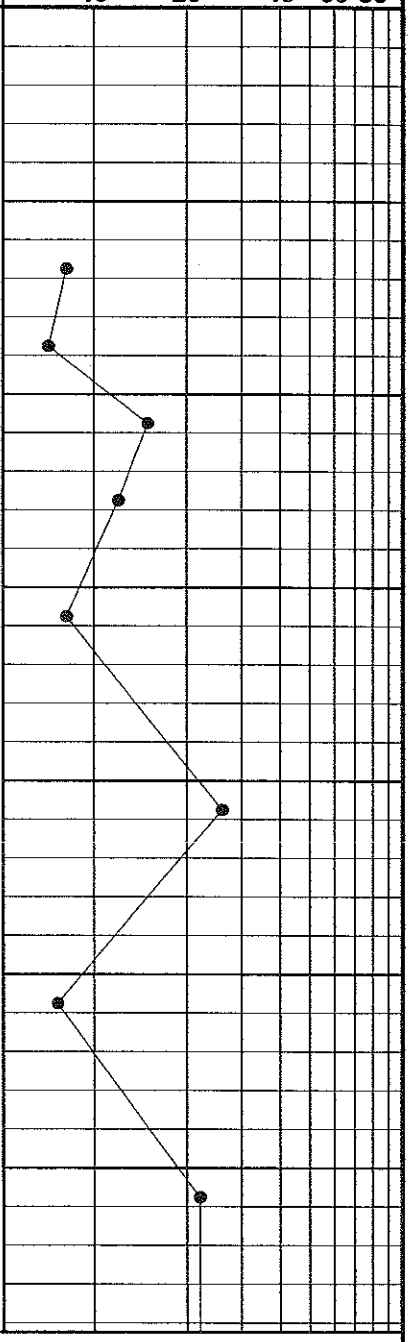
Location See Plate I **Foreman** J.R.

Completion Depth 51.5' **Date** 10/22/08 **Depth To Water** 6.2' **Time** _____ **Date** 10/22/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.
			SURF. EL: +26.6'	
0			Tannish-brown Fine SAND with some weakly cemented sand (SP)	
			Light brown Fine SAND (SP)	
			Dark gray Fine SAND (SP)	
			Dark brown Fine SAND (SP)	
5			Light brown Fine SAND (SP)	
			Loose light brown silty, slightly clayey Fine SAND (SM)	1/2/5
			Loose light brown slightly silty Fine SAND (SP-SM)	3/3/2
10			Medium dense very light brownish-gray to light brownish-gray Fine SAND (SP)	5/8/7
				5/5/7
15			Loose light gray phosphatic, slightly silty Fine SAND (SP-SM)	4/4/3
			Very stiff light greenish-gray CLAY with seams of light brownish-gray Fine SAND (CH/SP)	
20				10/17/9
			Medium dense brownish-gray Fine SAND (SP)	
			Loose brown clayey Fine SAND (SC)	
25				2/2/4
			Firm light greenish-gray CLAY with seams of brownish-gray phosphatic Fine SAND (CH/SP)	
30				
			Medium dense brownish-gray Fine SAND with trace of phosphate (SP)	4/10/12
			Stiff dark greenish-gray CLAY (CH)	

STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP

10 20 40 60 80



Remarks Borehole Grouted

Casing Length _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO.** B-8

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 51.5' **Date** 10/22/08 **Depth To Water** 6.2' **Time** _____ **Date** 10/22/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION (SURF. EL: +26.6')	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP (10 20 40 60 80)
35			Stiff dark greenish-gray CLAY (CH)		
			Medium dense dark greenish-gray Fine SAND (SP)	5/10/12	
			Hard light gray calcareous, variably cemented, sandy CLAY (CL)		
40				30/50*	* 0.2' Penetration
			Firm light greenish-gray calcareous CLAY (CL)		
45				3/3/5	
			Soft greenish-gray calcareous CLAY with seams of gray Fine SAND (CL/SP)		
50				2/4/4	
			Loose dark greenish-gray silty, slightly clayey Fine SAND (SM)		
55					
60					
65					

Remarks Borehole Grouted

Casing Length _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO. B-9**

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 51.5' **Date** 10/22/08 **Depth To Water** 6.1' **Time** **Date** 10/22/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.
			SURF. EL: +27.2'	
0			Light brown Fine SAND with some cemented sand (SP)	
			Dark gray Fine SAND (SP)	
			Dark brown Fine SAND (SP)	
5			Light brown Fine SAND (SP)	
			Very loose light brown weakly cemented, slightly silty Fine SAND (SP-SM)	1/2/2
			Loose light brown silty, slightly clayey Fine SAND (SM)	1/2/3
10			Loose light gray clayey Fine SAND with orange veins (SC)	3/4/4
			Loose light brown Fine SAND with seam of grayish-brown silty Fine SAND (SP/SM)	3/3/4
15			Very loose light gray and tan phosphatic, slightly silty Fine SAND (SP-SM)	4/2/1
			Firm green and light brown CLAY and loose brownish-gray phosphatic Fine SAND (CH/SP)	2/4/3
20			Loose greenish-gray clayey Fine SAND (SC)	
25				2/2/3
			Stiff to firm green and light brown CLAY with seams of light gray Fine SAND (CH/SP)	
30				5/4/7

STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP

10 20 40 60 80

Remarks Borehole Grouted

Casing Length

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO.** B-9

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 51.5' **Date** 10/22/08 **Depth To Water** 6.1' **Time** _____ **Date** 10/22/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION (SURF. EL: +27.2')	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP (10 20 40 60 80)
35			Stiff to firm green and light brown CLAY with seams of light gray Fine SAND (CH/SP)	5/3/5	
			Stiff green CLAY and loose brownish-gray phosphatic Fine SAND (CH/SP)		
			Hard light greenish-gray calcareous CLAY (CL)		
40				36/22/24	
			Firm dark greenish-gray CLAY with trace of Fine SAND (CH)		
45				4/3/5	
			Hard light greenish-gray calcareous, sandy CLAY (CL)		
50				6/12/24	
55					
60					
65					

Remarks Borehole Grouted

Casing Length _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO. B-13**

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 36.5' **Date** 10/21/08 **Depth To Water** 5.9' **Time** _____ **Date** 10/21/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION (SURF. EL: +28.0')	BLOWS ON SAMPLER PER 6" OR PEN. STR.
0			Brown Fine SAND (SP)	
			Grayish-brown Fine SAND (SP)	
			Brownish-gray Fine SAND (SP)	
			Dark brown slightly organic Fine SAND (SP)	
5			Brown Fine SAND (SP)	
			Very loose light brown silty Fine SAND (SM)	2/1/1
				0/0/1
10			Loose to very loose light brownish-gray to light brownish-gray and tan slightly silty Fine SAND (SP-SM)	2/2/3
				1/1/1
15			Medium dense gray and tan phosphatic, silty Fine SAND (SM)	5/6/5
			Firm green and light brown CLAY with seams of light brownish-gray Fine SAND (CH/SP)	
20				2/2/4
			Medium dense brownish-gray phosphatic, silty Fine SAND with seams of green and light brown CLAY (SP/CH)	
25				5/7/5
			Hard light brown calcareous, brittle CLAY (CL)	
30				50*
			Medium dense dark greenish-gray (1)	

STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP

10 20 40 60 80

* 0.2' Penetration

Remarks Borehole Grouted

(1) clayey Fine SAND (SC) **Casing Length** _____

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project No. DES 086271 **BORING NO.** B-13

Project North Water Reclamation Facility, Manatee County, Florida

Location See Plate I **Foreman** J.R.

Completion Depth 36.5' **Date** 10/21/08 **Depth To Water** 5.9' **Time** _____ **Date** 10/21/08

DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP
			SURF. EL: +28.0'		10 20 40 60 80
35			Medium dense dark greenish-gray clayey Fine SAND (SC)	4/4/8	
40					
45					
50					
55					
60					
65					

Remarks Borehole Grouted

Casing Length _____

HAND AUGER BORING LOGS

DRIGGERS ENGINEERING SERVICES INCORPORATED

HAND AUGER BORING LOG

PROJECT: North Wastewater Reclamation Facility Manatee County, Florida Project No.: DES 086271	**CLIENT:** McKim & Creed		
	WATER TABLE: 3.7'	**DATE:** 10/14/08	
TECHNICIAN: L.M.	**DATE:** 10/14/08	**COMPLETION DEPTH:** 6.0' *	
LOCATION: See Plate I	**TEST NUMBER:** B-10		

ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS
28	Brown slightly silty Fine SAND (SP-SM)	0		Ground Surface Elevation: +28.6'.
	Brown and gray Fine SAND (SP)	2		
26	Mottled brown Fine SAND (SP)			
	Brown Fine SAND (SP)			
	Light brown Fine SAND (SP)	4		
24				
		6		* Could not penetrate below depth 6.0' without setting PVC casing.
22				
		8		
20				
		10		
18				
		12		
16				
		14		

DRIGGERS ENGINEERING SERVICES INCORPORATED

HAND AUGER BORING LOG

PROJECT: North Wastewater Reclamation Facility Manatee County, Florida Project No.: DES 086271	**CLIENT:** McKim & Creed
	WATER TABLE: 7.5' — **DATE:** 10/16/08
TECHNICIAN: L.M.	**DATE:** 10/16/08 — **COMPLETION DEPTH:** 10.5'
LOCATION: See Plate I	**TEST NUMBER:** B-11

ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS
	Dark brown Fine SAND with trace of roots (SP)	0		Ground Surface Elevation: +32.8'.
32	Tannish-brown silty, slightly clayey Fine SAND (SM)			
	Dark gray Fine SAND (SP)	2		
	Gray Fine SAND (SP)			
30				
	Light gray and light brown Fine SAND (SP)	4		
	Dark brown slightly silty Fine SAND with trace of finely divided organic material (SP-SM)			
28	Brown Fine SAND (SP)			
		6		
26	Dark brown clayey Fine SAND (SC)			
	Tannish-brown silty, slightly clayey Fine SAND (SM)	8		
24				
		10		
	Grayish-tan slightly silty Fine SAND with trace of cemented sand (SP-SM)			
22				
		12		
20				
		14		

DRIGGERS ENGINEERING SERVICES INCORPORATED

HAND AUGER BORING LOG

PROJECT: North Wastewater Reclamation Facility Manatee County, Florida Project No.: DES 086271	**CLIENT:** McKim & Creed
TECHNICIAN: L.M.	**WATER TABLE:** 6.2' / **DATE:** 10/16/08
LOCATION: See Plate I	**DATE:** 10/16/08 / **COMPLETION DEPTH:** 8.0'
	TEST NUMBER: B-12

ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS
	Dark brown slightly silty Fine SAND with trace of roots (SP-SM)	0		Ground Surface Elevation: +29.7'.
	Light brown slightly silty Fine SAND (SP-SM)			
28	Tan and dark brown Fine SAND (SP)	2		
26	Light gray and dark gray Fine SAND (SP)	4		
	Light brown Fine SAND (SP)			
24		6		
	Brown Fine SAND (SP)			
22		8		
20		10		
18		12		
16		14		

DOUBLE RING INFILTRATION TEST RESULTS

DOUBLE RING INFILTRATION TEST

Job No: DES 086271 **Test No.** DRI-1 **Date:** 10/16/2008

Client : McKim & Creed

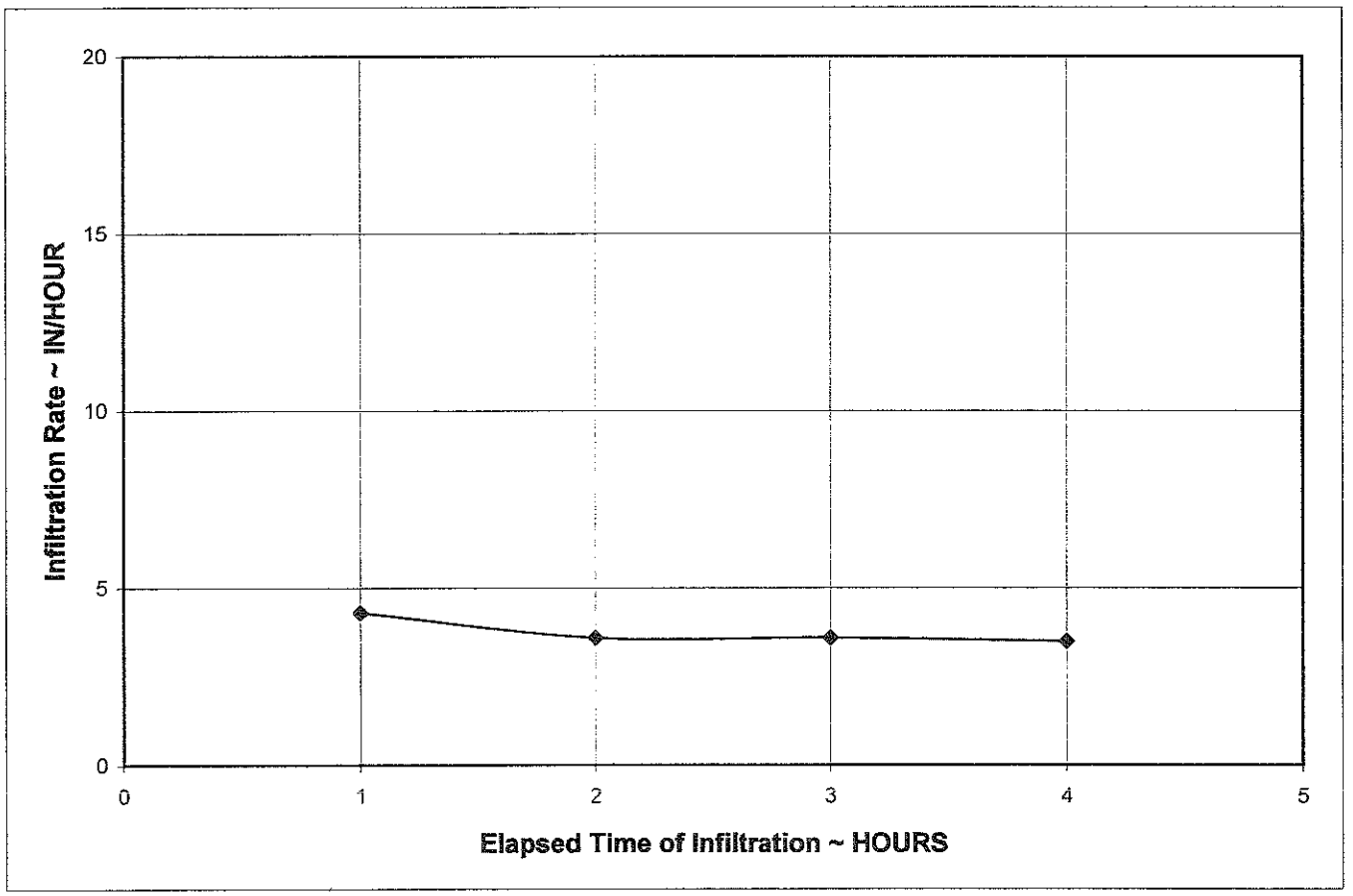
Project: North Water Reclamation Facility, Manatee County, Florida

Location: See Location Plan

Test Depth: 1.5 ft. **Outer Cyl. Diam:** 24" **Inner Cyl. Diam:** 12"

Description of Soil at Test Depth: Brown silty Fine SAND

Depth of Groundwater Below Test Depth: 3.4 ft. **Infiltration Rate:** 3.5 In/Hr



TEST PROCEDURE: The test was conducted in general accordance with ASTM D 3385-75. A seven (7") inch hydraulic head was utilized. The infiltration rate was determined at selected time intervals by recording the time for a 1 inch drop in water level. The seven (7") inch head was then re-established until the next test interval. The test was continued until stability was achieved and the infiltration rate did not vary in excess of 5% between successive one (1) hour measurements. Readings were recorded at intervals not exceeding 30 minutes. The plotted infiltration rate above represents the average of all observations during each hour interval.

Technician: L.M. **Reviewed by:** Nicholas T. Kurecki

DRIGGERS ENGINEERING SERVICES INCORPORATED

HAND AUGER BORING LOG

PROJECT: North Wastewater Reclamation Facility Manatee County, Florida Project No.: DES 086271	**CLIENT:** McKim & Creed **WATER TABLE:** 4.6' **DATE:** 10/14/08
TECHNICIAN: K.P.	**DATE:** 10/14/08 **COMPLETION DEPTH:** 7.0'
LOCATION: See Plate I	**TEST NUMBER:** DRI-1

ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS
	Brown slightly silty Fine SAND with trace of roots (SP-SM)	0		Ground Surface Elevation: +26.9'.
26	Mottled light brown slightly silty Fine SAND (SP-SM)			
	Gray Fine SAND (SP)	2		
24	Dark brown slightly silty Fine SAND with finely divided organic material (SP-SM)			
	Gray Fine SAND (SP)	4		
	Mottled brown Fine SAND (SP)			
22				
	Brown Fine SAND (SP)	6		
20				
		8		
18				
		10		
16				
		12		
14				
		14		

DOUBLE RING INFILTRATION TEST

Job No: DES 086271 **Test No.** DRI-2 **Date:** 10/14/2008

Client : McKim & Creed

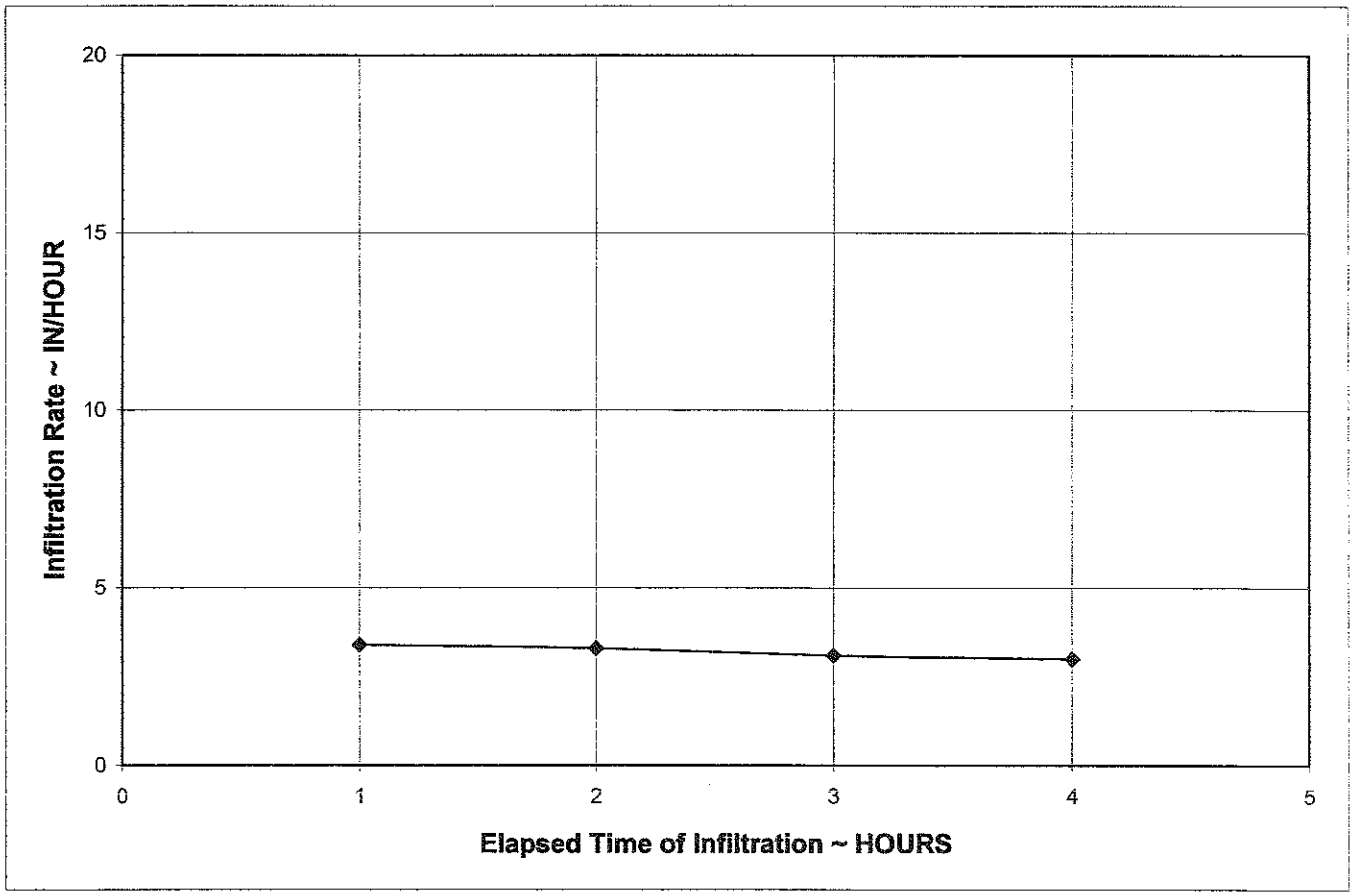
Project: North Water Reclamation Facility, Manatee County, Florida

Location: See Location Plan

Test Depth: 2.5 ft. **Outer Cyl. Diam:** 24" **Inner Cyl. Diam:** 12"

Description of Soil at Test Depth: Gray Fine SAND

Depth of Groundwater Below Test Depth: 4.0 ft. **Infiltration Rate:** 3.0 In/Hr



TEST PROCEDURE: The test was conducted in general accordance with ASTM D 3385-75. A seven (7") inch hydraulic head was utilized. The infiltration rate was determined at selected time intervals by recording the time for a 1 inch drop in water level. The seven (7") inch head was then re-established until the next test interval. The test was continued until stability was achieved and the infiltration rate did not vary in excess of 5% between successive one (1) hour measurements. Readings were recorded at intervals not exceeding 30 minutes. The plotted infiltration rate above represents the average of all observations during each hour interval.

Technician: K. P. **Reviewed by:** Nicholas T. Koreski

DRIGGERS ENGINEERING SERVICES INCORPORATED

HAND AUGER BORING LOG

PROJECT: North Wastewater Reclamation Facility Manatee County, Florida Project No.: DES 086271		**CLIENT:** McKim & Creed	
		WATER TABLE: 6.5'	**DATE:** 10/14/08
TECHNICIAN: K.P.		**DATE:** 10/14/08	**COMPLETION DEPTH:** 10.0'
LOCATION: See Plate I		**TEST NUMBER:** DRI-2	

ELEV. (FT)	DESCRIPTION	DEPTH (FT)	SYMBOL	REMARKS
30	Brown slightly silty Fine SAND (SP-SM)	0		Ground Surface Elevation: +31.5'.
	Gray Fine SAND (SP)	2		
28	Light gray Fine SAND (SP)			
	Brown to dark brown slightly silty Fine SAND with trace of finely divided organic material (SP-SM)	4		
26	Brown Fine SAND (SP)	6		
24	Brown slightly silty Fine SAND (SP-SM)	8		
22		10		
20		12		
18		14		

SUMMARY OF LABORATORY TEST RESULTS

SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	DEPTH (ft)	DESCRIPTION	W %	Y_d (pcf)	G_s	ATTERBERG LIMITS			P.P. (tsf)	U.C.	CON.	G.S.	ORG. (%)	pH	Cl. (ppm)	SO_4 (ppm)	RES. (Ohm-cm)
						LL	PL	SL									
B-1	8.0-9.5	Light brown silty Fine SAND										*					
B-1	12.0-13.5	Light brownish-gray and tan silty Fine SAND										*					
B-2	6.0-7.5	Light brown silty Fine SAND										*					
B-2	10.0-11.5	Very light brownish-gray Fine SAND										*					
B-3	1.3-4.0	Dark gray Fine SAND										*					
B-3	4.0-5.2	Dark brown Fine SAND with finely divided organic material											1.8				
B-3	8.0-9.5	Light brownish-gray weakly cemented, silty Fine SAND										*					
B-3	20.0-21.5	Green and light brown CLAY with seams of light brownish-gray Fine SAND	39.3			66	22					** 41.8					
B-4	10.0-11.5	Light brownish-gray and tan clayey Fine SAND	19.3			26	18					** 18.2					
B-5	8.0-9.0	Light brown silty, slightly clayey Fine SAND	20.1			NP	NP					** 16.8					
B-6	6.0-7.5	Light grayish-brown Fine SAND										*					
B-6	10.0-11.5	Light gray clayey Fine SAND	18.2			27	16					** 21.3					
B-7	5.0-6.0	Dark brown Fine SAND with finely divided organic material											1.6				
B-7	20.0-21.5	Gray phosphatic, silty Fine SAND										*					
B-8	6.0-7.5	Light brown silty, slightly clayey Fine SAND										*					
B-9	15.0-16.5	Light gray and tan phosphatic, slightly silty Fine SAND										*					

W % = Water Content
Y_d (pcf) = Dry Density
G_S = Specific Gravity
LL = Liquid Limit
PL = Plastic Limit
SL = Shrinkage Limit
P.P. (tsf) = Pocket Penetrometer
U.C. = Unconfined Compression

Con. = Consolidation Test
G.S. (+1) = Grainsize Analysis (Hydrometer)
ORG. (%) = Organic Content
Cl. (ppm) = Total Chloride
SO_4 (ppm) = Total Sulfate
RES. (ohm-cm) = Lab Resistivity
* = See Test Curves
** = Percent Passing No. 200 Sieve

CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	DEPTH (ft)	DESCRIPTION	W %	Y_d (pcf)	G_s	ATTERBERG LIMITS			P.P. (tsf)	U.C.	CON.	G.S.	ORG. (%)	pH	Cl. (ppm)	SO_4 (ppm)	RES. (Ohm-cm)
						LL	PL	SL									
B-9	25.0-26.5	Greenish-gray clayey Fine SAND	27.8			41	19					** 23.8					
B-13	3.5-5.0	Dark brown slightly organic Fine SAND											3.0				
B-13	8.0-9.5	Light brown slightly silty Fine SAND										*					
B-13	12.0-13.5	Light brownish-gray and tan slightly silty Fine SAND										*					
DRI-1	1.5	Mottled brown silty Fine SAND										*					
DRI-2	2.5	Gray Fine SAND										*					

W % = Water Content
Y_d (pcf) = Dry Density
G_S = Specific Gravity
LL = Liquid Limit
PL = Plastic Limit
SL = Shrinkage Limit
P.P. (tsf) = Pocket Penetrometer
U.C. = Unconfined Compression

Con. = Consolidation Test
G.S. (+1) = Grainsize Analysis (Hydrometer)
ORG. (%) = Organic Content
Cl. (ppm) = Total Chloride
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RES. (ohm-cm) = Lab Resistivity
* = See Test Curves
** = Percent Passing No. 200 Sieve

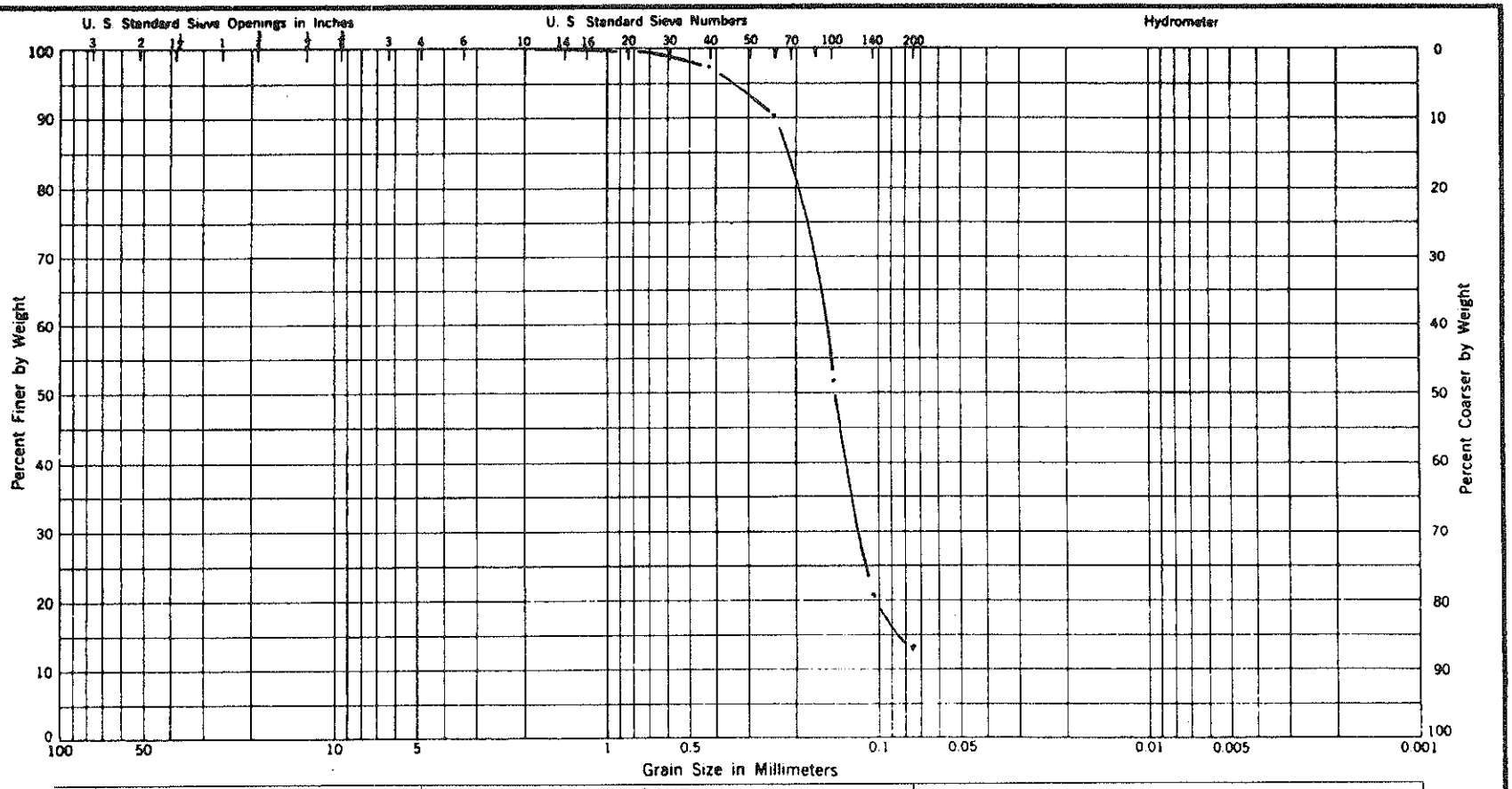
CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

GRAINSIZE ANALYSES

DRIGGERS ENGINEERING SERVICES, INC.



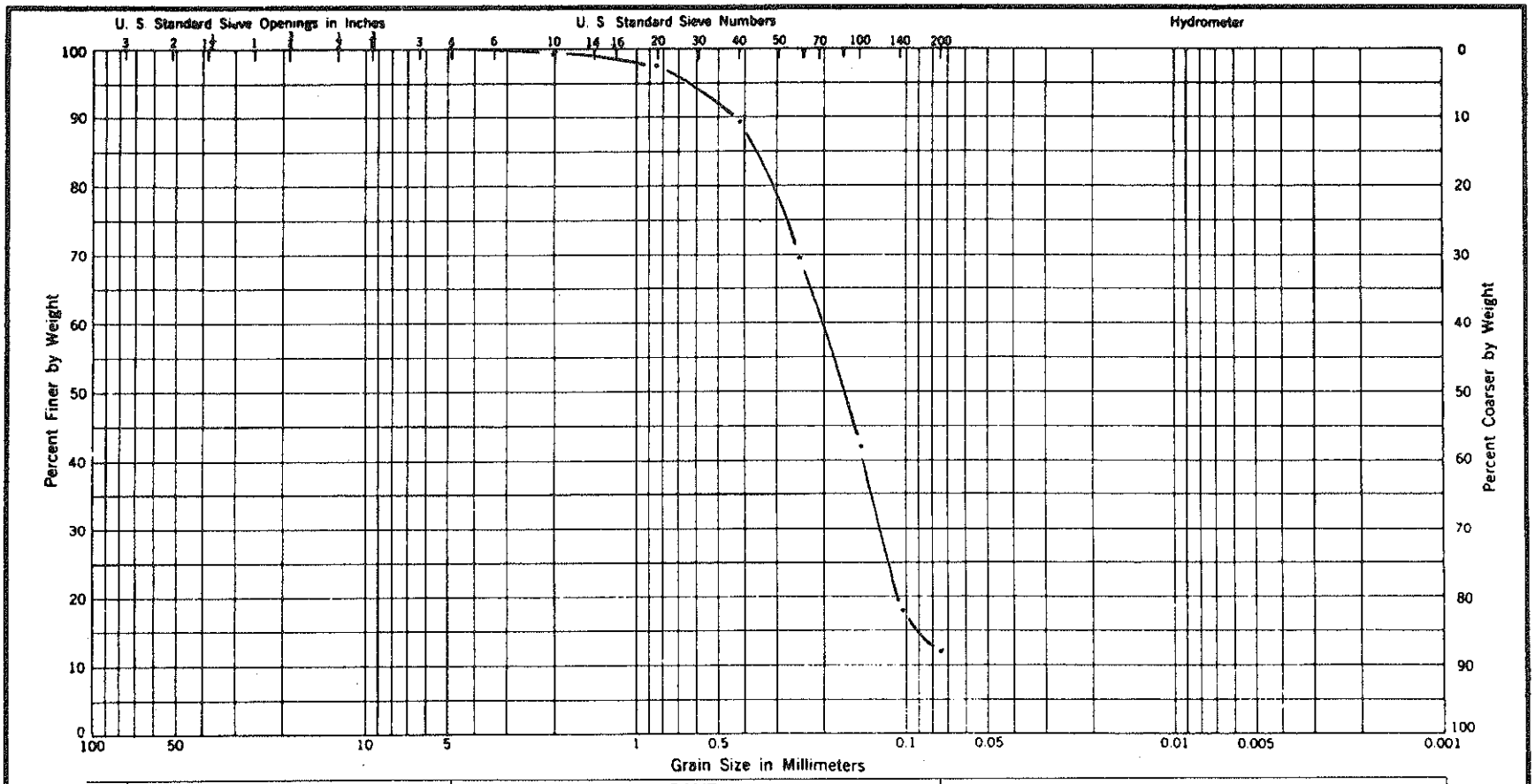
Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
B-1	8.0' - 9.5'					Light brown silty Fine SAND

CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

DRIGGERS ENGINEERING SERVICES, INC.



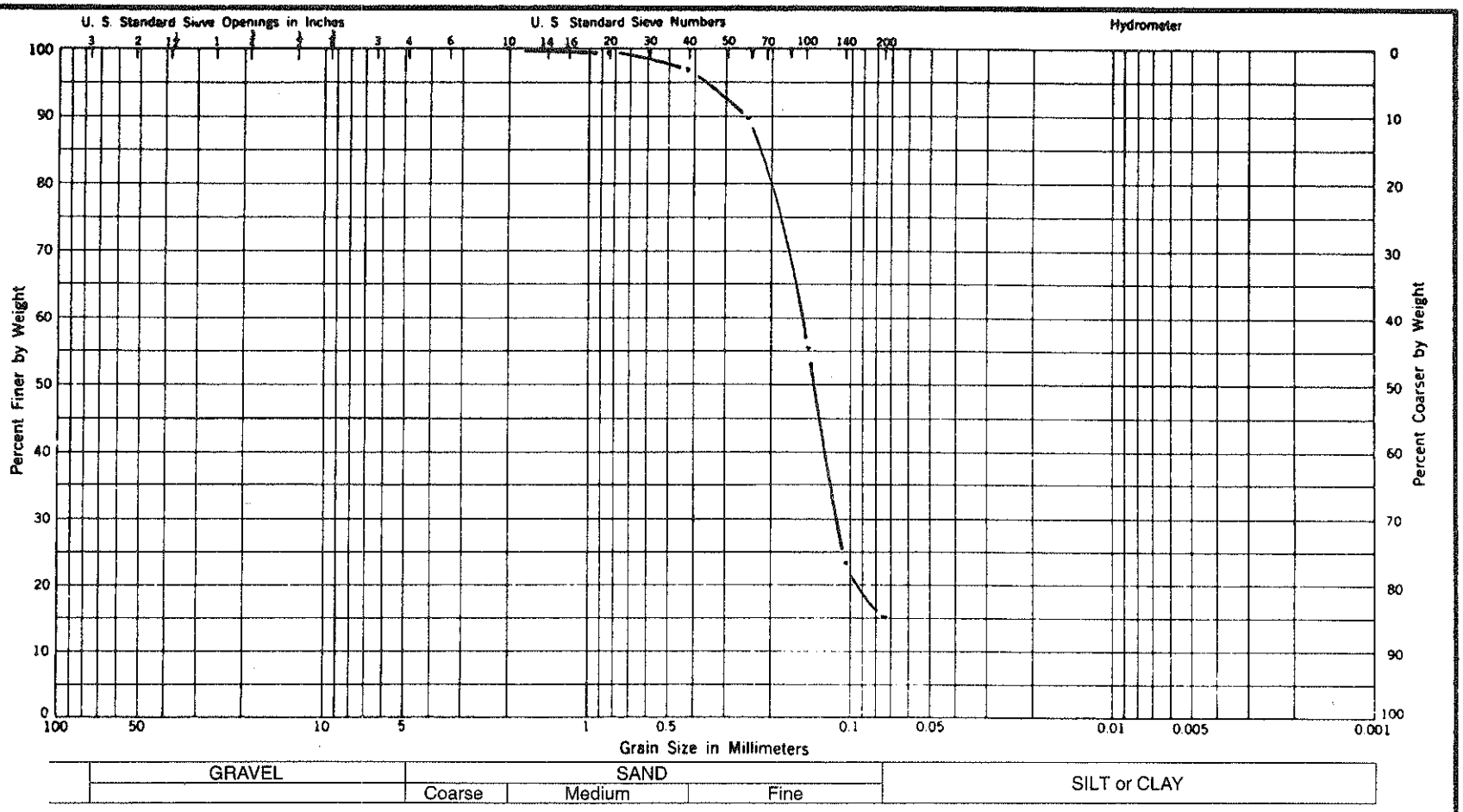
Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
B-1	12.0' - 13.5'					Light brownish-gray and tan silty Fine SAND

CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

DRIGGERS ENGINEERING SERVICES, INC.



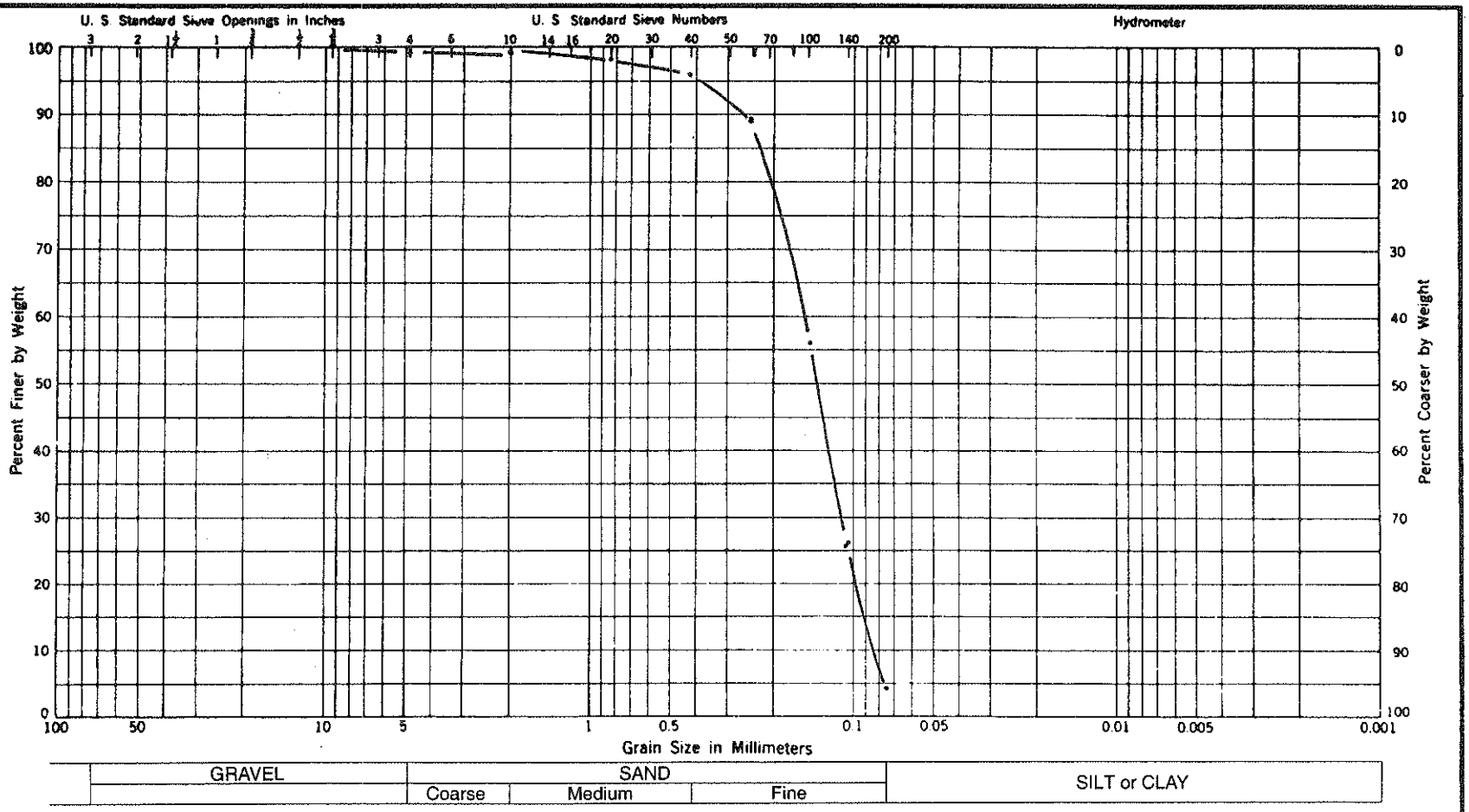
Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
B-2	6.0' - 7.5'					Light brown silty Fine SAND

CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

DRIGGERS ENGINEERING SERVICES, INC.



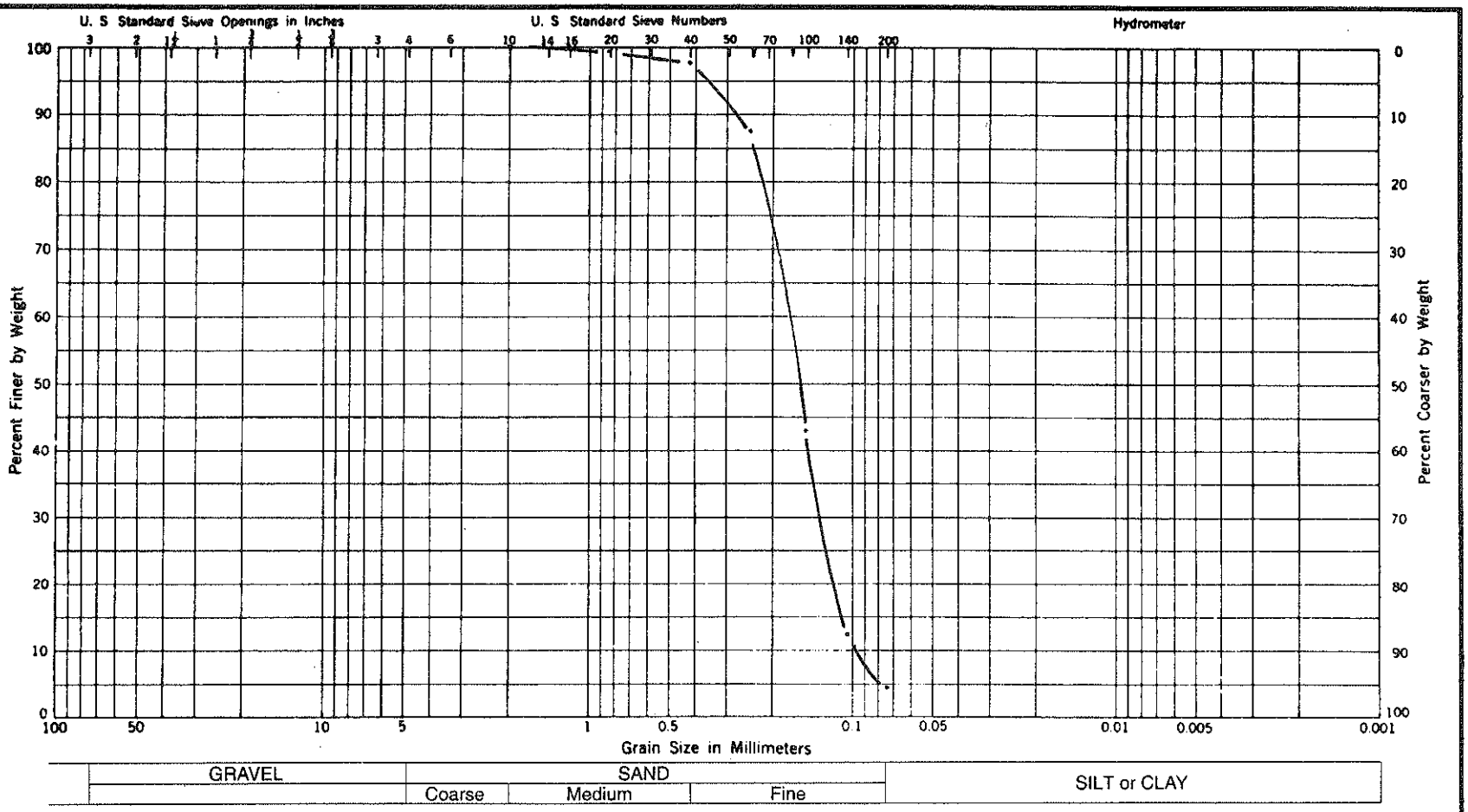
Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
B-2	10.0' - 11.5'					Very light brownish-gray Fine SAND

CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

DRIGGERS ENGINEERING SERVICES, INC.



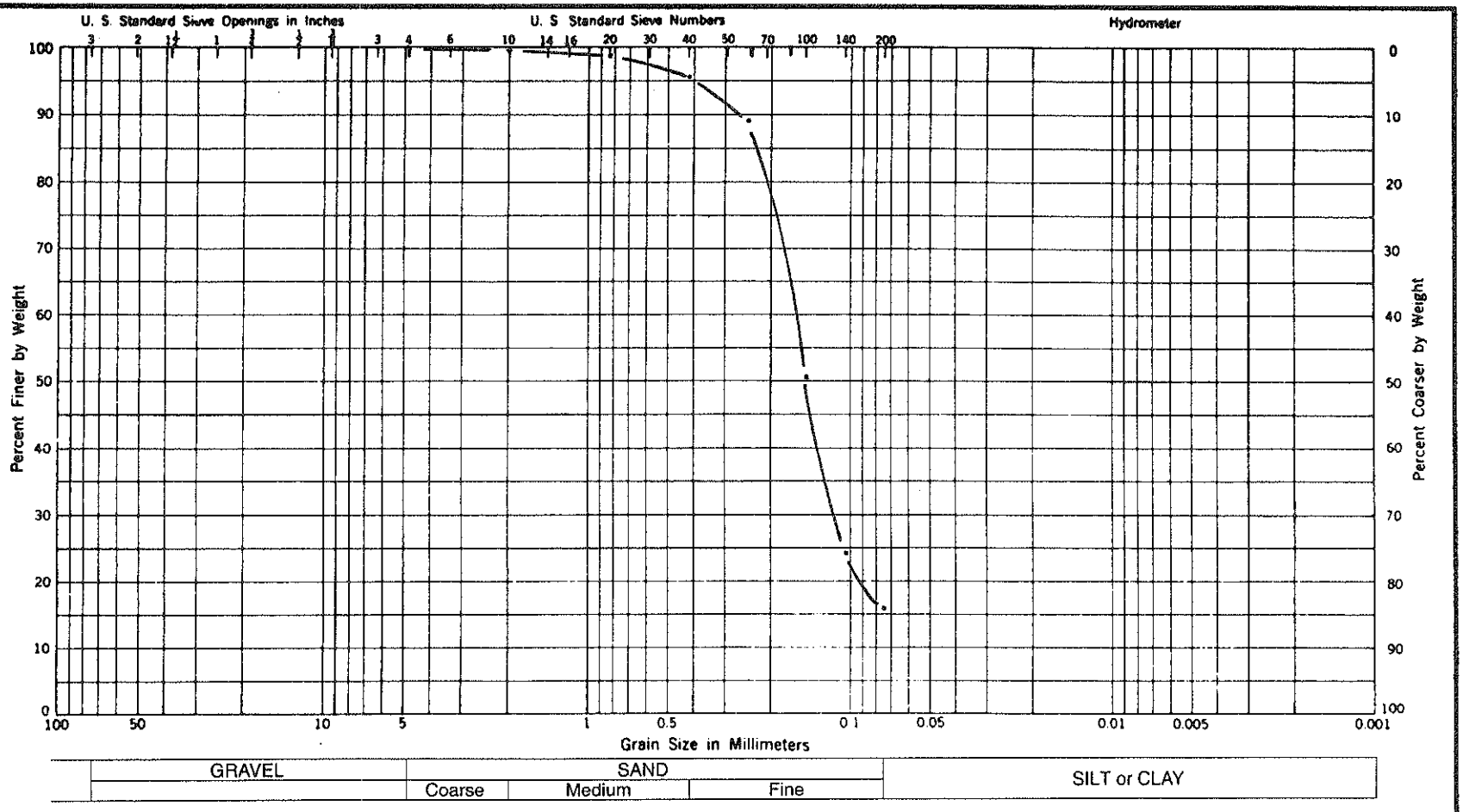
Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
B-3	1.3' - 4.0'					Dark gray Fine SAND

CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

DRIGGERS ENGINEERING SERVICES, INC.



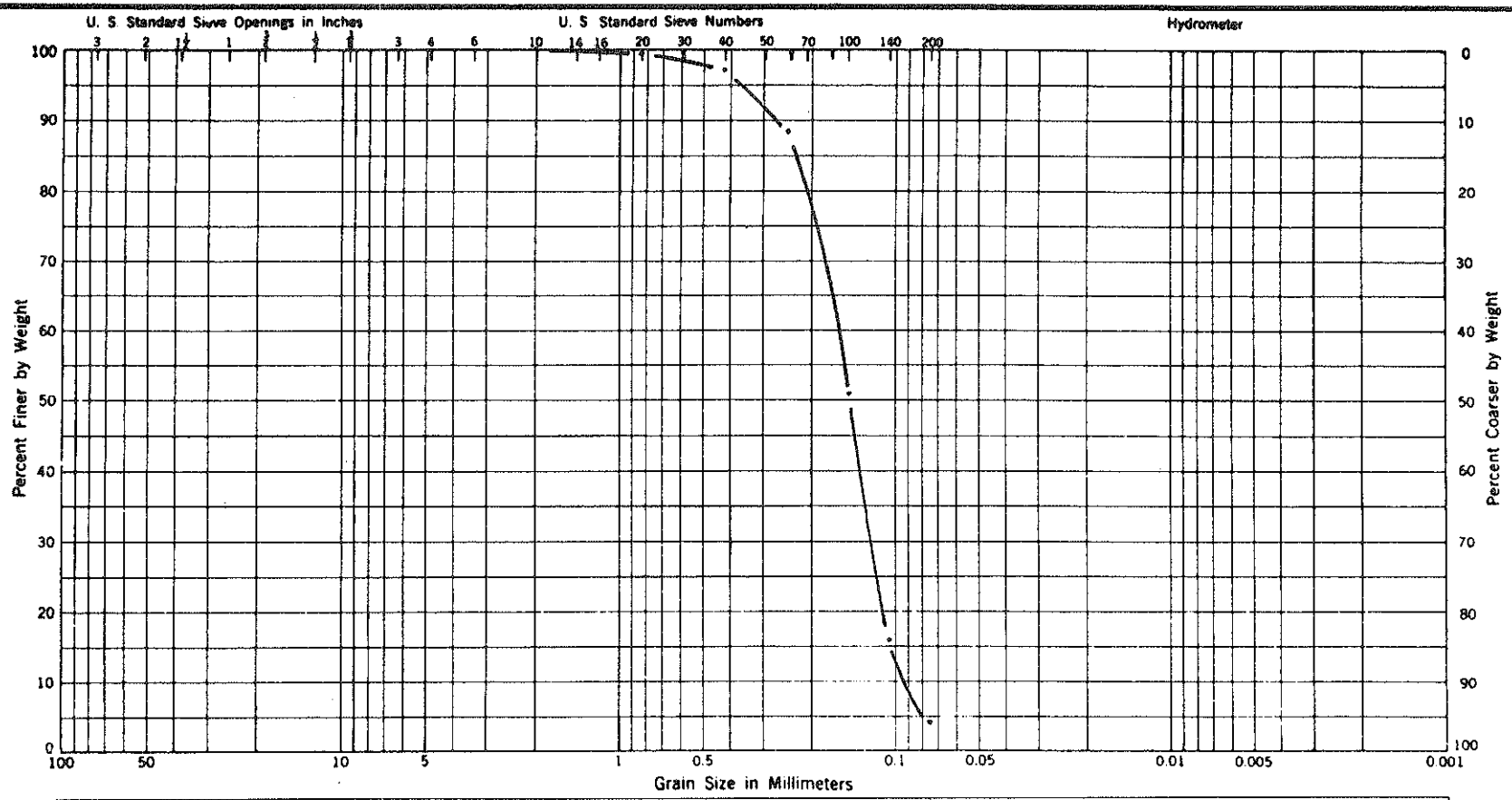
Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
B-3	8.0' - 9.5'					Light brownish-gray weakly cemented, silty Fine SAND

CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

DRIGGERS ENGINEERING SERVICES, INC.



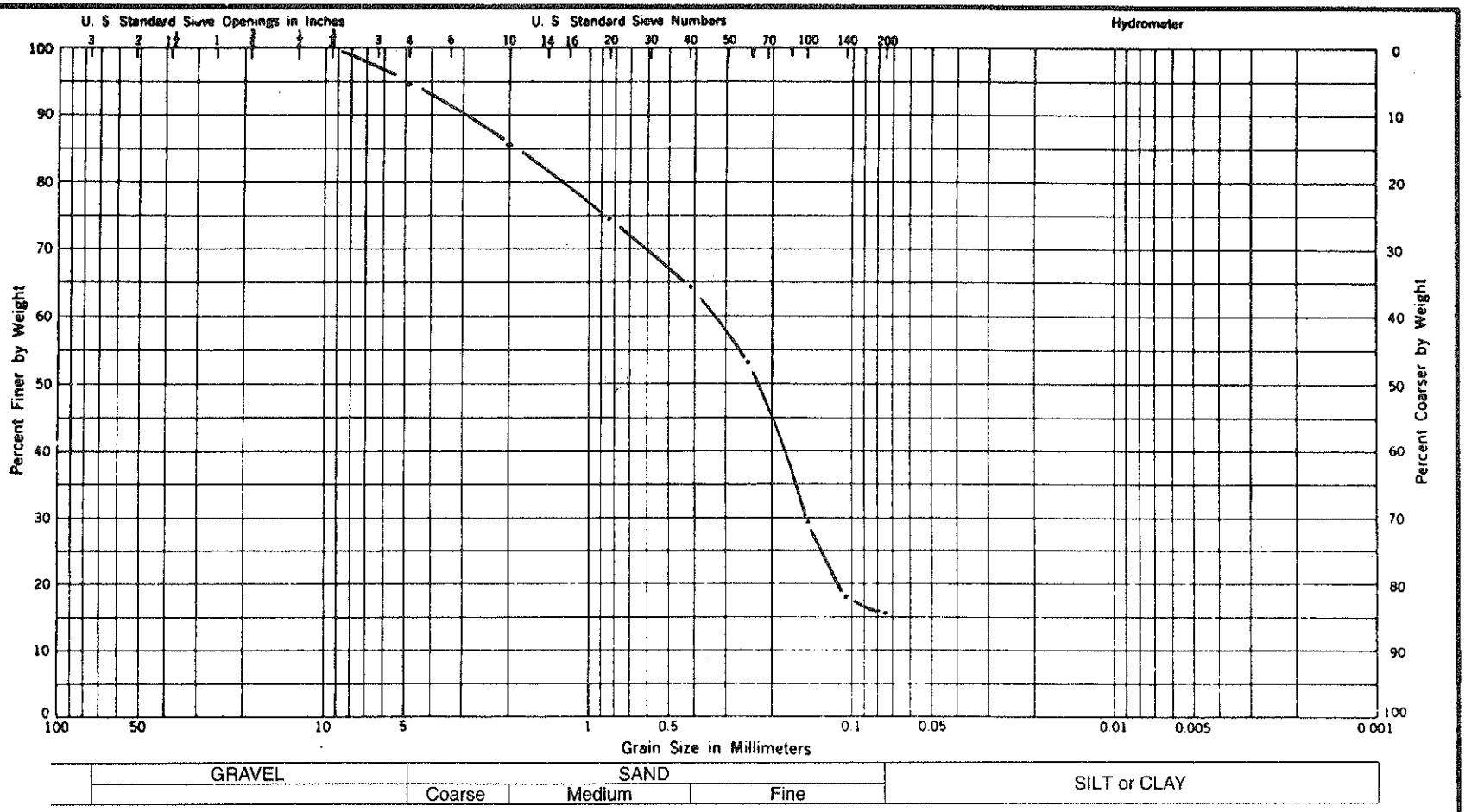
Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
B-6	6.0' - 7.5'					Light grayish-brown Fine SAND

CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

DRIGGERS ENGINEERING SERVICES, INC.



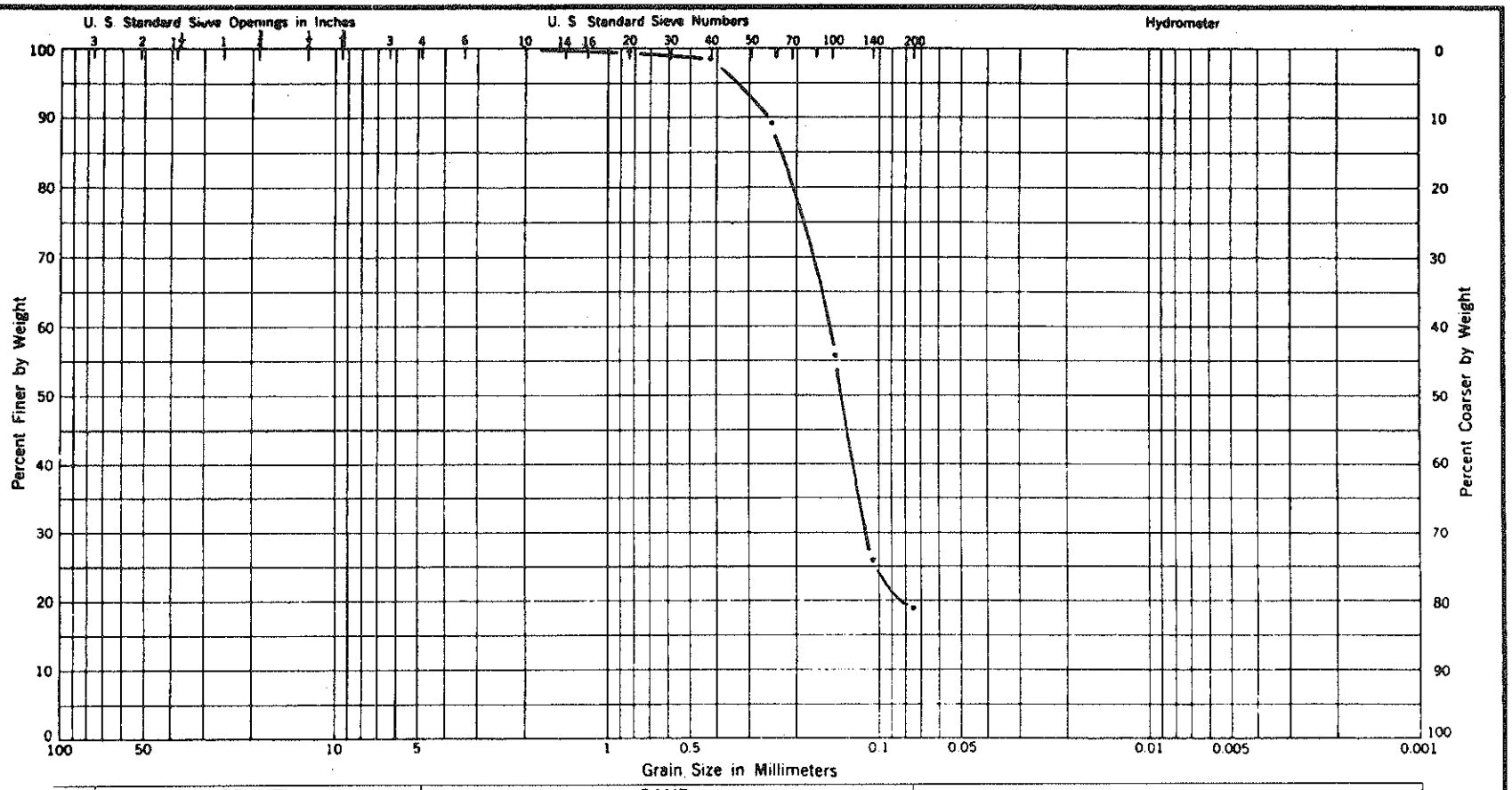
Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
B-7	20.0' - 21.5'					Gray phosphatic, silty Fine SAND

CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

DRIGGERS ENGINEERING SERVICES, INC.



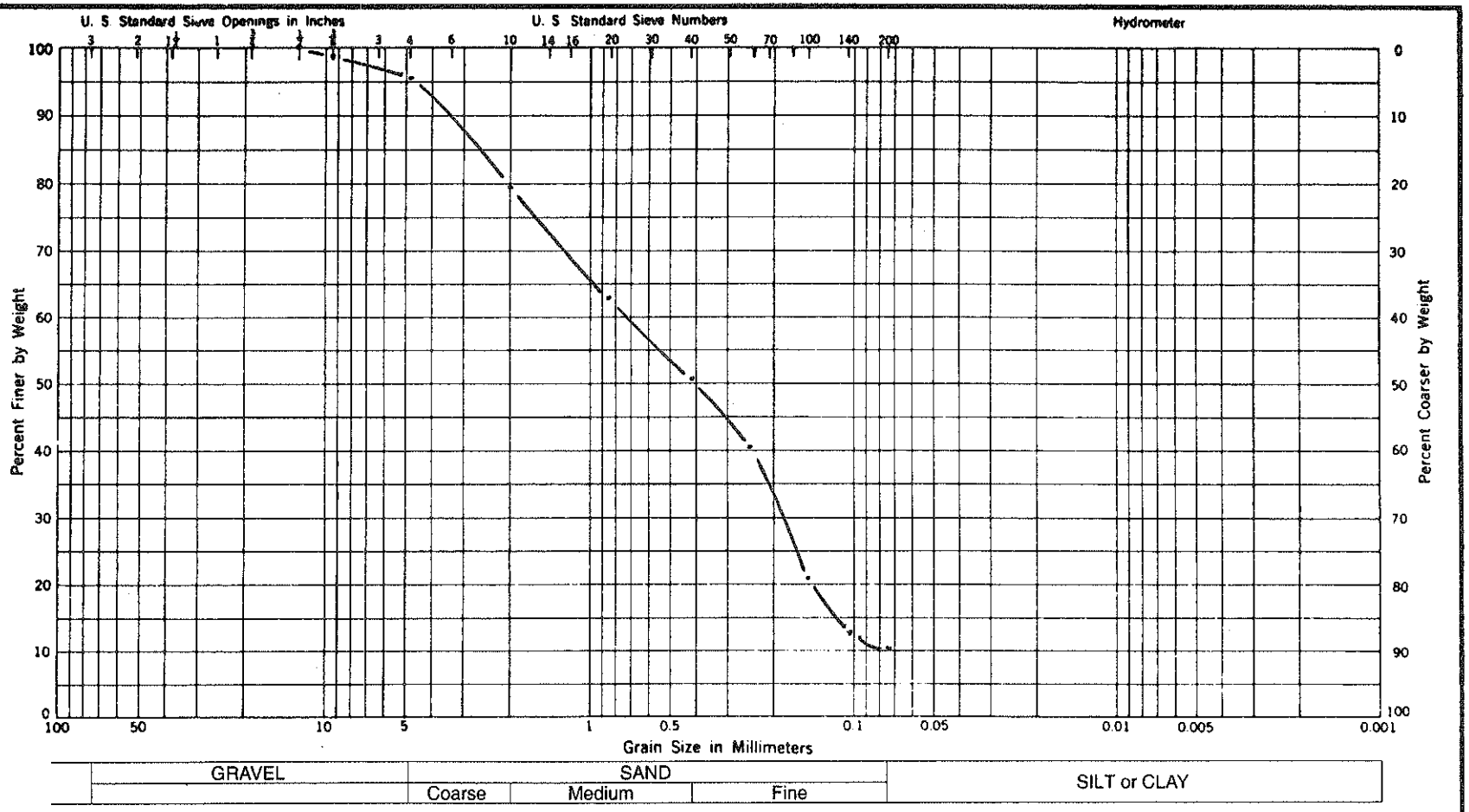
Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
B-8	6.0' - 7.5'					Light brown silty, slightly clayey Fine SAND

CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

DRIGGERS ENGINEERING SERVICES, INC.



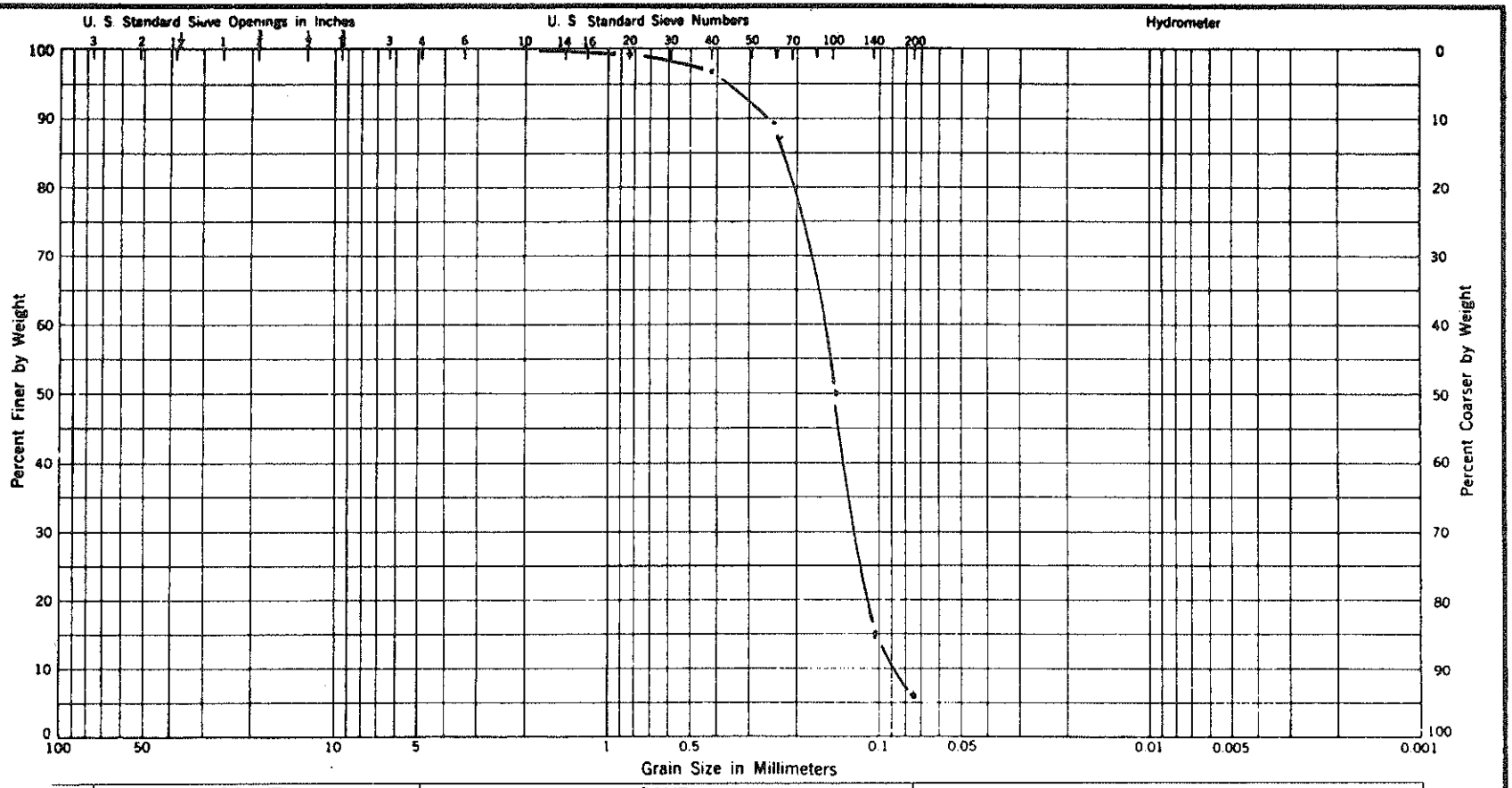
Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
B-9	15.0' - 16.5'					Light gray and tan phosphatic, slightly silty Fine SAND

CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

DRIGGERS ENGINEERING SERVICES, INC.



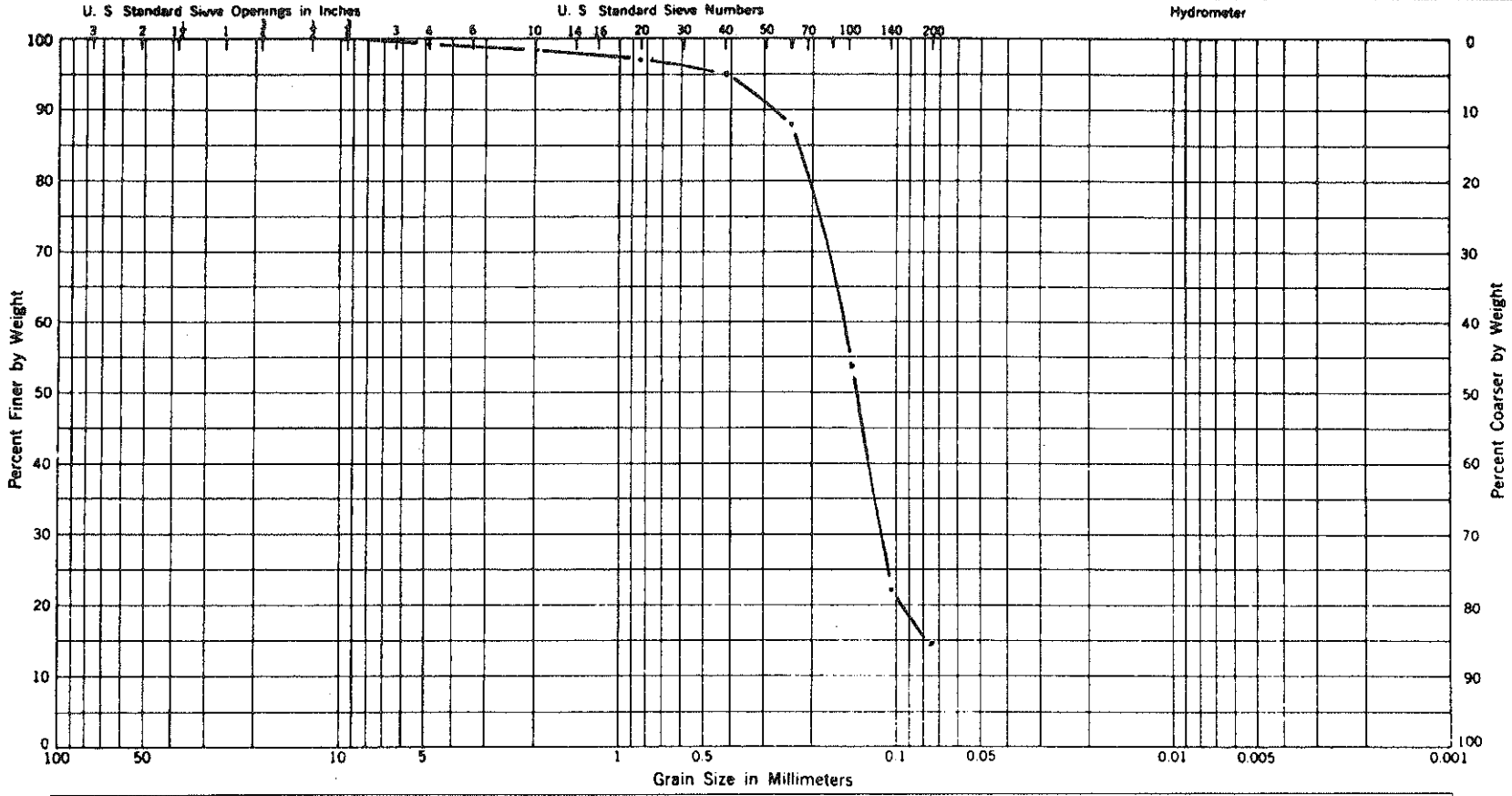
Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
B-13	8.0' - 9.5'					Light brown slightly silty Fine SAND

CLIENT: McKim & Creed

PROJECT: North water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

DRIGGERS ENGINEERING SERVICES, INC.



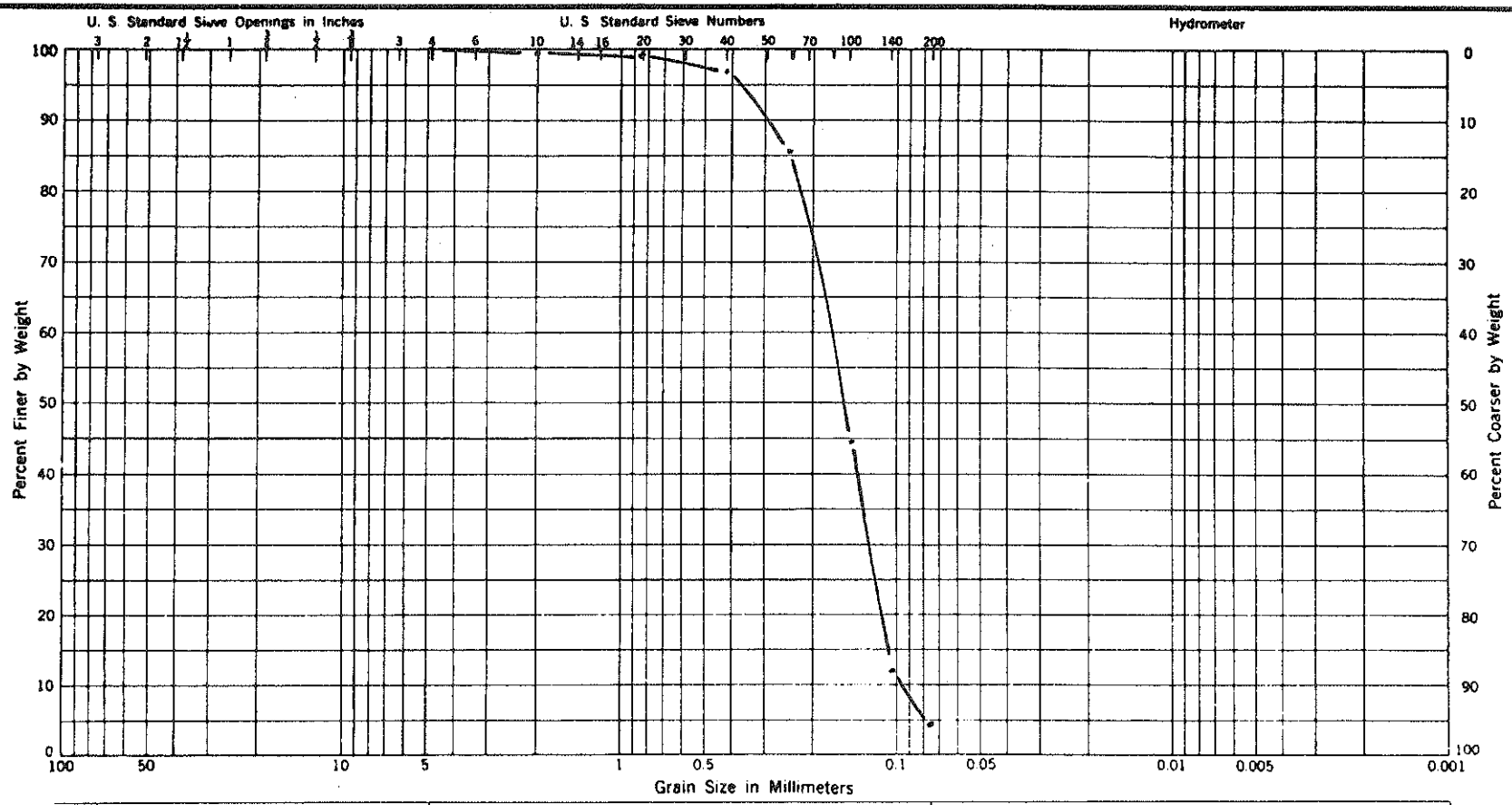
Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
DRI-1	1.5'					Mottled brown silty Fine SAND

CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

DRIGGERS ENGINEERING SERVICES, INC.



Number	Depth	Natural Moisture	L. L.	P. L.	P. I.	Classification
DRI-2	2.5'					Gray Fine SAND

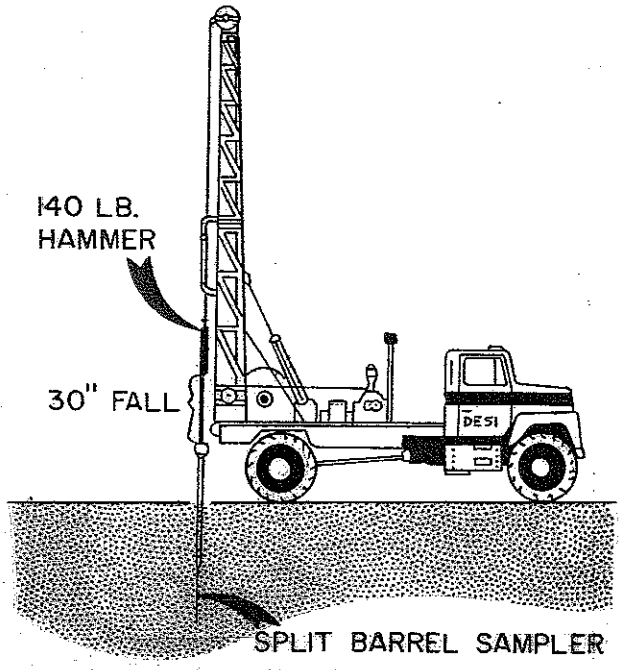
CLIENT: McKim & Creed

PROJECT: North Water Reclamation Facility, Manatee County, Florida

FILE: DES 086271

METHOD OF TESTING

STANDARD PENETRATION TEST
AND
SOIL CLASSIFICATION

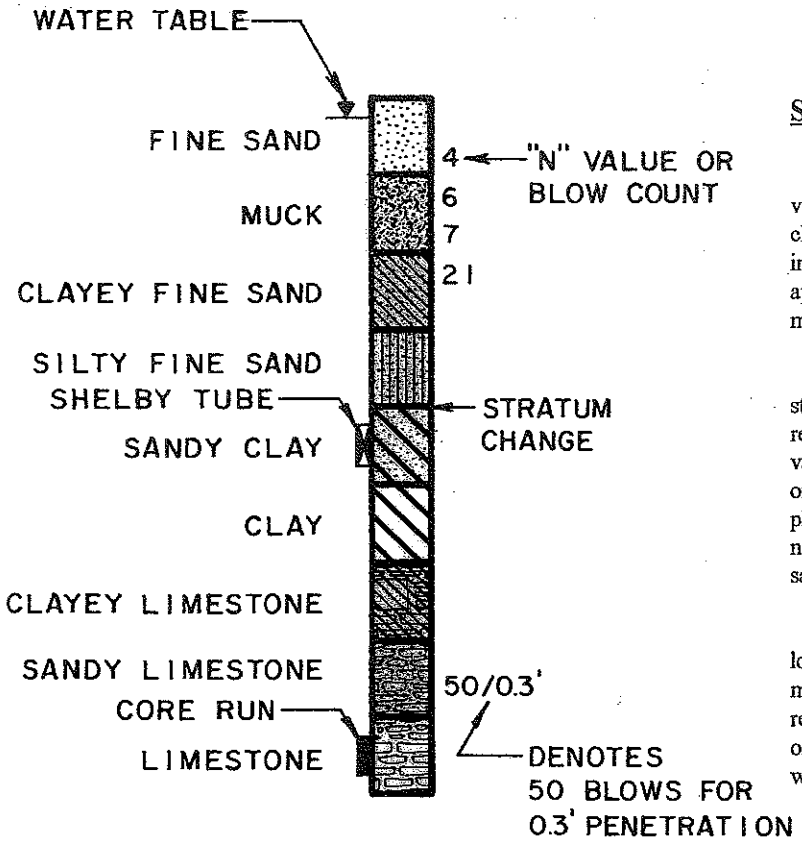


STANDARD PENETRATION TEST (ASTM D-1586)

In the Standard Penetration Test borings, a rotary drilling rig is used to advance the borehole to the desired test depth. A viscous drilling fluid is circulated through the drill rods and bit to stabilize the borehole and to assist in removal of soil and rock cuttings up and out of the borehole.

Upon reaching the desired test depth, the 2 inch O.D. split-barrel sampler or "split-spoon", as it is sometimes called, is attached to an N-size drill rod and lowered to the bottom of the borehole. A 140 pound hammer, attached to the drill string at the ground surface, is then used to drive the sampler into the formation. The hammer is successively raised and dropped for a distance of 30 inches using a rope and "cathead" assembly. The number of blows is recorded for each 6 inch interval of penetration or until virtual refusal is achieved. In the above manner, the samples are ideally advanced a total of 18 inches. The sum of the blows required to effect the final 12 inches of penetration is called the blowcount, penetration resistance of "N" value of the particular material at the sample depth.

After penetration, the rods and sampler are retracted to the ground surface where the core sample is removed, sealed in a glass jar and transported to the laboratory for verification of field classification and storage.



SOIL SYMBOLS AND CLASSIFICATION

Soil and rock samples secured in the field sampling operation were visually classified as to texture, color and consistency. Soil classifications are presented descriptively and symbolically for ease of interpretation. The stratum identification lines represent the approximate boundary between soil types. In many cases, this transition may be gradual.

Consistency of the soil as to relative density or undrained shear strength, unless otherwise noted, is based upon Standard Penetration resistance values of "N" values and industry-accepted standards. "N" values, or blowcounts, are presented in both tabular and graphical form on each respective boring log at each sample interval. The graphical plot of blowcount versus depth is for illustration purposes only and does not warrant continuity in soil consistency or linear variation between sample intervals.

The borings represent subsurface conditions at respective boring locations and sample intervals only. Variations in subsurface conditions may occur between boring locations. Groundwater depths shown represent water depths at the dates and time shown only. The absence of water table information does not necessarily imply that groundwater was not encountered.

Florida Department of Environmental Protection

Southwest District Office
13051 North Telecom Parkway
Temple Terrace, Florida 33637-0926

Rick Scott
Governor

Jennifer Carroll
Lt. Governor

Herschel T. Vinyard Jr.
Secretary

JUN 27 2011

McKim & Creed

JUN - 2011

RECEIVED

Manatee County Utilities Department
c/o Mr. Daniel T. Gray, Director
4410 66th Street
Bradenton, FL 34210

Dear Mr. Gray:

Enclosed is the Environmental Resource Permit, DEP Project No.: 41-0288451-002 issued pursuant to Part IV of Chapter 373, Florida Statutes, and Title 62, Florida Administrative Code.

Appeal rights for you and for any affected third party are described in the text of the permit along with conditions that must be met when authorized activities are undertaken.

You, as the applicant, are responsible for all aspects of permit compliance. You should therefore review this permit document carefully to ensure compliance with the general conditions, and specific conditions contained herein.

Please be aware of permit specific condition number 3 which states:

> Subsequent to the selection of the contractor to perform the authorized activity and prior to the initiation of work authorized by this permit, the permittee (or authorized agent) and the contractor shall schedule and attend a pre-construction conference with a representative of the Department's Environmental Resource Management staff.

If you have any questions about this document, please contact me at (813) 632-7600, ext. 393.

Thank you for your participation in the permit process and in managing the natural resources of the State of Florida.

Sincerely yours,

R. Douglas Hyman

R. Douglas Hyman, P.E.
Environmental Resource Permitting

Enc: Environmental Resource Permit with attachments (44 pages)

Florida Department of Environmental Protection

Southwest District Office
13051 North Telecom Parkway
Temple Terrace, Florida 33637-0926

Permittee/Authorized Entity:
Manatee County Utilities Department
C/o Mr. Daniel T. Gray, Director
4410 66th Street
Bradenton, FL 34210

North Water Reclamation Facility Expansion

Authorized Agent:
Mr. Phillip J. Locke, P.E., Senior Project Manager
McKim & Creed, P.A.
1365 Hamlet Avenue
Clearwater, FL 33756

Standard General
Environmental Resource Permit
State-owned Submerged Lands Authorization – Granted

U.S. Army Corps of Engineers Authorization – Separate Corps Authorization Required

Permit No.: 41-0288451-002

Permit Issuance Date: JUN 27 2011
Permit Construction Phase Expiration Date: JUN 27 2016

Florida Department of Environmental Protection
Southwest District Office
13051 North Telecom Parkway
Temple Terrace, Florida 33637-0926

Rick Scott
Governor

Jennifer Carroll
Lt. Governor

Herschel T. Vinyard Jr.
Secretary

Standard General Environmental Resource Permit

Permittee: Manatee County Utilities
Permit No: 41-0288451-002
Permit Issuance Date: JUN 27 2011
Permit Construction Phase Expiration Date: JUN 27 2016

AUTHORIZATIONS

Project Description
The permittee is authorized to construct a stormwater management system (SWMS) in two phases in order to provide stormwater runoff pre-treatment and discharge rate attenuation for a total contributing area of approximately 19.49 acres including 1.81 acres of impervious surfaces for the 26.37-acre Manatee County North Water Reclamation Facility expansion project.

Phases I and II may be done concurrently with one another or independently. The activities authorized by this permit shall occur within three drainage basins spanning the 26.37-acre expansion project including approximately 2.8 acres of impervious surfaces and will consist of the construction of an aeration/anoxic basin, disk filter system, electrical building, pump station, reject storage tanks, plant drain pump station, yard piping, effluent pump station, a lake filter concrete pad, asphalt pavement, and all related appurtenances.

Phase I shall consist of the construction of a filter pad and dry treatment swale within a 0.13-acre project area which will be encompassed within 2.91-acre drainage basin W-1. The remaining 2.78 acres of project area within W-1 will be included in Phase II and will not require an associated SWMS since there will be a net reduction in impervious surfaces and no significant changes to existing runoff patterns. Runoff will continue to sheet flow to a system of drainage swales, including one proposed swale, and flow into existing inlets from whence stormwater will be delivered to a system of wetlands located along the western edge of the reclamation facility.

The remainder of Phase II shall be located in 1.57-acre drainage basin R-1, and in 21.89-acre drainage basin D-1.

In drainage basin R-1, surface water management shall include the construction within the footprint of a reject pond that will be decommissioned of new dry retention pond R-1. Pond R-1 will be fitted with a skimmer-equipped broad-crested weir and discharge through an existing swale system to the wetland system noted above.

Since there will be 4.09 acres of open tanks in drainage basin D-1, only 17.8 acres will contribute runoff to pond D-1. The SWMS shall consist of the alteration of existing wet detention pond D-1 which will be retrofitted with new intake and discharge structures and discharge through a new skimmer-equipped control structure, with effluent directed to an existing swale system that drains ultimately into the Buffalo Canal System north of the project area.

In addition to the Phase I and II activities, a temporary sediment holding area will be constructed in order to treat storm water runoff from a temporary construction demolition debris (C& DD) stockpile. As noted above, the existing reject pond will be decommissioned. Dewatered surface water will be piped into a domestic waste collection system, and ground water conveyed to Pond D-1.

No impacts to wetlands or other surface waters are proposed or authorized. The project is not in the 100-year flood plain.

The project described above may be conducted only in accordance with the terms, conditions and attachments contained in this permit. The issuance of this permit does not infer, nor guarantee, nor imply that future permits or modifications will be granted by the Department.

Federal Authorization
A copy of this permit has been sent to the U.S. Army Corps of Engineers (USACE). The USACE may require a separate permit. Failure to obtain any required federal permits prior to construction could subject you to enforcement action by that agency.

Coastal Zone Management
This permit also constitutes a finding of consistency with Florida's Coastal Zone Management Program, as required by Section 307 of the Coastal Management Act.

Water Quality Certification
This permit constitutes certification of compliance with state water quality standards under Section 401 of the Clean Water Act, 33 U.S.C. 1341.

Other Authorizations
You are advised that authorizations or permits for this project may be required by other federal, state or local entities. This permit does not relieve you from the requirements to obtain all other required permits or authorizations.

PROJECT LOCATION
The project is located at the Manatee County North Water Reclamation Facility at 8100 E. 69th St., Palmetto, Section 26, Township 33 South, Range 18 East, in Manatee County at latitude 27°, 35', 30" North, longitude 82°, 28', 40" West.

PERMIT
The activities described herein must be conducted in accordance with:
The Specific Conditions
The General Conditions
The limits, conditions and locations of work shown in the attached drawings
The term limits of this authorization

You are advised to read and understand these conditions and drawings prior to commencing the authorized activities, and to ensure the work is conducted in conformance with all the terms, conditions, and drawings. If you are utilizing a contractor, the contractor also should read and understand these conditions and drawings prior to commencing the authorized activities. Failure to comply with these conditions shall constitute grounds for revocation of the permit and appropriate enforcement action by the Department.

Operation of the facility is not authorized except when determined to be in conformance with all applicable rules and this permit as specifically described above.

SPECIFIC CONDITIONS:

1. Submittals required herein (e.g., progress reports, record drawings, etc.) shall be directed to:
   Department of Environmental Protection
   Environmental Resource Management Program
   Southwest District
   13051 North Telecom Parkway
   Temple Terrace, FL 33637-0926

   Submittals shall include the permittee's name and permit number 41-0288451-002.

2. Progress reports for the project shall be submitted to the Department beginning: October 1, 2011, and shall continue to be submitted biannually until construction of the permitted project is completed. The cover page shall indicate the permit number, project name and the permittee name. Progress reports must be submitted to the Department, even if there is no ongoing construction. Reports shall include the current project status and construction schedule for the following six months. The report shall include the following information:

   a. Date permitted activity was begun; if work has not begun on-site, please indicate.

   b. Brief description and extent of the work i.e., (construction, maintenance, excavation, dewatering, stockpiling) completed since the previous report

or since the permit was issued. Show on copies of the permit drawings those areas where work has been completed.

c. Brief description and extent of the work i.e., (construction, maintenance, excavation, dewatering, stockpiling) anticipated in the next six months. Indicate on copies of the permit drawings those areas where it is anticipated that work will be done.

d. This report shall include on the first page, just below the title, the certification of the following statement by the individual who supervised preparation of the report: "This report represents a true and accurate description of the activities conducted during the six month period covered by this report."

PRE-CONSTRUCTION CONDITIONS: (The permittee shall comply with the following conditions prior to commencement of construction.)

3. Subsequent to the selection of the contractor to perform the authorized activity and within 14 days prior to the initiation of work authorized by this permit, the permittee (or authorized agent) and the contractor shall schedule and attend a pre-construction conference with a representative of the Department's Environmental Resource Management staff. A copy of the Industrial Waste (IW) permit determination for the dewatering of produced groundwater shall be provided at the pre-construction conference and prior to construction activities.

4. Prior to construction and prior to dewatering of produced groundwater from within the reject pond for disposal into the D-1 pond, and no less than thirty days prior to the pre-construction conference, the permittee shall submit a final dewatering plan based on the *Suggested Dewatering Plan For Reject Pond Excavation* Drawing C-0.2.4 dated March 3, 2011, for Department review and approval.

EROSION CONTROL CONDITIONS:

5. Erosion control methods shall be implemented as depicted in C-0.2.2 (both the 11-24-10 and the 4-11-11 versions), C-0.2.3, C-0.3.2, C-0.3.3, C-0.3.4, C-0.3.5, C-0.3.6, G-0.2, G-0.3, G-0.5, D-0.1 C-0.3.11, of the attached permit drawings. Turbidity/erosion controls shall be installed prior to clearing, demolition, excavation or placement of fill material, and shall be maintained until construction is completed.

6. The permittee shall install and maintain grass seed or sod on exposed slopes and disturbed soil areas within 48 hours of completing final grade, and at other times as necessary, to prevent erosion, sedimentation or turbid discharges into waters of the state and/or adjacent wetlands. A vegetative cover that stabilizes and prevents erosion of the fill material shall be established within 60 days of sodding or seeding. If a substantial

vegetative cover cannot be achieved, the permittee shall submit an alternative ground cover plan for approval by the Department. Turbidity barriers/erosion control devices shall be removed upon establishment of a substantial vegetative/alternative cover.

7. Prior to demolition of existing structures, the permittee shall provide clear color photographs showing that the temporary SWMS for the C& DD stockpile area has been completed as shown on C-0.2.3 of the attached permit drawings.

CONSTRUCTION ACTIVITIES

8. Storage or stockpiling of tools and materials within wetlands, or other surface waters is prohibited.

9. Excavation of the wet detention pond, dry detention ponds and swales shall be limited to the permitted design specifications as depicted on Drawing Nos. C-0.1.1, C-0.3.10, C-0.3.11 & Figure 6d of the attached project drawings. If a clay confining layer or limestone bedrock is encountered during excavation, construction in the affected area shall cease. Prior to proceeding with construction the permittee must submit a design revision to the Department for review and approval that will demonstrate compliance with Rule 6.4.1.b. of the Southwest Florida Water Management District Environmental Resource Permitting Information Manual, Part B, Basis of Review (B.O.R.).

10. Reject pond sediments and muck shall be disposed of in an upland disposal location.

11. The authorized stormwater management system shall be completed prior to or simultaneously with associated upland development. Occupation and utilization of the site shall be in accordance with General Condition 12.

PHASE I & II CONSTRUCTION COMPLETION ACTIVITIES: (The permittee shall comply with the following conditions prior to operation.)

12. The permittee shall submit two copies of signed, dated and sealed as-built drawings to the Department for review and approval within 30 days of completion of construction. The as-built drawings shall be based on the Department permitted construction drawings, which should be revised to reflect changes made during construction. Both the original design and constructed elevation must be clearly shown. The plans must be clearly labeled as "as-built" or "record" drawings. Surveyed dimensions and elevations required shall be verified and signed, dated and sealed by a Florida registered surveyor or engineer. *As-builts shall be submitted to the Department regardless of whether or not deviations are present. In addition to the "As-built Certification" form, the permittee shall submit the "Request for Transfer of Environmental Resource Permit Construction Phase to Operation Phase" form as required in General Condition #13.*

The following information shall be verified on the as-built drawings from the engineering drawings signed and sealed by Travis N. Terpstra, P.E. #71412 on April 08 & April 15, 2011:

Plan View/Cross-Section	Drawing Number
Proposed Drainage Map - North	Figure 6a
Proposed Site Plan - South	Figure 6b
Proposed Drainage Map W-1s, Filter Sub-basin in Detail	Figure 6C
Grading and Drainage Plan	C-0.1.1

The following information shall be verified on the as-built drawings from the engineering drawings signed and sealed by Travis N. Terpstra, P.E. #71412 on February 10, 2011:

Plan View/Cross-Section	Drawing Number
Paving, Grading and Drainage Plan	C-0.3.5
Stormwater Pond Details	C-0.3.10
Stormwater Pond Details	C-0.3.11

The following information shall be verified on the as-built drawings from the engineering drawings signed and sealed by Travis N. Terpstra, P.E. #71412 on November 24, 2010:

Plan View/Cross-Section	Drawing Number
Proposed Site Plan - North	C-0.2.0
Paving, Grading and Drainage Plan No. 6	C-0.3.6
Paving, Grading and Drainage Plan No. 7	C-0.3.7

13. Should the permittee construct and complete Phase I in advance of Phase II, a request to transfer Phase I to operations may be submitted along with the following as-built: Figure 6C, C-0.1.1 and the "*As-built Certification" form* 62-343.900(5), F.A.C.

14. The permittee shall remove and properly dispose of the temporary demolition stockpile within 30 days of the completion of demolition activities, restore the area to final grade and install and maintain grass seed or sod on disturbed soil areas within 48 hours of completing final grade.

OPERATION CONDITIONS: (The permittee shall comply with the following conditions for the life of the facility.)

15. The Operation and Maintenance Entity shall submit inspection reports in the form required by the Department, FDEP Form# 62-343.900(6), *Inspection Certification* beginning 12 months after operation is authorized and every 18 months thereafter.

16. The maintenance of the surface water management system shall be in accordance with, "Operation and Maintenance Instructions for the Manatee County North Water

Reclamation Facility Surface Water Management System". It is the responsibility of the permittee to ensure that that the surface water management system is functioning as designed.

17. The permittee shall notify the Department of any sinkhole development in the surface water management system within 24 hours after discovery, and must submit a detailed sinkhole evaluation and repair plan for approval by the Department within 30 days of discovery.

18. The permitted surface water management system shall only be used for the purpose of controlling surface water runoff from the site, and shall not be used to dispose of or store any solid/liquid waste or products generated or used during operation or construction of the facility.

END OF SPECIFIC CONDITIONS

GENERAL CONDITIONS:

1. All activities shall be implemented as set forth in the plans, specifications and performance criteria as approved by this permit. Any deviation from the permitted activity and the conditions for undertaking that activity shall constitute a violation of this permit.

2. This permit or a copy thereof, complete with all conditions, attachments, exhibits, and modifications, shall be kept at the work site of the permitted activity. The complete permit shall be available for review at the work site upon request by Department staff. The permittee shall require the contractor to review the complete permit prior to commencement of the activity authorized by this permit.

3. Activities approved by this permit shall be conducted in a manner which does not cause violations of state water quality standards. The permittee shall implement best management practices for erosion and pollution control to prevent violation of state water quality standards. Temporary erosion control shall be implemented prior to and during construction and permanent control measures shall be completed within seven days of any construction activity. Turbidity barriers shall be installed and maintained at all locations where the possibility of transferring suspended solids into the receiving waterbody exists due to the permitted work. Turbidity barriers shall remain in place at all locations until construction is completed and soils are stabilized and vegetation has been established. Thereafter the permittee shall be responsible for the removal of the barriers. The permittee shall correct any erosion or shoaling that causes adverse impacts to the water resources.

4. Water quality data for the water discharged from the permittee's property or into the surface waters of the state shall be submitted to the Department as required by the permit. Analyses shall be performed according to procedures outlined in the current edition of Standard Methods for the Examination of Water and Wastewater by the American Public Health Association or Methods for Chemical Analyses of Water and Wastes by the U.S. Environmental Protection Agency. If water quality data are required, the permittee shall provide data as required on volumes of water discharged, including total volume discharged during the days of sampling and total monthly volume discharged from the property or into surface waters of the state.

5. Department staff must be notified in advance of any proposed construction dewatering. If the dewatering activity is likely to result in offsite discharge or sediment transport into wetlands or surface waters, a written dewatering plan must either have been submitted and approved with the permit application or submitted to the Department as a permit prior to the dewatering event as a permit modification. The permittee is advised that the rules of the Southwest Florida Water Management District state that a water use permit may be required prior to any use exceeding the thresholds in Chapter 40D-2, F.A.C.

6. Stabilization measures shall be initiated for erosion and sediment control on disturbed areas as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than seven days after the construction activity in that portion of the site has temporarily or permanently ceased.

7. Off site discharges during construction and development shall be made only through the facilities authorized by this permit. Water discharged from the project shall be through structures having a mechanism suitable for regulating upstream stages. Stages may be subject to operation schedules satisfactory to the Department.

8. The permittee shall complete construction of all aspects of the surface water management system, including wetland compensation (grading mulching, planting), water quality treatment features, and discharge control facilities prior to beneficial occupancy or use of the development being served by this system.

9. The following shall be properly abandoned and/or removed in accordance with the applicable regulations:

   a. Any existing wells in the path of construction shall be properly plugged and abandoned by a licensed well contractor.

   b. Any existing septic tanks on site shall be abandoned at the beginning of construction.

   c. Any existing fuel storage tanks and fuel pumps shall be removed at the beginning of construction.

10. All surface water management systems shall be operated to conserve water in order to maintain environmental quality and resource protection; to increase the efficiency of transport, application and use; to decrease waste; to minimize unnatural runoff from the property and to minimize dewatering of offsite property.

11. At least 48 hours prior to commencement of activity authorized by this permit, the permittee shall submit to the Department a written notification of commencement using an "Environmental Resource Permit Construction Commencement" notice (Form No. 62-343.900(3), F.A.C.) indicating the actual start date and the expected completion date.

12. Each phase or independent portion of the permitted system must be completed in accordance with the permitted plans and permit conditions prior to the occupation of the site or operation of site infrastructure located within the area served by that portion or phase of the system. Each phase or independent portion of the system must be completed in accordance with the permitted plans and permit conditions prior to transfer of responsibility for operation and maintenance of that phase or portion of the system to a local government or other responsible entity.

13. Within 30 days after completion of construction of the permitted activity, the permittee shall submit a written statement of completion and certification by a registered professional engineer or other appropriate individual as authorized by law, utilizing the required "Environmental Resource Permit As-Built Certification by a Registered Professional" (Form No. 62-343.900(5), F.A.C.), and "Request for Transfer of Environmental Resource Permit Construction Phase to Operation Phase" (Form 62-343-900(7), F.A.C.). Additionally, if deviations from the approved drawings are discovered during the certification process the certification must be accompanied by a copy of the approved permit drawings with deviations noted.

14. This permit is valid only for the specific processes, operations and designs indicated on the approved drawings or exhibits submitted in support of the permit application. Any substantial deviation from the approved drawings, exhibits, specifications or permit conditions, including construction within the total land area but outside the approved project area(s), may constitute grounds for revocation or enforcement action by the Department, unless a modification has been applied for and approved. Examples of substantial deviations include excavation of ponds, ditches or sump areas deeper than shown on the approved plans.

15. The operation phase of this permit shall not become effective until the permittee has complied with the requirements of the conditions herein, the Department determines the system to be in compliance with the permitted plans, and the entity approved by the Department accepts responsibility for operation and maintenance of the system. The permit may not be transferred to the operation and maintenance entity approved by the Department until the operation phase of the permit becomes effective. Following

inspection and approval of the permitted system by the Department, the permittee shall request transfer of the permit to the responsible operation and maintenance entity approved by the Department, if different from the permittee. Until a transfer is approved by the Department pursuant to Section 62-343.110(1)(d), F.A.C., the permittee shall be liable for compliance with the terms of the permit.

16. Should any other regulatory agency require changes to the permitted system, the Department shall be notified of the changes prior to implementation so that a determination can be made whether a permit modification is required.

17. This permit does not eliminate the necessity to obtain any required federal, state, local and special district authorizations including a determination of the proposed activities' compliance with the applicable comprehensive plan prior to the start of any activity approved by this permit.

18. This permit does not convey to the permittee or create in the permittee any property right, or any interest in real property, nor does it authorize any entrance upon or activities on property which is not owned or controlled by the permittee, or convey any rights or privileges other than those specified in the permit and Chapter 40D-4 or Chapter 40D-40, F.A.C.

19. The permittee is hereby advised that Section 253.77, F.S., states that a person may not commence any excavation, construction, other activity involving the use of sovereign or other lands of the state, the title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund without obtaining the required lease, license, easement, or other form of consent authorizing the proposed use. Therefore, the permittee is responsible for obtaining any necessary authorizations from the Board of Trustees prior to commencing activity on sovereignty lands or other state-owned lands.

20. The permittee shall hold and save the Department harmless from any and all damages, claims, or liabilities which may arise by reason of the activities authorized by the permit or any use of the permitted system.

21. Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered binding unless a specific condition of this permit or a formal determination under section 373.421(2), F.S., provides otherwise.

22. The permittee shall notify the Department in writing within 30 days of any sale, conveyance, or other transfer of ownership or control of the permitted system or the real property at which the permitted system is located. All transfers of ownership or transfers of a permit are subject to the requirements of section 62-343.130, F.A.C. The permittee transferring the permit shall remain liable for any corrective actions that may be required as a result of any permit violations prior to such sale, conveyance or other transfer.

23. Upon reasonable notice to the permittee, Department authorized staff with proper identification shall have permission to enter, inspect, sample and test the system to insure conformity with Department rules, regulations and conditions of the permits.

24. If historical or archaeological artifacts are discovered at any time on the project site, the permittee shall immediately notify the Department and the Florida Department of State, Division of Historical Resources.

25. The permittee shall immediately notify the Department in writing of any previously submitted information that is later discovered to be inaccurate.

NOTICE OF RIGHTS

This permit is hereby final unless a sufficient petition for an administrative hearing is timely filed under Sections 120.569 and 120.57 of the Florida Statutes (F.S.) as provided below. The procedures for petitioning for a hearing are set forth below.

Mediation is not available.

A person whose substantial interests are affected by the Department's action may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, F.S. The petition must contain the information set forth below and must be filed (received by the clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000.

Because the administrative hearing process is designed to re-determine final agency action on the application, the filing of a petition for an administrative hearing may result in a modification of the permit or even a denial of the application. If a sufficient petition for an administrative hearing or request for an extension of time to file a petition is timely filed, this permit automatically becomes only proposed agency action on the application, subject to the result of the administrative review process. Accordingly, the applicant is advised not to commence construction or other activities under this permit until the deadlines noted below for filing a petition for an administrative hearing, or request for an extension of time has expired.

Under Rule 62-110.106(4), Florida Administrative Code (F.A.C.), a person whose substantial interests are affected by the Department's action may also request an extension of time to file a petition for an administrative hearing. The Department may, for good cause shown, grant the request for an extension of time. Requests for extension of time must be filed with the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, before the applicable deadline. A timely request for extension of time shall toll the running of the time period for filing a petition until the request is acted upon. If a request is filed late, the Department may still grant it upon a motion by the requesting

party showing that the failure to file a request for an extension of time before the deadline was the result of excusable neglect.

In the event that a timely and sufficient petition for an administrative hearing is filed, other persons whose substantial interests will be affected by the outcome of the administrative process have the right to petition to intervene in the proceeding. Any intervention will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, F.A.C.

In accordance with Rule 62-110.106(3) F.A.C., petitions for an administrative hearing by the applicant must be filed within 21 days of receipt of this written notice. Petitions filed by any persons other than the applicant, and other than those entitled to written notice under section 120.60(3) of the Florida Statutes must be filed within 21 days of publication of the notice or within 21 days of receipt of the written notice, whichever occurs first.

Under section 120.60(3) of the Florida Statutes, however, any person who has asked the Department for notice of agency action may file a petition within 21 days of receipt of such notice, regardless of the date of publication.

The petitioner shall mail a copy of the petition to the applicant at the address indicated above at the time of filing. The failure of any person to file a petition for an administrative hearing within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under sections 120.569 and 120.57 of the Florida Statutes.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

(a) The name and address of each agency affected and each agency's file or identification number, if known;

(b) The name, address, and telephone number of the petitioner; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding;·· and an explanation of how the petitioner's substantial interests are or will be affected by the agency determination;

(c) A statement of when and how the petitioner received notice of the agency decision;

(d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;

(e) A concise statement of the ultimate facts alleged, including the specific facts that the petitioner contends warrant reversal or modification of the agency's proposed action; and

(f) A statement of the specific rules or statutes that the petitioner contends require reversal or modification of the agency's proposed action;

(g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wishes the agency to take with respect to the agency's proposed action.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301, F.A.C. Under Sections 120.569(2)(c) and (d), F.S., a petition for administrative hearing must be dismissed by the agency if the petition does not substantially comply with the above requirements or is untimely filed.

This action is final and effective on the d.ate filed with the Clerk of the Department unless a petition is filed in accordance with the above. Upon the timely filing of a petition this order will not be effective until further order of the Department.

This permit constitutes an order of the Department. The applicant has the right to seek judicial review of the order under Section 120.68, F.S., by the filing of a notice of appeal under Rule 9.110 of the Florida Rules of Appellate Procedure with the Clerk of the Department in the Office of General Counsel, 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida, 32399-3000; and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice of appeal must be filed within 30 days from the date when the final order is filed with the Clerk of the Department. The applicant, or any party within the meaning of Section 373.114(1)(a), F.S., may also seek appellate review of this order before the Land and Water Adjudicatory Commission under Section 373.114(1), F.S. Requests for review before the Land and Water Adjudicatory Commission must be filed with the Secretary of the Commission and served on the Department within 20 days from the date when the final order is filed with the Clerk of the Department.

Executed in Hillsborough County Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

William L. Vorstadt
Program Administrator
Environmental Resource Management
Southwest District

WLV/dh

Attachments:
Commencement notice /62-343.900(3)
As-built certification/62-343.900(5)
Inspection certification/62-343.900(6)
Transfer construction to operation phase/ 62-343.900(7)
Project Location Map, (1 page)
Project Drawings, (21 pages)

Exhibit 1: "Operation and Maintenance Instructions for the Manatee County North Water Reclamation Facility Surface Water Management System", (3 pages)
Exhibit 2: *Suggested Dewatering Plan For Reject Pond Excavation* Drawing C-0.2.4 dated March 3, 2011, (1 page)

Copies furnished to:

Mr. Phillip J. Locke, P.E., Sr. Project Manager, McKim & Creed, P.A.,1365 Hamlet Avenue Clearwater, FL 33756
Mr. Jeff Hilton, P.E., FDEP SWD Domestic Waste Program Manager (by e-mail)
Ms. Yanisa Angulo, P.E., I.W. Program Manager (by e-mail)
Mr. Bob Hayes, NPDES Environmental Manager (by e-mail)
Mr. Chuck Schnepel, P.E. ACOE (by e-mail)
File

CERTIFICATE OF SERVICE

The undersigned hereby certifies that this permit including all copies, was mailed before the close of business on 6/27/11, to the above listed persons.

FILING AND ACKNOWLEDGMENT

FILED, on this date, under 120.52(7) of the Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

E Robinson 6/27/11

Clerk Date

Form #62-343.900(3) FAC
Form Title: Construction Commencement Notice
Effective Date: October 3,1995

ENVIRONMENTAL RESOURCE PERMIT
Construction Commencement Notice

Project: Phase:

I hereby notify the Department of Environmental Protection that the construction of the surface water management system authorized by Environmental Resource Permit Number has commenced / is expected to commence on and will require a duration of approximately months weeks days to complete. It is understood that should the construction term extend beyond one year, I am obligated to submit the Annual Status Report for surface Water Management System Construction.

PLEASE NOTE: If the actual construction commencement date is not known, Department staff should be so notified in writing in order to satisfy permit conditions.

_____

Permittee or Authorized Agent Title and Company Date

Phone Address

Form #62-343.900(5), F.A.C.
Form Title: As-Built Certification by a Registered Professional
Effective Date: October 3, 1995

ENVIRONMENTAL RESOURCE PERMIT
AS-BUILT CERTIFICATION BY A REGISTERED PROFESSIONAL

Permit Number:

Project Name:

I hereby certify that all components of this surface water management system have been built substantially in accordance with the approved plans and specifications and are ready for inspection. Any substantial deviations (noted below) from the approved plans and specifications will not prevent the system from functioning as designed when properly maintained and operated. These determinations are based upon on-site observation of the system conducted by me or by my designee under my direct supervision and/or my review of as-built plans certified by a registered professional or Land Surveyor licensed in the State of Florida.

Name (please print) _____ Signature of Professional

Company Name Florida Registration Number

Company Address Date

City, State, Zip Code

Telephone Number (Affix Seal)

Substantial deviations from the approved plans and specifications:

(Note: attach two copies of as-built plans when there are substantial deviations)

Within 30 days of completion of the system, submit two copies of the form to:

Form #62-343.900(6) FAC
Form Title: Inspection Certification
Effective Date: October 3,1995

ENVIRONMENTAL RESOURCE PERMIT
INSPECTION CERTIFICATION

Permit Number:

Project Name:

Inspection Date(s):

Inspection results: (check one)

☐ I hereby certify that I or my designee under my direct supervision have inspected the system at the above referenced project and that the system appears to be functioning in accordance with the requirements of the permit and Chapter 373 F.S. (as applicable).

☐ The following necessary maintenance was conducted:

☐ I hereby certify that I or my designee under my direct supervision has inspected the system at the above referenced project and that the system does not appear to be functioning in accordance with the requirements of the permit and Chapter 373 F.S. (as applicable). I have informed the operation and maintenance entity of the following: (a) that the system does not appear to be functioning properly, (b) that maintenance is required to bring the system into compliance, and (c) if maintenance measures are not adequate to bring the system into compliance, the system may have to be replaced or an alternative design constructed subsequent to Department approval.

Name

Signature of Professional Engineer

Company Name

Florida Registration Number

Company Address

Date

City, State, Zip Code

Telephone Number

(affix seal)

Within 30 days of completion of the inspection, submit two copies of the form to the following Department Office:

Department of Environmental Protection

Form #: 62-353.900(7)F.A.C.
Form Title: Request for Transfer to Operation Phase
Effective Date: September 25, 1995

Request for Transfer of Environmental Resource Permit Construction Phase to Operation Phase

(To be completed and submitted by the operating entity)

Florida Department of Environmental Protection

It is requested that Department Permit Number _____authorizing the construction and operation of a surface water management system for the below mention project be transferred from the construction phase permittee to the operation phase operating entity.

Project:

From: Name:
Address:
City: State: Zip:

To: Name:
Address:
City: State: Zip:

The surface water management facilities are hereby accepted for operation and maintenance in accordance with the engineers certification and as outlined in the restrictive covenants and articles of incorporation for the operating entity. Enclosed is a copy of the document transferring title of the operating entity for the common areas on which the surface water management system is located. Note that if the operating entity has not been previously approved, the applicant should contact the Department staff prior to filing for a permit transfer.

The undersigned hereby agrees that all terms and conditions of the permit and subsequent modifications, if any, have been reviewed, are understood and are hereby accepted. Any proposed modifications shall be applied for and obtained prior to such modification.

Operating Entity: _____

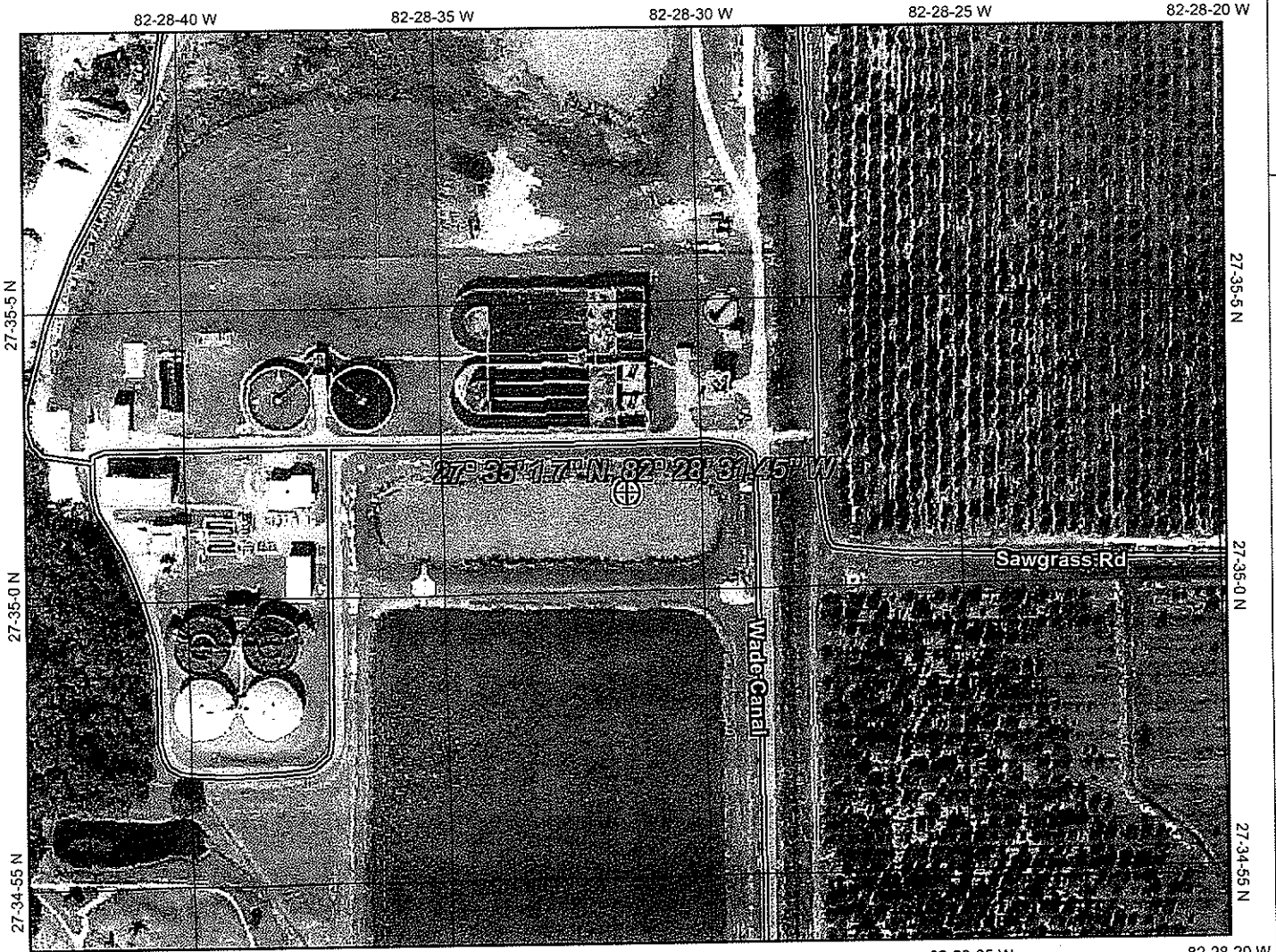
_____ Title: _____
Name

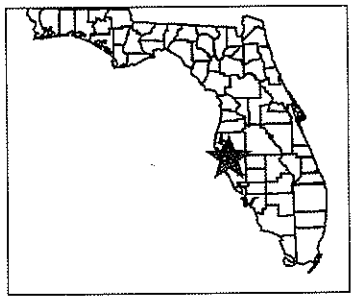
Telephone: _____

Enclosure

☐ Copy of recorded transfer of title surface water management system
☐ Copy of plat(s)
☐ Copy of recorded restrictive covenants, articles of incorporation, and certificate of incorporation.

NORTH WATER RECLAMATION FACILITY EXPANSION





Legend

- Environmental Resource Permits (Historic)
- ERP Permitting Application (ERPpa)
- Street Map
- Cities (census places)
- Counties (generalized)

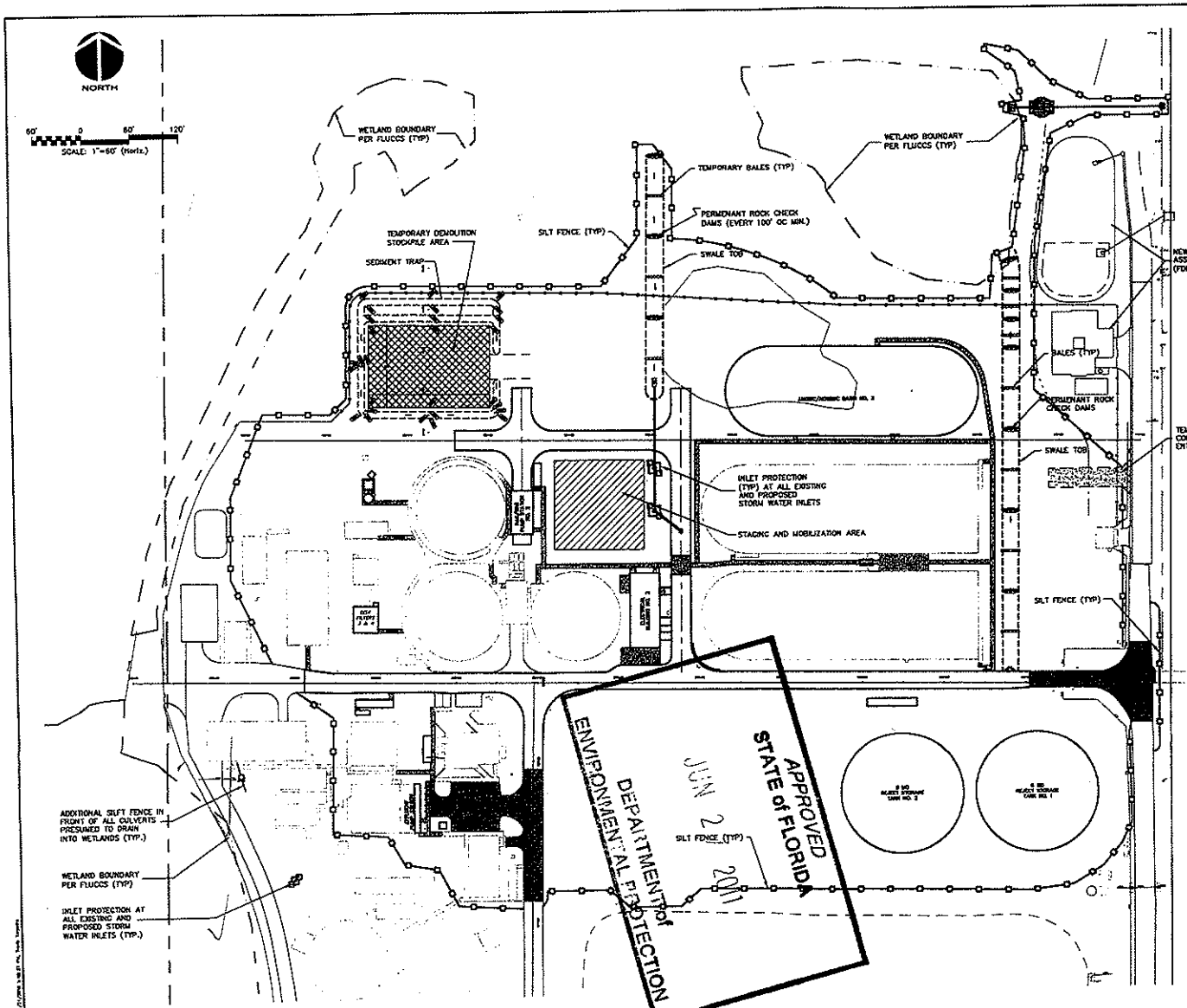
0 325 650 975 ft.

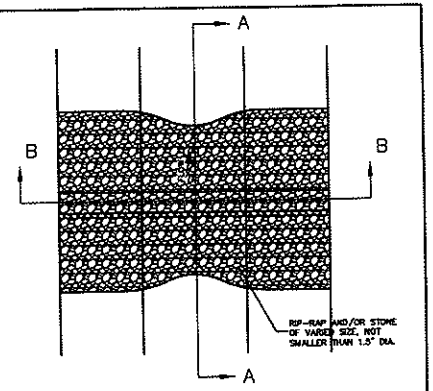
Scale: 1:3,431

Map center: 550210, 398508

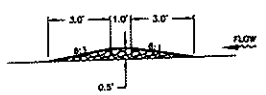
[Florida Department of Environmental Protection] Disclaimer: This map is intended for display purposes only. It was created using data from different sources collected at different scales, with different levels of accuracy, and/or covering different periods of time.

Notes: Map produced on Sun Jul 04 14:57:27 EDT 2010

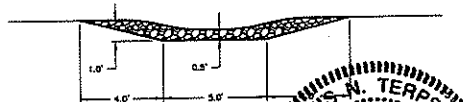




CHECK DAM PLAN VIEW



A-A: CHECK DAM PROFILE



B-B CHECK DAM CROSS SECTION

CONSTRUCTION SCHEDULE

TASK	ESTIMATED START DATE	ESTIMATED DURATION	ESTIMATED END DATE
PROJECT BID	2/1/11	1 DAY	2/1/11
CONTRACTOR SELECTED	5/09/11	30 DAYS	6/08/11
APPLICATION FOR DEMOLITION PERMIT	7/18/11	30 DAYS	8/24/11
APPLICATION FOR CONSUMPTIVE USE PERMIT	7/18/11	30 DAYS	8/24/11
APPLICATION FOR ALL OTHER PERMITS	7/18/11	30 DAYS	8/24/11
OBTAIN REQUIRED PERMITS AND APPROVALS	8/22/11	90 DAYS	11/20/11
SUBMIT NOTICE OF COMMENCEMENT TO OWNER	11/14/11	1 DAY	11/14/11
INSTALL SWPPP AND ENVIRONMENTAL PROTECTION	11/15/11	4 DAYS	11/18/11
LAYOUT CONSTRUCTION	11/18/11	5 DAYS	11/23/11
MOBILIZE EQUIPMENT	11/23/11	30 DAYS	12/23/11
CONSTRUCT IMPROVEMENTS	2/28/11	680 DAYS	12/18/13
PASS ALL INSPECTIONS	12/19/13	14 DAYS	1/1/14
REMOVE ALL TEMPORARY BMPS	1/2/14	5 DAYS	1/8/14

NOTES

1. PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES, ALL SOIL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE IN PLACE AND REMAIN THROUGHOUT CONSTRUCTION.
2. IMMEDIATELY UPON SATISFACTORY INSTALLATION OF SOIL EROSION AND SEDIMENTATION CONTROL MEASURES THE CONTRACTOR SHALL REMOVE THE EXISTING TOP SOIL PILE ON SITE AND DISPOSE OF THE MATERIAL OFF-SITE, AT THE CONTRACTOR'S DISCRETION.
3. THE WESTERN PORTION OF THE EXISTING REJECT POND IS NOT TO BE FILLED IN UNTIL THE NEW REJECT STORAGE TANKS AND ALL RELATED MECHANICAL, ELECTRICAL, AND CONTROLS SYSTEMS (INCLUDING REDUNDANT POWER SOURCES) ARE IN PLACE AND OPERATING TO THE SATISFACTION OF THE OWNER.
4. REFER TO SECTION 01030 OF THE PROJECT SPECIFICATIONS FOR FURTHER INFORMATION REGARDING CONSTRUCTION SEQUENCING.
5. CONTRACTOR SHALL FOLLOW BEST MANAGEMENT PRACTICES THROUGHOUT CONSTRUCTION.
6. CONTRACTOR SHALL PREPARE AND SUBMIT A STORM WATER POLLUTION PREVENTION PLAN (SWPPP) FOR REVIEW AND APPROVAL PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES.
7. CONTRACTOR SHALL PREPARE AND SUBMIT A DISPOSAL PLAN FOR EXCAVATION MATERIAL AND DISPOSAL OF THE EXISTING TOPSOIL PILE INCLUDING THE LOCATION OF DISPOSAL SITE(S) AND DISPOSAL PLANS SHOWING APPLICABLE BEST MANAGEMENT PRACTICES FOR REVIEW AND APPROVAL PRIOR TO ANY EARTHWORK ACTIVITIES.

TRAVIS N. TERPSTRA
LICENSE
No 71412
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

11-24-10

REVISIONS

PHILLIP J. LOCKE, P.E.
No. 57527

McKIM&CREED
1365 Hamlet Avenue
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CA#00645
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MANATEE COUNTY, FLORIDA

NWRF EXPANSION

SOIL EROSION AND SEDIMENTATION CONTROL PLAN

DATE: NOVEMBER 2010
MCK PROJ. # 1021-0032
DRAWN: BFH
DESIGNED: TT
CHECKED: JB
PROJ. MGR.: PJL

SCALE: HORIZONTAL: 1"=20' VERTICAL: NA

C-0.2.2

STATUS: ISSUE FOR CONSTRUCTION

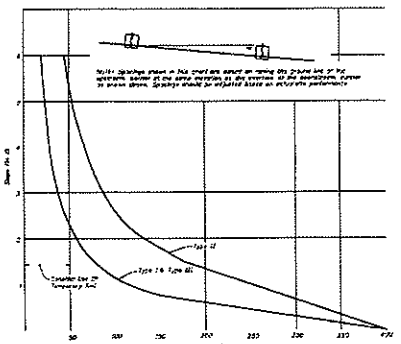
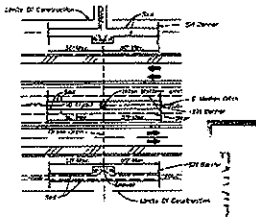


CHART 1

RECOMMENDED SPACING FOR SYNTHETIC BALES OR BALE TYPE BARRIERS AND TYPE III SILT FENCE



DITCH INSTALLATIONS AT DRAINAGE STRUCTURES

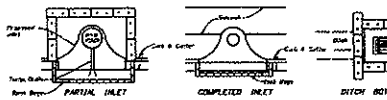
DEPARTMENT of ENVIRONMENTAL PROTECTION

JUN 27 2011

APPROVED
STATE of FLORIDA

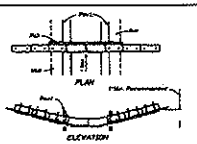
TEMPORARY EROSION AND SEDIMENT CONTROL

102

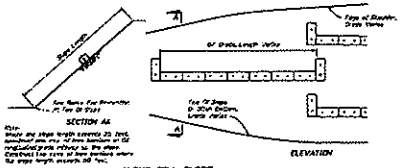


PARTIAL INLET — COMPLETED INLET — DITCH BOTTOM INLET

PROTECTION AROUND INLETS OR SIMILAR STRUCTURES

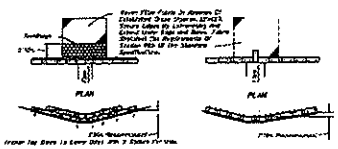


SYNTHETIC BALES OR BALE TYPE BARRIERS FOR PAVED DITCHES



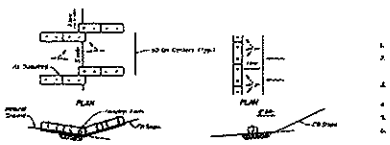
SECTION AA — ELEVATION

ALONG FILL SLOPE



ELEVATION TYPE III — ELEVATION TYPE I

SYNTHETIC BALES OR BALE TYPE BARRIERS FOR UNPAVED DITCHES



ELEVATION — ELEVATION

AT TOE OF SLOPE BARRIERS FOR FILL SLOPES

NOTES FOR SYNTHETIC BALES OR BALE TYPE BARRIERS

1. Use 1 and 2 Synthetic Barrier bales to conform to specifications with Chart 1, Sheet 1.
2. Bales shall be [illegible] 3" to 4" and embedded with 2x2" x 3" to 4" (4x4) x 4' wood stakes. Stakes at other embedment depth specified required strength may be used if approved by the Engineer. Stakes other than wood shall be non-degradable as the project.
3. Bale and stake shall be 3" x 4" used. Other materials providing equivalent strength may be used if approved by the Engineer.
4. Adjacent bales shall be butted firmly together.
5. Bales used in conjunction with silt fence, bales shall be placed on the uphill side of the fence.
6. Refer to to guide for under the approval and grade for Synthetic bales, to the end grade, and bales the Chart of Bar Chart 1 and Sheet 1 and Sheet 2 and Sheet 3 and Sheet 4 and Sheet 5 and Sheet 6 and Sheet 7 and Sheet 8 and Sheet 9 and Sheet 10 and Sheet 11 and Sheet 12 and Sheet 13 and Sheet 14 and Sheet 15 and Sheet 16 and Sheet 17 and Sheet 18 and Sheet 19 and Sheet 20 and Sheet 21 and Sheet 22 and Sheet 23 and Sheet 24 and Sheet 25 and Sheet 26 and Sheet 27 and Sheet 28 and Sheet 29 and Sheet 30 and Sheet 31 and Sheet 32 and Sheet 33 and Sheet 34 and Sheet 35 and Sheet 36 and Sheet 37 and Sheet 38 and Sheet 39 and Sheet 40 and Sheet 41 and Sheet 42 and Sheet 43 and Sheet 44 and Sheet 45 and Sheet 46 and Sheet 47 and Sheet 48 and Sheet 49 and Sheet 50 and Sheet 51 and Sheet 52 and Sheet 53 and Sheet 54 and Sheet 55 and Sheet 56 and Sheet 57 and Sheet 58 and Sheet 59 and Sheet 60 and Sheet 61 and Sheet 62 and Sheet 63 and Sheet 64 and Sheet 65 and Sheet 66 and Sheet 67 and Sheet 68 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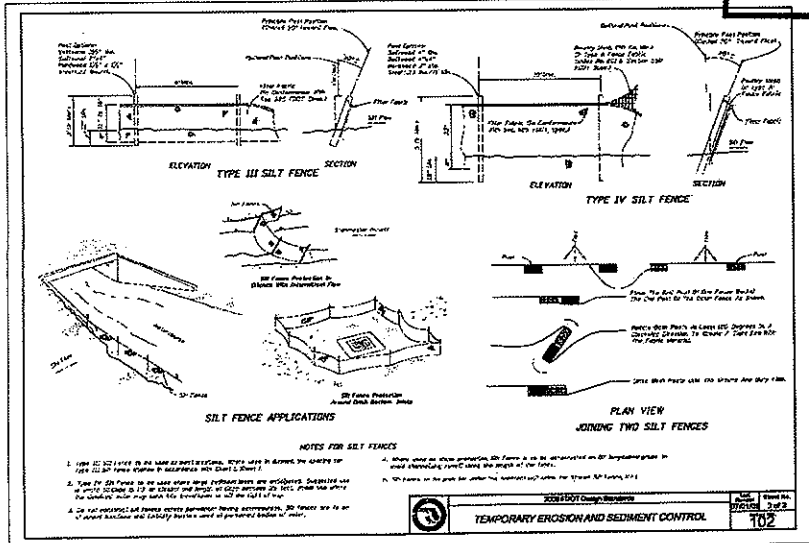


ELEVATION — SECTION

TYPE III SILT FENCE

ELEVATION — SECTION

TYPE IV SILT FENCE

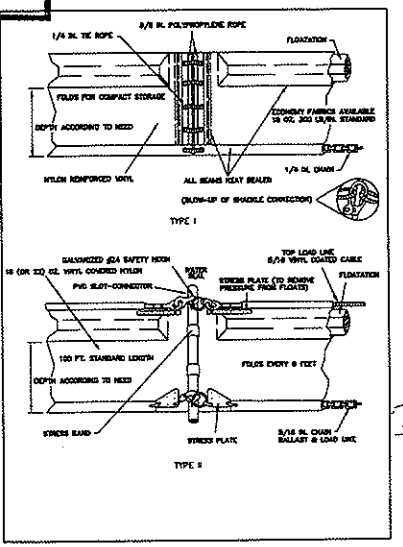
SILT FENCE APPLICATIONS

PLAN VIEW
JOINING TWO SILT FENCES

NOTES FOR SILT FENCES

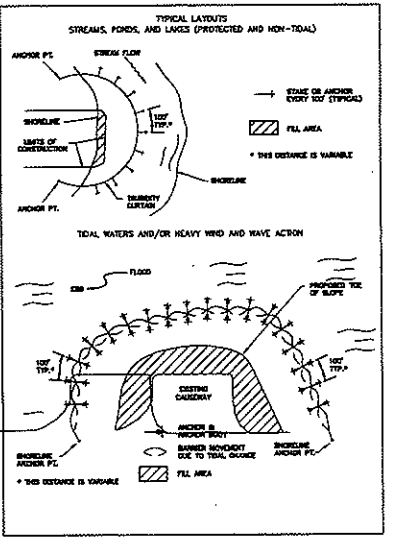
TEMPORARY EROSION AND SEDIMENT CONTROL

102



TYPE I

TYPE II



TYPICAL LAYOUTS
STREAMS, PONDS, AND LAKES (PROTECTED AND NON-TIDAL)

TIDAL WATERS AND/OR HEAVY WIND AND WAVE ACTION

McKIM&CREED
1365 Hamlet Avenue
Clearwater, Florida 33756
Phone: (727)442-7196, Fax: (727)461-3827
EB000649
www.mckimcreed.com

MANATEE COUNTY, FLORIDA

NWRF EXPANSION PHASE 1

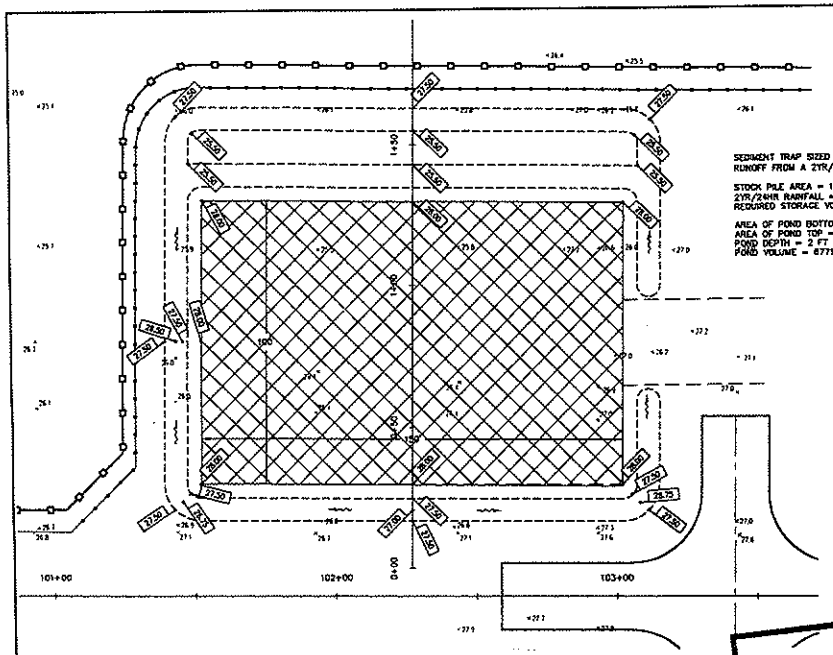
CIVIL DETAILS NO. 2

DATE: APRIL 2011
MCK PROJ. # 1025-0140
DRAWN BPS
DESIGNED DCW
CHECKED JS
PROJ. MGR. DCW

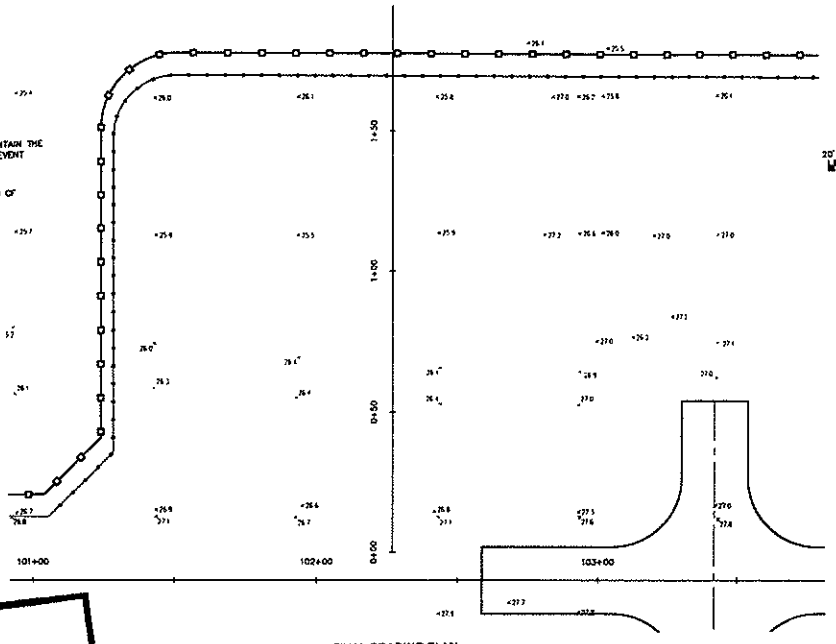
SCALE
HORIZONTAL: NA
VERTICAL: NA

C-0.2.2

STATUS: ISSUED FOR PERMIT



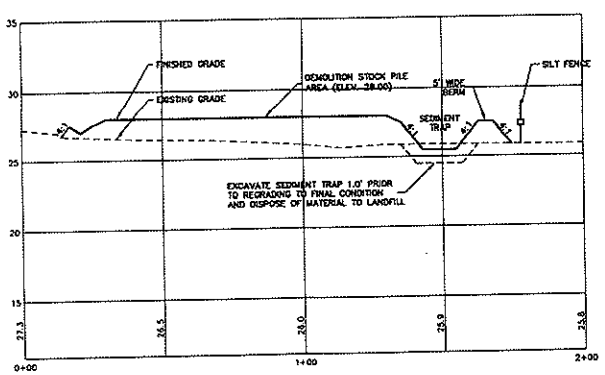
STOCK PILE PLAN

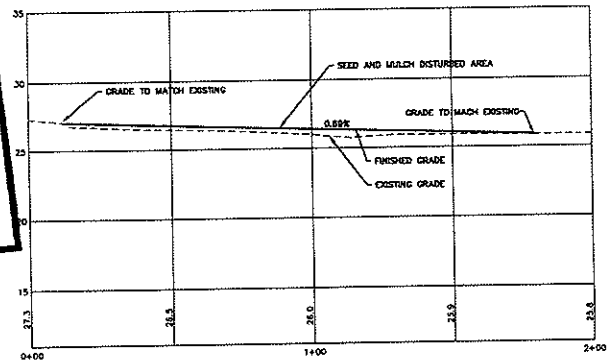


FINAL GRADING PLAN

NORTH

SCALE: 1"=20' (Horiz.)





APPROVED
STATE of FLORIDA
DEPARTMENT of ENVIRONMENTAL PROTECTION
JUN 27 2011

TRAVIS N. TERPSTRA
LICENSE
No 71412
STATE OF FLORIDA
PROFESSIONAL ENGINEER

11-24-10

REVISIONS		
NO.	DESCRIPTION	DATE

PHILLIP J. LOCKE, P.E. No. 37527

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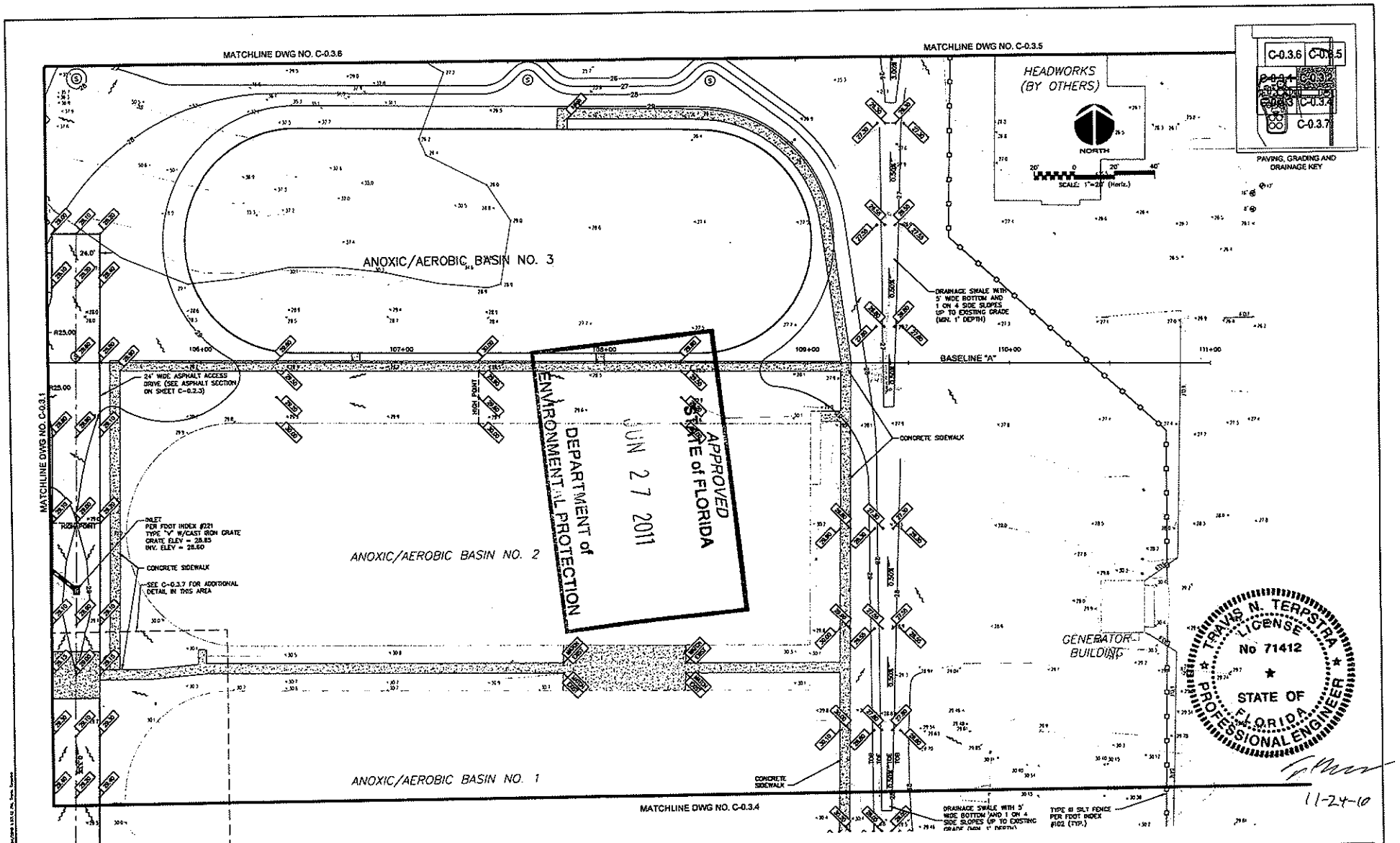
1365 Hamlet Avenue
Clearwater, Florida 33756
Phone: (727)442-7196, Fax: (727)461-3827
EB0008691
www.mckimcreed.com

MANATEE COUNTY, FLORIDA

NWRF EXPANSION

STOCKPILE AREA PLANS AND SECTIONS

DATE	NOVEMBER 2010
MCK. PROJ. #	0074-0033
DRAWN	BPS
DESIGNED	JT
CHECKED	JS
PROJ. MGR.	PJL
SCALE	HORIZONTAL: 1"=20' VERTICAL: NA
DRAWING NUMBER	C-0.2.3
STATUS	ISSUE FOR CONSTRUCTION
REVISION	



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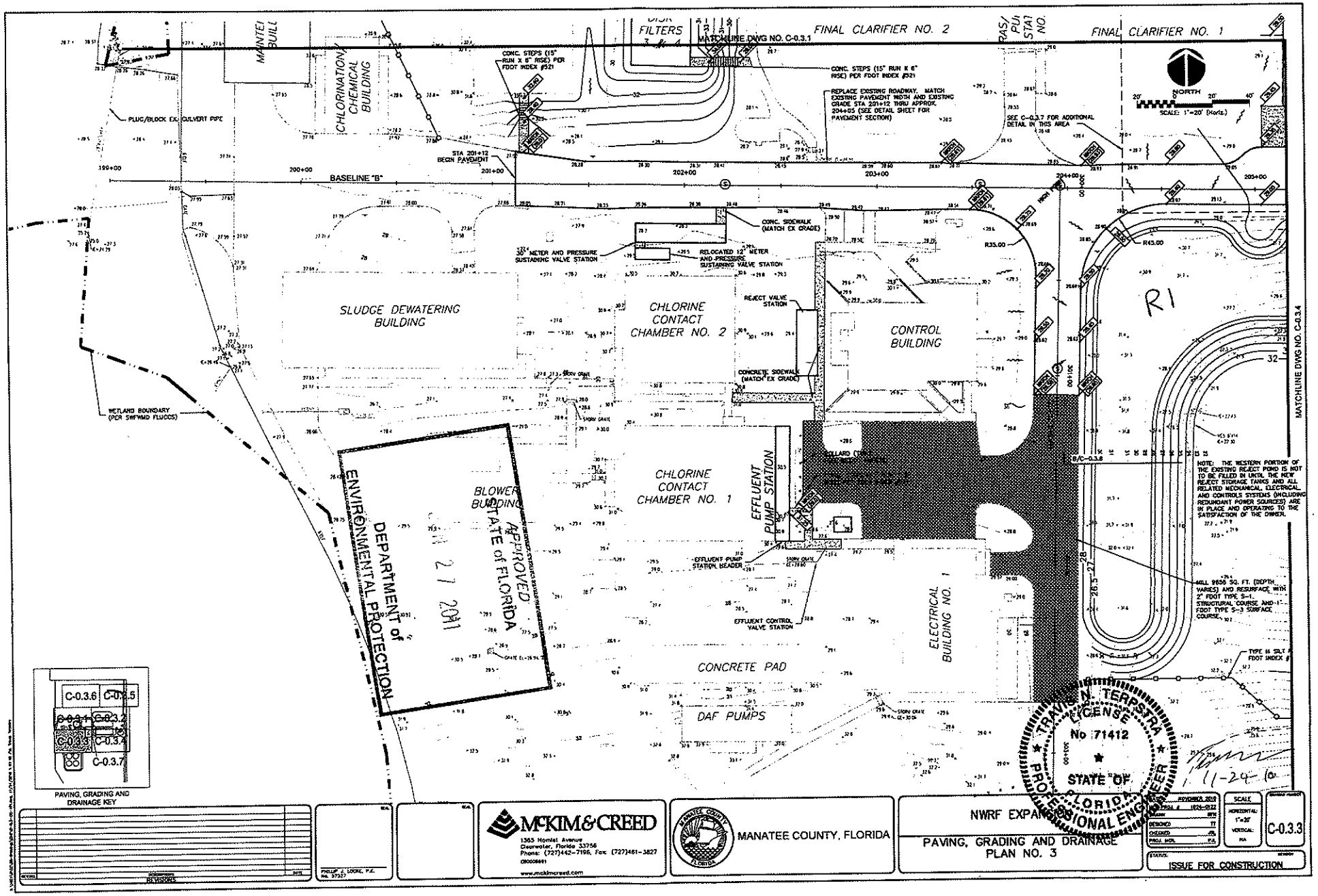
www.mckimcreed.com

MANATEE COUNTY, FLORIDA

NWRF EXPANSION

PAVING, GRADING AND DRAINAGE PLAN NO. 2

DATE: NOVEMBER 2010
WCF PROJ. # 1024-0123
DRAWN: BFK
DESIGNED: TT
CHECKED: JSL
PROJ. MGR.: P.A.
SCALE: HORIZONTAL: 1"=20' VERTICAL: NA
C-0.3.2
STATUS: ISSUE FOR CONSTRUCTION



PAVING, GRADING AND DRAINAGE KEY

C-0.3.6 C-0.3.5 C-0.3.1 C-0.3.2 C-0.3.8 C-0.3.4 C-0.3.7

REVISIONS

PHILLIP J. LOORE, P.E. No. 57527

McKIM&CREED
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CB000691
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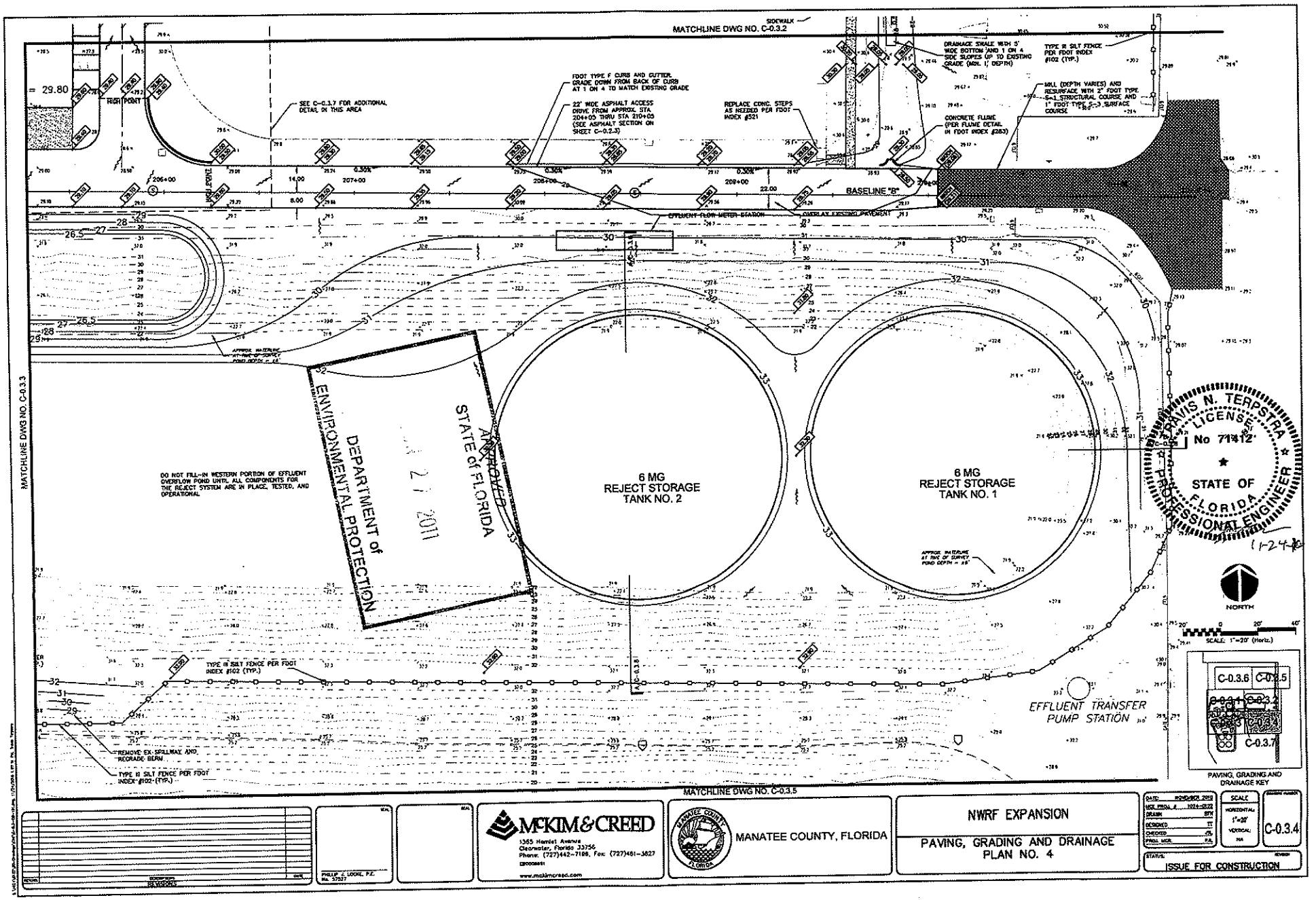
MANATEE COUNTY, FLORIDA

NWRF EXPANSION
PAVING, GRADING AND DRAINAGE PLAN NO. 3

TRAVIS N. TERSTRA
LICENSE
No 71412
STATE OF FLORIDA
PROFESSIONAL ENGINEER
11-24-10

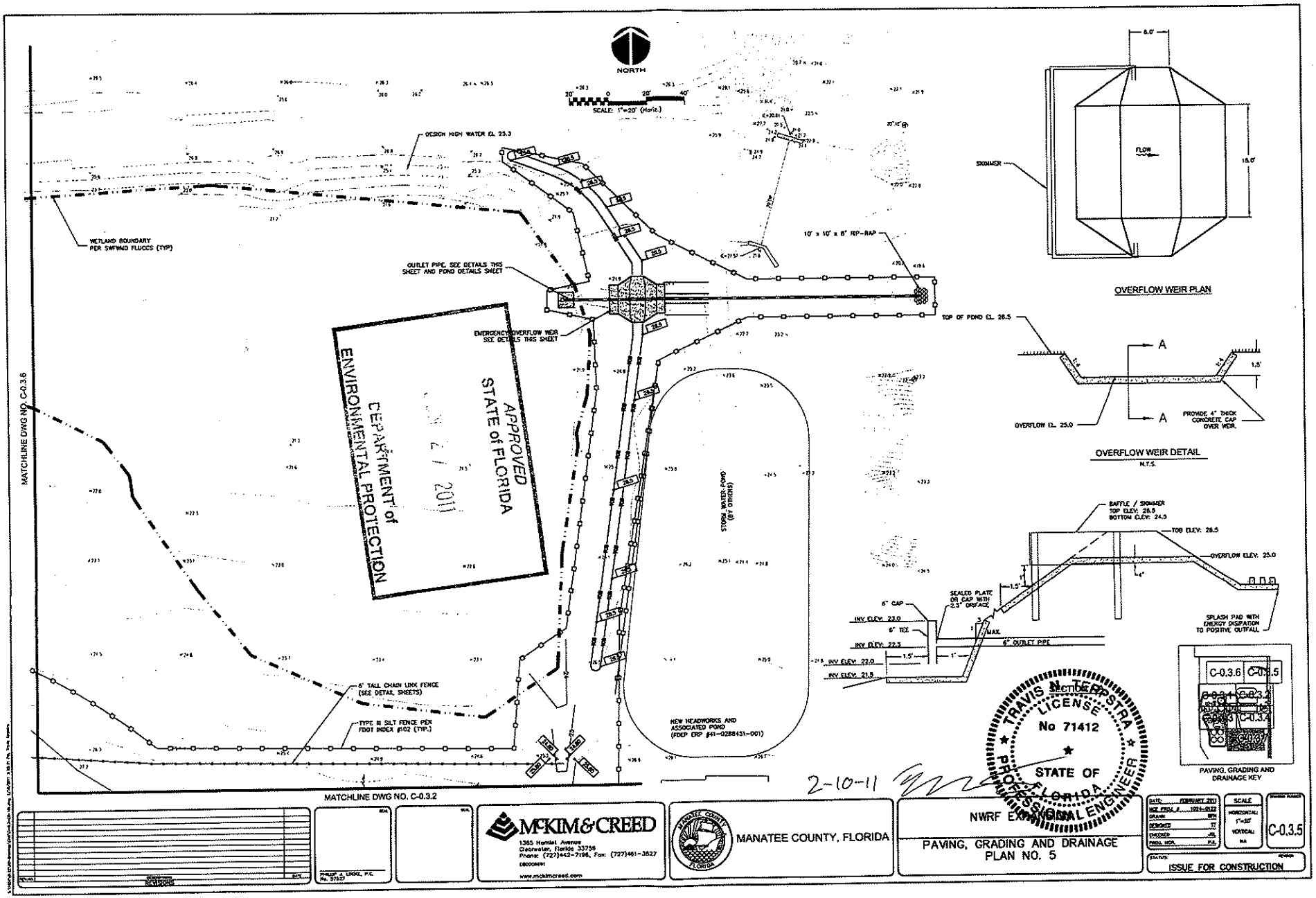
DESIGNED TT
CHECKED JS
PROJ. MGR. P.A.
SCALE HORIZONTAL: 1"=20' VERTICAL: AS
C-0.3.3

STATUS: ISSUE FOR CONSTRUCTION

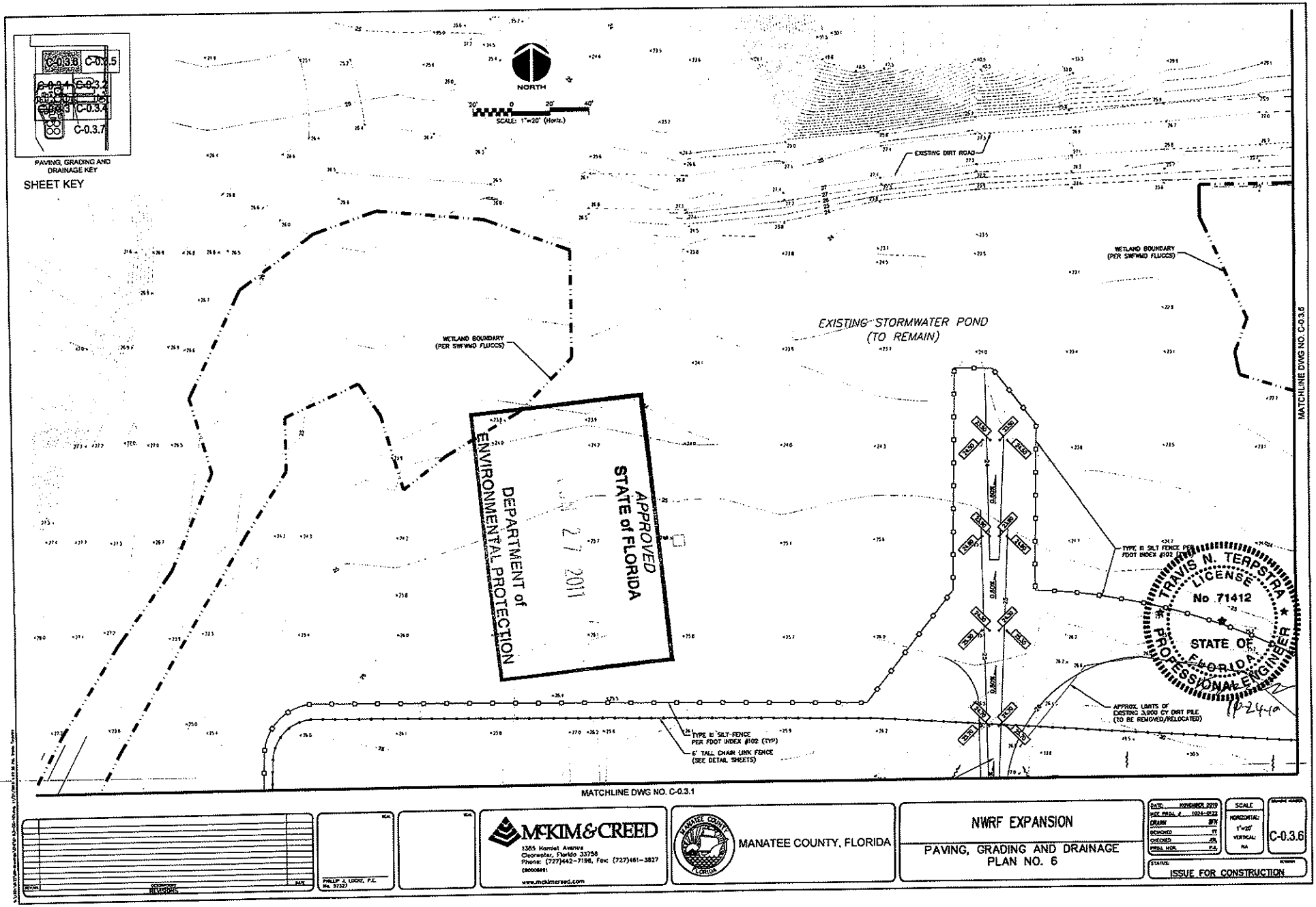


REVISIONS	PHILLIP C. LOOKE, P.E. No. 57527		McKIM&CREED 1365 Hamlet Avenue Clearwater, Florida 33756 Phone: (727)442-7196, Fax: (727)461-3827 www.mckimcreed.com	MANATEE COUNTY, FLORIDA	NWRF EXPANSION PAVING, GRADING AND DRAINAGE PLAN NO. 4

DATE	NOVEMBER 2010
DRAWN	BTV
DESIGNED	TT
CHECKED	PCL
PROJ. MGR.	P.K.
SCALE	HORIZONTAL 1"=20' VERTICAL: N/A
DRAWING NUMBER	C-0.3.4
STATUS:	ISSUE FOR CONSTRUCTION



McKIM&CREED 1365 Hamlet Avenue Clearwater, Florida 33756 Phone: (727)442-7196, Fax: (727)461-3627 www.mckimcreed.com	MANATEE COUNTY, FLORIDA	NWRF EXPANSION PAVING, GRADING AND DRAINAGE PLAN NO. 5	DATE: FEBRUARY 2011 SCALE: HORIZONTAL 1"=20', VERTICAL: NA C-0.3.5 STATUS: ISSUE FOR CONSTRUCTION



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MANATEE COUNTY, FLORIDA

NWRF EXPANSION

PAVING, GRADING AND DRAINAGE PLAN NO. 6

DATE: NOVEMBER 2019
MCK PROJ. # 1024-0023
DRAWN: BFK
DESIGNED: TT
CHECKED: JS
PROJ. MGR.: PA

SCALE: HORIZONTAL 1"=20' VERTICAL NA

C-0.3.6

STATUS: ISSUE FOR CONSTRUCTION

NO/DATE REVISIONS

PHILLIP J. LUCHZ, P.E. No. 57327

DISCIPLINE	DRAWING	TITLE
GENERAL	G-0.1	COVER SHEET
	G-0.2	DRAWING INDEX AND GENERAL NOTES
	G-0.3	ABBREVIATIONS AND LEGENDS
	G-0.4	SITE PLAN AND PROPOSED WORK LOCATIONS
	G-0.5	SOIL EROSION AND SEDIMENTATION CONTROL PLAN
	G-0.6	PROPOSED EFFLUENT IMPROVEMENT SCHEMATIC
DEMOLITION	D-0.1	EXISTING SITE AND DEMOLITION PLAN
	D-0.2	YARD PIPING DEMOLITION PLAN NO. 1
	D-0.3	YARD PIPING DEMOLITION PLAN NO. 2
	D-3.1	INTERNAL RECYCLE PUMPS PLAN AND SECTIONS
	D-3.2	ANOXIC / AEROBIC BASINS NO. 1 AND NO. 2 DEMOLITION PLAN AND DETAILS
	D-7.1	EFFLUENT PUMP BACK STATION NO. 1 AND NO. 2 DEMOLITION PLAN
	D-7.2	EFFLUENT PUMP BACK STATION NO.3 DEMOLITION PLAN
	D-10.1	PLANT DRAIN PUMP STATION DEMOLITION PLAN AND SECTION
CIVIL	C-0.1.1	GRADING AND DRAINAGE PLAN
	C-0.2.1	CIVIL DETAILS NO. 1
	C-0.2.2	CIVIL DETAILS NO. 2
	C-0.2.3	CIVIL DETAILS NO. 3
	C-0.2.4	CIVIL DETAILS NO. 4
	C-0.4.1	YARD PIPING PLAN NO. 1
	C-0.4.2	YARD PIPING PLAN NO. 2
	C-0.4.3	YARD PIPING PLAN NO. 3
	C-0.4.4	YARD PIPING PLAN NO. 4
STRUCTURAL	S-0.1	STRUCTURAL, GENERAL NOTES, DESIGN LOADS, CRITERIA AND LEGEND
	S-0.2	OVERALL STRUCTURAL KEY PLAN
	S-3.1	ANOXIC / AEROBIC BASINS No. 1 & No. 2 BOTTOM PLAN, SECTIONS & DETAILS
	S-3.2	ANOXIC / AEROBIC BASINS No. 1 & No. 2 TOP PLAN, SECTIONS AND DETAILS
	S-7.1	LAKE GRAVITY DISC FILTER FOUNDATION PLAN, SECTIONS & DETAILS
MECHANICAL	M-0.1	MECHANICAL DETAILS
	M-0.2	MECHANICAL DETAILS
	M-3.1	NEW INTERNAL RECYCLE PUMPS PLAN AND SECTIONS
	M-7.1	METER AND PIPE ASSEMBLY METER AND CHECK VALVE ASSEMBLY PLAN AND SECTION
	M-7.2	GOLF COURSE STORAGE LAKE FLOW CONTROL STRUCTURE AND INTAKE STRUCTURE PLAN AND SECTIONS
	M-7.3	LAKE GRAVITY DISC FILTER PLAN
	M-7.4	LAKE GRAVITY DISC FILTER SECTIONS
	M-7.5	LAKE GRAVITY DISC FILTER SECTIONS
	M-7.6	LAKE FILTER BACKWASH PUMP STATION PLAN AND SECTION
	M-7.7	ABW / DIGESTER CONNECTION DETAILS
	M-7.8	VAVLE MODIFICATIONS
	M-8.1	DEWATERING BUILDING PLAN AND DETAILS
	M-8.2	DEWATERING BUILDING DETAILS
	M-10.1	PLANT DRAIN PUMP STATION PLAN A
	M-10.2	PLANT DRAIN PUMP STATION SECTION
INSTRUMENTATION	I-0.1	PROCESS AND INSTRUMENTATION GENERAL NOTE, LEGENDS AND ABBREVIATIONS
	I-0.2	NETWORK DIAGRAM
	I-0.3	PROCESS AND INSTRUMENTATION DETAILS
	I-3.1	PROCESS AND INSTRUMENTATION DIAGRAM ANOXIC / AEROBIC BASIN NO. 1 AND NO. 2
	I-7.1	PROCESS AND INSTRUMENTATION DIAGRAM EFFLUENT METERING AND DISCHARGE
	I-8.1	PROCESS AND INSTRUMENTATION DIAGRAM SODIUM HYPOCHLORITE STORAGE AND PUMPING
	I-10.1	PROCESS AND INSTRUMENTATION DIAGRAM PLANT DRAIN PUMP STATION
ELECTRICAL	E-0.1	ELECTRICAL GENERAL NOTE, LEGENDS AND ABBREVIATIONS
	E-0.2	OVERALL ELECTRICAL SITE PLAN
	E-0.3	ELECTRICAL BUILDING NO. 1 EXISTING SINGLE-LINE DIAGRAM AND MODIFICATIONS
	E-0.4	ELECTRICAL BUILDING NO. 1 MCC-1 MODIFICATIONS SINGLE-LINE DIAGRAM
	E-0.5	ELECTRICAL BUILDING NO. 1 EXISTING MCC ELEVATIONS
	E-0.6	ELECTRICAL SCHEMATICS
	E-0.7	MISCELLANEOUS ELECTRICAL DETAILS NO. 1
	E-0.8	MISCELLANEOUS ELECTRICAL DETAILS NO. 2
	E-0.9	PANEL BOARD SCHEDULE
	E-3.1	ANOXIC / AEROBIC BASIN NO. 1 AND NO. 2 POWER PLAN
	E-3.2	NEW INTERNAL RECYCLE PUMP PLAN AND SECTIONS
	E-7.1	EFFLUENT PUMP STATION POWER AND FLOWMETER PLAN
	E-7.2	FILL CONTROL VALVE AND INTAKE STRUCTURE ELECTRICAL PLAN
	E-7.3	LAKE GRAVITY DISC FILTER PLAN
	E-8.1	DEWATERING BUILDING PLAN AND DETAIL
	E-10.1	PLANT DRAIN PUMP STATION ELECTRICAL MODIFICATIONS
	E-10.2	PLANT DRAIN PUMP STATION METERING POWER PLAN

DRAWING NUMBER DESIGNATION

M - 7 . 1

- M — INDICATES DISCIPLINE (EX. "M" REFERS TO MECHANICAL)
- 7 — INDICATES PROCESS AREA OR STRUCTURE (EX. "7" REFERS TO THE EFFLUENT PROCESS AREA) * NOT ALL PROCESS AREAS / STRUCTURES ARE INCLUDED FOR EACH DISCIPLINE
- 1 — INDICATES SHEET NUMBER OF PROCESS AREA OR STRUCTURE

PROCESS AREA TABLE

NUMERIC DESIGNATION	PROCESS AREA
0	SITE CIVIL AND MISCELLANEOUS
1	NOT USED
2	HEADWORKS
3	BIOLOGICAL PROCESS
4	SECONDARY CLARIFICATION/RAS
5	FILTRATION
6	NOT USED
7	EFFLUENT
8	DEWATERING BUILDING .
9	NOT USED
10	REJECT WATER/PLANT DRAIN
11	ELECTRICAL/GENERATOR BUILDING NO. 2
12	ELECTRICAL/GENERATOR BUILDING NO. 1

APPROVED
STATE of FLORIDA
JUN 27 2011
DEPARTMENT of
ENVIRONMENTAL PROTECTION

GENERAL NOTES

1. THESE PLANS ARE SOLELY TO ASSIST THE CONTRACTOR IN ASSESSING THE NATURE AND EXTENT OF THE EXISTING CONDITIONS WHICH MAY BE ENCOUNTERED DURING THE COURSE OF WORK. CONTRACTORS ARE DIRECTED TO CONDUCT WHATEVER INVESTIGATION THEY DEEM NECESSARY PRIOR TO BIDDING TO DETERMINE THE ACTUAL CONDITIONS THAT WILL BE ENCOUNTERED.
2. LOCATIONS, ELEVATIONS AND DIMENSIONS OF EXISTING UTILITIES, STRUCTURES, AND OTHER FEATURES ARE SHOWN BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF PREPARATION OF THESE PLANS BUT DO NOT PURPORT TO BE ABSOLUTELY CORRECT. THE CONTRACTOR SHALL VERIFY, PRIOR TO CONSTRUCTION, THE LOCATIONS, ELEVATIONS, AND DIMENSIONS OF ALL EXISTING UTILITIES, STRUCTURES, AND OTHER FEATURES (WHETHER OR NOT SHOWN ON THE PLANS) AFFECTING HIS WORK.
3. THE CONTRACTOR SHALL REVIEW AND VERIFY ALL DIMENSIONS ON THE PLANS AND REVIEW ALL FIELD CONDITIONS THAT MAY AFFECT CONSTRUCTION. SHOULD DISCREPANCIES OCCUR, THE CONTRACTOR SHALL NOTIFY THE ENGINEER TO OBTAIN WRITTEN CLARIFICATION BEFORE COMMENCING WITH CONSTRUCTION.
4. THE CONTRACTOR SHALL PROTECT ALL EXISTING STRUCTURES, STORM DRAINS, SEWERS, UTILITIES, AND OTHER FACILITIES IN THE CONSTRUCTION AREA. THE CONTRACTOR SHALL REPAIR ANY DAMAGES DUE TO HIS CONSTRUCTION ACTIVITIES AT NO ADDITIONAL COST TO THE OWNER.
5. WHERE IT IS NECESSARY TO DEFLECT PIPE EITHER HORIZONTALLY OR VERTICALLY, PIPE JOINT DEFLECTION SHALL NOT EXCEED 75% OF THE MANUFACTURERS' MAXIMUM RECOMMENDED DEFLECTION.
6. THERE ARE TO BE NO "SIZE ON SIZE TAPS" OR "SIZE ON SMALLER TAPS" ON THIS PROJECT.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF THE EXISTING DRAINAGE SYSTEM WITHIN THE LIMITS OF THE PROJECT AREA FOR THE DURATION OF THE PROJECT.
8. THE CONTRACTOR SHALL PROVIDE CERTIFIED RECORD DRAWINGS AS OUTLINED IN THE SPECIFICATIONS. RED-LINE DRAWINGS SHALL BE CURRENT WITH EACH PAY APPLICATION SUBMITTED AND WILL BE CHECKED AS PART OF THE PAY APPLICATION REVIEW PROCESS. PAYMENT WILL NOT BE MADE TO CONTRACTOR WITHOUT APPROVED RED-LINE DRAWINGS. THE MOST CURRENT SET OF RED-LINES DRAWINGS SHALL ALSO BE BROUGHT TO EACH MONTHLY PROGRESS MEETING.
9. A GENERAL CONSTRUCTION PHASING PLAN HAS BEEN PROVIDED TO ASSIST THE CONTRACTOR IN CONSTRUCTION SEQUENCING. THE CONTRACTOR SHALL PROVIDE THE OWNER WITH A DETAILED CONSTRUCTION PHASING PLAN FOR APPROVAL, PRIOR TO BEGINING CONSTRUCTION.
10. FIELD CONDITIONS MAY NECESSITATE ALIGNMENT AND GRADE DEVIATION OF THE PROPOSED PIPELINES TO AVOID CONFLICTS. NO ADDITIONAL PAYMENT SHALL BE MADE WITHOUT PRIOR APPROVAL OF THE OWNER AND THE OWNER'S ENGINEER.
11. THE CONTRACTOR SHALL INCLUDE IN HIS BID, BY-PASS PUMPING FACILITIES, PUMPS, FITTINGS, LABOR, ETC. AS NECESSARY, BASED ON METHOD AND SEQUENCE OF CONSTRUCTION TO COMPLETE ALL WORK WHILE MAINTAINING THE EXISTING WASTEWATER TREATMENT PLANT OPERATIONS AT ALL TIMES.
12. ALL PROPOSED WORK SHALL BE COORDINATED WITH WASTEWATER TREATMENT PLANT PERSONNEL AND MANATEE COUNTY UTILITIES DEPARTMENT AT LEAST TWO WEEKS IN ADVANCE OF PROPOSED CONSTRUCTION.
13. THE CONTRACTOR SHALL FURNISH SHOP DRAWINGS TO THE ENGINEER FOR APPROVAL OF ALL PIPE CONNECTIONS, TRANSITIONS, AND SPECIALS PRIOR TO FABRICATION OR DELIVERY TO THE JOB SITE.
14. CONNECTIONS TO EXISTING FACILITIES SHALL BE ACCOMPLISHED IN A NEAT WORKMANLIKE MANNER. WHEN FIELD CONDITIONS INDICATE ANY VARIANCE FROM DETAILED METHODS, THE CONTRACTOR SHALL PROVIDE COMPREHENSIVE AND DETAILED DRAWINGS FOR OWNER REVIEW AND APPROVAL PRIOR TO MAKING THE CONNECTIONS.
15. UNLESS OTHERWISE INDICATED OR APPROVED, ALL BELOW GROUND DUCTILE IRON PIPE SHALL HAVE PUSH-ON OR MECHANICAL JOINTS, AND ALL ABOVE GROUND DUCTILE IRON PIPE SHALL HAVE FLANGED JOINTS. ALL JOINTS SHALL BE FULLY RESTRAINED.
16. ALL PIPELINES SHALL HAVE A MINIMUM COVER OF 36" BELOW EXISTING GRADE UNLESS OTHERWISE NOTED OR DIRECTED.
17. SANITARY SEWERS AND FORCE MAINS CROSSING OVER OR UNDER WATER MAINS SHALL BE LAID TO PROVIDE A MINIMUM VERTICAL DISTANCE OF 18" BETWEEN THE INVERT OF THE UPPER PIPE AND THE CROWN OF THE LOWER PIPE. WHERE THIS MINIMUM SEPARATION CANNOT BE MAINTAINED, THE CROSSING SHALL BE ARRANGED SO THAT THE SEWER OR FORCE MAIN PIPE JOINTS ARE EQUIDISTANT FROM THE POINT OF CROSSING WITH NO LESS THAN 10' BETWEEN ANY TWO JOINTS. AS AN ALTERNATE, THE SEWER OR FORCE MAIN MAY BE PLACED IN A WATERTIGHT CASING PIPE.
18. WATER SHALL NOT BE PERMITTED IN BUILDING EXCAVATIONS AND TRENCHES DURING CONSTRUCTION. DEWATERING IS REQUIRED TO A MINIMUM OF 18" BELOW BOTTOM OF EXCAVATION.
19. THE CONTRACTOR SHALL NOT ALLOW ANY DISCHARGE OF WASTEWATER TO LANDS AND/OR ADJACENT WATER BODIES OR STORM DRAINS. ANY LEAKAGE MUST BE CONTAINED AND TRANSFERRED BY THE CONTRACTOR TO THE PLANT DRAIN PUMP STATION AT THE WASTEWATER TREATMENT PLANT.
20. ALL BELOW-GRADE FITTINGS 4-INCHES AND GREATER IN DIAMETER SHALL BE MECHANICAL JOINT DUCTILE IRON WITH FACTORY APPLIED, FUSION BONDED EPOXY COATINGS FOR THEIR INTERIOR AND EXTERIOR SURFACES.
21. ALL EXPOSED PIPING SHALL BE PAINTED WITH DESIGNATED COLORS ASSOCIATED WITH THEIR USAGE AS PROVIDED IN THE SPECIFICATIONS.
22. ALL NEW PIPELINES SHALL BE FLUSHED, PRESSURE TESTED, AND APPROVED PRIOR TO TIE-INS TO EXISTING FACILITIES. THE CONTRACTOR WILL BE ALLOWED TO USE TEMPORARY PLUGS FOR PRESSURE TESTING.
23. ALL CONCRETE THRUST BLOCKS INSTALLED FOR TESTING PURPOSES AND NOT REQUIRED FOR THE PIPELINE SHALL BE REMOVED AND DISPOSED OF BY THE CONTRACTOR PRIOR TO FINAL ACCEPTANCE.
24. CONTRACTOR SHALL MAINTAIN A CLEAR PATH FOR ALL SURFACE WATER DRAINAGE STRUCTURES AND DITCHES DURING ALL PHASES OF CONSTRUCTION.THE CONTRACTOR SHALL BE REQUIRED TO INSTALL ALL EROSION, SEDIMENT AND TURBIDITY CONTROL MEASURES PRIOR TO CONSTRUCTION OF ANY COMPONENTS ASSOCIATED WITH THE PROJECT. SEDIMENT CONTROL INCLUDES SILT DAMS, TRAPS, EROSION PROTECTION, AND ANY OTHER APPURTENANCES NEEDED BUT NOT NECESSARILY SHOWN ON THESE DRAWINGS.
25. CONTRACTOR SHALL PROVIDE PROTECTIVE MATTING, FUEL CONTAINMENT AND ALL OTHER MATERIALS, EQUIPMENT AND LABOR TO PROTECT THE STAGING AREA DURING CONSTRUCTION.
26. CONTRACTOR SHALL, PRIOR TO BEGINNING CONSTRUCTION, SUBMIT A "FUELING SPILL PREVENTION PLAN" THAT SHALL CLEARLY INDICATE HOW FUEL SPILLS WILL BE PREVENTED WHEN FUELING BOTH WITHIN AND OUTSIDE OF THE STAGING AREA.
27. CONTRACTOR SHALL SUBMIT A DEWATERING PLAN FOR APPROVAL PRIOR TO BEGINNING CONSTRUCTION. DEWATERING SHALL BE CONDUCTED IN ACCORDANCE WITH THE BMPS IDENTIFIED IN CHAPTER 4, 4.40 "DEWATERING" OF "THE FLORIDA STORMWATER EROSION AND SEDIMENTATION CONTROL INSPECTOR'S MANUAL."

SURVEY NOTES

1. ELEVATIONS ARE BASED ON MANATEE COUNTY BENCHMARK 133-2, A DISK AND RIVET ON TOP OF THE NORTH 6" CURB, AT A BRIDGE OVER A CANAL THAT RUNS NORTH AND SOUTH AND IS EAST OF THE TREATMENT PLANT, 50'± EAST OF THE INTERSECTION OF THE ENTRANCE ROAD AND THE ROAD THAT LEADS TO THE TREATMENT PLANT ADMINISTRATION BUILDING, HAVING AN ELEVATION OF 28.686, NATIONAL GEODETIC VERTICAL DATUM 1929 (NGVD 29).
2. ALL COORDINATES ARE BASED ON THE FLORIDA STATE PLANE COORDINATE SYSTEM FOR THE WEST ZONE (SPC FL W), NORTH AMERICAN DATUM OF 1983/1989 ADJUSTMENT (NAD 83/99), TRANSVERSE MERCATOR PROJECTION AND ARE MATCHED TO THE FOLLOWING NATIONAL GEODETIC SURVEY (NGS) PUBLISHED CONTROL.

   ORIGINATING COORDINATES:

   STATION DESIGNATION – NORTHING – EASTING

   GS 009 – 1158044.30 – 484782.22

   173 84 A45 – 1171938.88 – 490517.99
3. CONTRACTOR SHALL EMPLOY A PROFESSIONAL SURVEYOR, LICENSED IN THE STATE OF FLORIDA TO PERFORM CONSTRUCTION STAKING IN ACCORDANCE WITH RULE 61G17-6.004(3) OF THE FLORIDA ADMINISTRATIVE CODE.
4. THE LOCATIONS AND ELEVATIONS OF ALL EXISTING FACILITIES SHOWN WITHIN THE LIMITS OF CONSTRUCTION ARE PROVIDED BY FORESIGHT SURVEYORS SPECIFICALLY FOR THIS PROJECT.

UTILITY NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING WITH THE FOLLOWING JURISDICTIONAL BODIES AND UTILITY COMPANIES:

   CALL LOCAL PUBLIC UTILITY NOTIFICATION CENTER

   MANATEE COUNTY TRANSPORTATION DEPT. GENE BROCK 2904 13TH STREET COURT E. BRADENTON, FL 34208 (941) 708-7509 Ext. 7509

   MANATEE COUNTY UTILITIES OPERATIONS BOB CROUCH 4422-C 68TH STREET W. BRADENTON, FL 34210 (941) 792-8811 Ext 5075

   VERIZON FLORIDA, INC. DON DURDEN 1701 RINGLING BLVD. SARASOTA, FL 34236 (941) 952-5418

   PARADISE CABLE – BROADBAND NETWORK, LLC WALTER ERIEL 3413 SR. 64 E. BRADENTON, FL 34208 (941) 748-3614 Ext. 24053

   FLORIDA POWER AND LIGHT LARRY RUSSO 175 12TH AVENUE EAST BRADENTON, FL 34208 (941) 753-1474

   TECO/PEOPLES GAS ED FOLEY 8351 WEST CT. SARASOTA, FL 34240 (941) 342-4028
2. ALL UTILITY CONSTRUCTION SHALL BE IN CONFORMANCE WITH THE LATEST VERSION OF THE MANATEE COUNTY UTILITY STANDARDS.
3. ALL BELOW GROUND DUCTILE IRON PIPE SHALL BE ENCASED IN A POLYETHYLENE WRAP IN ACCORDANCE WITH AWWA STANDARDS.
4. ALL VALVE BOX COVERS SHALL BE PAINTED TO INDICATE THEIR TYPE OF SERVICE.
5. ALL TEST POINT TAPPING SHALL BE CUT LOOSE FROM THE CORPORATION STOP AND COMPLETELY REMOVED AND DISPOSED OF BY THE CONTRACTOR PRIOR TO FINAL ACCEPTANCE. THE CORPORATION STOP SHALL BE CAPPED AND REMAIN IN PLACE.
6. ADJUST EXISTING MANHOLE FRAMES AND COVERS TO MATCH FOAL GRADE.

RESTORATION AND MISCELLANEOUS NOTES

1. THE CONTRACTOR SHALL PROVIDE AN ASPHALT PATCH FOR TRENCH AREAS CONSTRUCTED IN EXISTING ROADWAYS. ADJUST ALL CASTINGS TO MATCH NEW PAVEMENT SURFACE.
2. THE CONTRACTOR SHALL REPLACE ALL EXISTING PAVING, STABILIZED EARTH, CURBS, SIDEWALKS, FENCES, LANDSCAPING AND OTHER IMPROVEMENTS WITH THE SAME OR BETTER TYPE OF MATERIAL THAT WAS REMOVED DURING CONSTRUCTION OR AS DIRECTED BY THE ENGINEER.
3. ALL RESTORATION WORK PERFORMED THROUGHOUT THE PROJECT SHALL CONFORM TO EXISTING LINES AND GRADES UNLESS OTHERWISE NOTED.
4. ALL EXISTING FENCES DISTURBED DURING CONSTRUCTION SHALL BE REPLACED AND REINSTALLED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER UNLESS SHOWN TO BE REMOVED ON CONSTRUCTION PLANS.
5. CONTRACTOR SHALL RESTORE ALL IRRIGATION SYSTEM COMPONENTS TO PRE-CONSTRUCTION CONDITIONS.
6. THE CONTRACTOR SHALL ADJUST EXISTING MANHOLE FRAMES AND COVERS TO MATCH FINAL GRADE.
8. ALL DISTURBED GRASS AREAS SHALL BE RESTORED WITH SOLID SOD IN LIKE KIND UNLESS OTHERWISE DIRECTED BY OWNER

SIDEWALK NOTES

1. ALL SIDEWALKS SHALL BE CONSTRUCTED WITH 4 INCH THICK 3000 PSI CLASS I CONCRETE REINFORCED WITH 6X6 NO. 10 MESH.
2. SIDEWALKS SHALL BE CONSTRUCTED TO THE SPECIFICATIONS OF THE MANATEE COUNTY DEVELOPMENT STANDARDS AND A MINIMUM OF FIVE (5) FEET WIDE.
3. THE CONCRETE SHALL BE GIVEN A BROOM FINISH. THE SURFACE VARIATIONS SHALL NOT BE MORE THAN 1/2 INCH UNDER A TEN-FOOT STRAIGHTEDGE, NOR MORE THAN 1/8 INCH ON A FIVE-FOOT TRAVERSE SECTION. THE EDGE OF THE SIDEWALK SHALL BE CAREFULLY FINISHED WITH AN EDGING TOOL HAVING A RADIUS OF 1/2 INCH.
4. EXPANSION JOINT: EXPANSION JOINTS BETWEEN THE SIDEWALK AND DRIVEWAYS OR AT FIXED OBJECTS AND SIDEWALK INTERSECTIONS SHALL BE 1/2 INCH JOINTS.
5. CONTRACTION JOINTS: FIXED OPEN-TYPE CONTRACTION JOINTS SHALL BE FORMED BY STAKING A METAL BULKHEAD IN PLACE AND DEPOSITING THE CONCRETE ON BOTH SIDES. AFTER THE CONCRETE HAS SET SUFFICIENTLY TO PRESERVE THE WIDTH AND SHAPE OF THE JOINT, THE BULKHEAD SHALL BE REMOVED. AFTER THE SIDEWALK HAS BEEN FINISHED OVER THE JOINT, THE SLOT SHALL BE EDGED WITH A TOOL HAVING A 1/2 INCH RADIUS. SAWED JOINTS: A SLOT APPROXIMATELY 3/16 INCH WIDE AND NOT LESS THAN 1-1/2 INCHES DEEP SHALL BE CUT WITH A CONCRETE SAW AFTER THE CONCRETE HAS SET.

NO.	REVISIONS	BY	DATE	APP'D

DAVID C. HOWER, P.E. No. 36591

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Clearwater, Florida 33756
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MANATEE COUNTY, FLORIDA

NWRF EXPANSION PHASE 1

DRAWING INDEX AND GENERAL NOTES

DATE	APRIL 2011
MCC PROJ. #	1074-0115
DRAWN	BTB
DESIGNED	DCH
CHECKED	MTS
PROJ. MGR.	DCH

SCALE: HORIZONTAL: NONE, VERTICAL: NA

DRAWING NUMBER: G-0.2

STATUS: ISSUED FOR PERMIT

GENERAL NOTES

1. THESE PLANS ARE SOLELY TO ASSIST THE CONTRACTOR IN ASSESSING THE NATURE AND EXTENT OF THE EXISTING CONDITIONS WHICH MAY BE ENCOUNTERED DURING THE COURSE OF WORK. CONTRACTORS ARE DIRECTED TO CONDUCT WHATEVER INVESTIGATION THEY DEEM NECESSARY, PRIOR TO BIDDING, TO DETERMINE THE ACTUAL CONDITIONS THAT WILL BE ENCOUNTERED.
2. LOCATIONS, ELEVATIONS AND DIMENSIONS OF EXISTING UTILITIES, STRUCTURES, AND OTHER FEATURES ARE SHOWN BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF PREPARATION OF THESE PLANS BUT DO NOT PURPORT TO BE ABSOLUTELY CORRECT. THE CONTRACTOR SHALL VERIFY, PRIOR TO CONSTRUCTION, THE LOCATIONS, ELEVATIONS, AND DIMENSIONS OF ALL EXISTING UTILITIES, STRUCTURES, AND OTHER FEATURES (WHETHER OR NOT SHOWN ON THE PLANS) AFFECTING HIS WORK.
3. THE CONTRACTOR SHALL REVIEW AND VERIFY ALL DIMENSIONS ON THE PLANS AND REVIEW ALL FIELD CONDITIONS THAT MAY AFFECT CONSTRUCTION. SHOULD DISCREPANCIES OCCUR, THE CONTRACTOR SHALL NOTIFY THE ENGINEER TO OBTAIN WRITTEN CLARIFICATION BEFORE COMMENCING WITH CONSTRUCTION.
4. THE CONTRACTOR SHALL PROTECT ALL EXISTING STRUCTURES, STORM DRAINS, SEWERS, UTILITIES, AND OTHER FACILITIES IN THE CONSTRUCTION AREA. THE CONTRACTOR SHALL REPAIR ANY DAMAGES DUE TO HIS CONSTRUCTION ACTIVITIES AT NO ADDITIONAL COST TO THE OWNER.
5. WHERE IT IS NECESSARY TO DEFLECT PIPE EITHER HORIZONTALLY OR VERTICALLY, PIPE JOINT DEFLECTION SHALL NOT EXCEED 75% OF THE MANUFACTURERS' MAXIMUM RECOMMENDED DEFLECTION.
6. THERE ARE TO BE NO "SIZE ON SIZE TAPS" OR "SIZE ON SMALLER TAPS" ON THIS PROJECT.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF THE EXISTING DRAINAGE SYSTEM WITHIN THE LIMITS OF THE PROJECT AREA FOR THE DURATION OF THE PROJECT.
8. THE CONTRACTOR SHALL PROVIDE CERTIFIED RECORD DRAWINGS AS OUTLINED IN THE SPECIFICATIONS. RED-LINE DRAWINGS SHALL BE CURRENT WITH EACH PAY APPLICATION SUBMITTED AND WILL BE CHECKED AS PART OF THE PAY APPLICATION REVIEW PROCESS. PAYMENT WILL NOT BE MADE TO CONTRACTOR WITHOUT APPROVED RED-LINE DRAWINGS.
9. A GENERAL CONSTRUCTION PHASING PLAN HAS BEEN PROVIDED TO ASSIST THE CONTRACTOR IN CONSTRUCTION SEQUENCING. THE CONTRACTOR SHALL PROVIDE THE OWNER WITH A DETAILED CONSTRUCTION PHASING PLAN FOR APPROVAL, PRIOR TO BEGINNING CONSTRUCTION.
10. FIELD CONDITIONS MAY NECESSITATE ALIGNMENT AND GRADE DEVIATION OF THE PROPOSED PIPELINES TO AVOID CONFLICTS. NO ADDITIONAL PAYMENT SHALL BE MADE WITHOUT PRIOR APPROVAL OF THE OWNER AND THE OWNER'S ENGINEER.
11. THE CONTRACTOR SHALL INCLUDE IN HIS BID; BY-PASS PUMPING FACILITIES, PUMPS, FITTINGS, LABOR, ETC. AS NECESSARY, BASED ON METHOD AND SEQUENCE OF CONSTRUCTION TO COMPLETE ALL WORK WHILE MAINTAINING THE EXISTING WASTEWATER TREATMENT PLANT OPERATIONS AT ALL TIMES.
12. ALL PROPOSED WORK SHALL BE COORDINATED WITH WASTEWATER TREATMENT PLANT PERSONNEL AND MANATEE COUNTY UTILITIES DEPARTMENT AT LEAST TWO WEEKS IN ADVANCE OF PROPOSED CONSTRUCTION.
13. THE CONTRACTOR SHALL FURNISH SHOP DRAWINGS TO THE ENGINEER FOR APPROVAL OF ALL PIPE CONNECTIONS, TRANSITIONS, AND SPECIALS PRIOR TO FABRICATION OR DELIVERY TO THE JOB SITE.
14. CONNECTIONS TO EXISTING FACILITIES SHALL BE ACCOMPLISHED IN A NEAT WORKMANLIKE MANNER. WHEN FIELD CONDITIONS INDICATE ANY VARIANCE FROM DETAILED METHODS, THE CONTRACTOR SHALL PROVIDE COMPREHENSIVE AND DETAILED DRAWINGS FOR OWNER REVIEW AND APPROVAL PRIOR TO MAKING THE CONNECTIONS.
15. UNLESS OTHERWISE INDICATED OR APPROVED, ALL BELOW GROUND DUCTILE IRON PIPE SHALL HAVE PUSH-ON OR MECHANICAL JOINTS, AND ALL ABOVE GROUND DUCTILE IRON PIPE SHALL HAVE FLANGED JOINTS. ALL JOINTS SHALL BE FULLY RESTRAINED.
16. ALL PIPELINES SHALL HAVE A MINIMUM COVER OF 36" BELOW EXISTING GRADE UNLESS OTHERWISE NOTED OR DIRECTED.
17. SANITARY SEWERS AND FORCE MAINS CROSSING OVER OR UNDER WATER MAINS SHALL BE LAID TO PROVIDE A MINIMUM VERTICAL DISTANCE OF 18" BETWEEN THE INVERT OF THE UPPER PIPE AND THE CROWN OF THE LOWER PIPE. WHERE THIS MINIMUM SEPARATION CANNOT BE MAINTAINED, THE CROSSING SHALL BE ARRANGED SO THAT THE SEWER OR FORCE MAIN PIPE JOINTS ARE EQUIDISTANT FROM THE POINT OF CROSSING WITH NO LESS THAN 10' BETWEEN ANY TWO JOINTS. AS AN ALTERNATE, THE SEWER OR FORCE MAIN MAY BE PLACED IN A WATERTIGHT CASING PIPE.
18. WATER SHALL NOT BE PERMITTED IN BUILDING EXCAVATIONS AND TRENCHES DURING CONSTRUCTION. DEWATERING IS REQUIRED TO A MINIMUM OF 18" BELOW BOTTOM OF EXCAVATION.
19. THE CONTRACTOR SHALL NOT ALLOW ANY DISCHARGE OF WASTEWATER TO LANDS AND/OR ADJACENT WATER BODIES OR STORM DRAINS. ANY LEAKAGE MUST BE CONTAINED AND TRANSFERRED BY THE CONTRACTOR TO THE PLANT DRAIN PUMP STATION AT THE WASTEWATER TREATMENT PLANT.
20. ALL BELOW-GRADE FITTINGS SHALL BE MECHANICAL JOINT DUCTILE IRON WITH FACTORY APPLIED, FUSION BONDED POLYETHYLENE LINING FOR ALL PIPE 4-INCHES AND GREATER IN DIAMETER.
21. ALL EXPOSED PIPING SHALL BE PAINTED WITH DESIGNATED COLORS ASSOCIATED WITH THEIR USAGE AS PROVIDED IN THE SPECIFICATIONS.
22. ALL NEW PIPELINES SHALL BE FLUSHED, PRESSURE TESTED, AND APPROVED PRIOR TO TIE-INS TO EXISTING FACILITIES. THE CONTRACTOR WILL BE ALLOWED TO USE TEMPORARY PLUGS FOR PRESSURE TESTING.
23. ALL CONCRETE THRUST BLOCKS INSTALLED FOR TESTING PURPOSES AND NOT REQUIRED FOR THE PIPELINE SHALL BE REMOVED AND DISPOSED OF BY THE CONTRACTOR PRIOR TO FINAL ACCEPTANCE.
24. CONTRACTOR SHALL MAINTAIN A CLEAR PATH FOR ALL SURFACE WATER DRAINAGE STRUCTURES AND DITCHES DURING ALL PHASES OF CONSTRUCTION. THE CONTRACTOR SHALL BE REQUIRED TO INSTALL ALL EROSION, SEDIMENT AND TURBIDITY CONTROL MEASURES PRIOR TO CONSTRUCTION OF ANY COMPONENTS ASSOCIATED WITH THE PROJECT. SEDIMENT CONTROL INCLUDES SILT DAMS, TRAPS, EROSION PROTECTION, AND ANY OTHER APPURTENANCES NEEDED BUT NOT NECESSARILY SHOWN ON THESE DRAWINGS.
25. CONTRACTOR SHALL PROVIDE PROTECTIVE MATTING, FUEL CONTAINMENT AND ALL OTHER MATERIALS, EQUIPMENT AND LABOR TO PROTECT THE STAGING AREA DURING CONSTRUCTION.
26. CONTRACTOR SHALL, PRIOR TO BEGINNING CONSTRUCTION, SUBMIT A "FUELING SPILL PREVENTION PLAN" THAT SHALL CLEARLY INDICATE HOW FUEL SPILLS WILL BE PREVENTED WHEN FUELING BOTH WITHIN AND OUTSIDE OF THE STAGING AREA.
27. CONTRACTOR SHALL SUBMIT A DEWATERING PLAN FOR APPROVAL PRIOR TO BEGINNING CONSTRUCTION. DEWATERING SHALL BE CONDUCTED IN ACCORDANCE WITH THE BMPS IDENTIFIED IN CHAPTER 4, 4.40 "DEWATERING" OF "THE FLORIDA STORMWATER EROSION AND SEDIMENTATION CONTROL INSPECTOR'S MANUAL".

SURVEY NOTES

1. ELEVATIONS ARE BASED ON MANATEE COUNTY BENCHMARK 133-2, A DISK AND RIVET ON TOP OF THE NORTH 6" CURB, AT A BRIDGE OVER A CANAL THAT RUNS NORTH AND SOUTH AND IS EAST OF THE TREATMENT PLANT, 50'± EAST OF THE INTERSECTION OF THE ENTRANCE ROAD AND THE ROAD THAT LEADS TO THE TREATMENT PLANT ADMINISTRATION BUILDING, HAVING AN ELEVATION OF 28.886, NATIONAL GEODETIC VERTICAL DATUM 1929 (NGVD 29).
2. ALL COORDINATES ARE BASED ON THE FLORIDA STATE PLANE COORDINATE SYSTEM FOR THE WEST ZONE (SPC FL W), NORTH AMERICAN DATUM OF 1983/1999 ADJUSTMENT (NAD 83/99), TRANSVERSE MERCATOR PROJECTION AND ARE MATCHED TO THE FOLLOWING NATIONAL GEODETIC SURVEY (NGS) PUBLISHED CONTROL.

   ORIGINATING COORDINATES:

   STATION DESIGNATION - NORTHING - EASTING

   GIS 009 - 1168044.30 - 494782.22

   175 84 A45 - 1171936.68 - 490517.59
3. CONTRACTOR SHALL EMPLOY A PROFESSIONAL SURVEYOR, LICENSED IN THE STATE OF FLORIDA TO PERFORM CONSTRUCTION STAKING IN ACCORDANCE WITH RULE 61G17-6.004(3) OF THE FLORIDA ADMINISTRATIVE CODE.
4. THE LOCATIONS AND ELEVATIONS OF ALL EXISTING FACILITIES SHOWN WITHIN THE LIMITS OF CONSTRUCTION ARE PROVIDED BY FORESIGHT SURVEYORS SPECIFICALLY FOR THIS PROJECT.

UTILITY NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING WITH THE FOLLOWING JURISDICTIONAL BODIES AND UTILITY COMPANIES:

   SUNSHINE STATE ONE CALL OF FLORIDA, INC. — CALL 1-800-432-4770 — UTILITY NOTIFICATION CENTER

   MANATEE COUNTY TRANSPORTATION DEP. ALLEN BRADLEY 2964 13TH STREET COURT E. BRADENTON, FL 34208 (941) 708-7509

   MANATEE COUNTY UTILITIES OPERATIONS KATHY MANNING 4102-C 68TH STREET W. BRADENTON, FL 34210

   FLORIDA POWER AND LIGHT LARRY KLOTZ 123 19TH AVENUE EAST BRADENTON, FL 34208 (941) 753-4434

   TECO/PEOPLES GAS TED FELICCI 8891 YEO CT. SARASOTA, FL 34240 (941) 342-4026

   VERIZON FLORIDA, INC. DON DUNDEE 1701 FLORIDA BLVD. SARASOTA, FL 34236 (941) 552-5616

   PARAGON CABLE - BRIGHTHOUSE NETWORKS, LLC WALTER KRUG 5413 S.R. 64 E. BRADENTON, FL 34208 (941) 748-3816 Ext. 24803
2. ALL UTILITY CONSTRUCTION SHALL BE IN CONFORMANCE WITH THE LATEST VERSION OF THE MANATEE COUNTY UTILITY STANDARDS.
3. ALL BELOW GROUND DUCTILE IRON PIPE SHALL BE ENCASED IN A POLYETHYLENE WRAP IN ACCORDANCE WITH AWWA STANDARDS.
4. ALL VALVE BOX COVERS SHALL BE PAINTED TO INDICATE THEIR TYPE OF SERVICE.
5. ALL TEST POINT TAMPING SHALL BE CUT LOOSE FROM THE CORPORATION STOP AND COMPLETELY REMOVED AND DISPOSED OF BY THE CONTRACTOR PRIOR TO FINAL ACCEPTANCE. THE CORPORATION STOP SHALL BE CAPPED AND REMAIN IN PLACE.
6. ADJUST EXISTING MANHOLE FRAMES AND COVERS TO MATCH FINAL GRADE.

RESTORATION AND MISCELLANEOUS NOTES

1. THE CONTRACTOR SHALL PROVIDE AN ASPHALT PATCH FOR TRENCH AREAS CONSTRUCTED IN EXISTING ROADWAYS. ADJUST ALL CASTINGS TO MATCH NEW PAVEMENT SURFACE.
2. THE CONTRACTOR SHALL REPLACE ALL EXISTING PAVING, STABILIZED EARTH, CURBS, SIDEWALKS, FENCES, LANDSCAPING AND OTHER IMPROVEMENTS WITH THE SAME OR BETTER TYPE OF MATERIAL THAT WAS REMOVED DURING CONSTRUCTION OR AS DIRECTED BY THE ENGINEER.
3. ALL RESTORATION WORK PERFORMED THROUGHOUT THE PROJECT SHALL CONFORM TO EXISTING LINES AND GRADES UNLESS OTHERWISE NOTED.
4. ALL EXISTING FENCES DISTURBED DURING CONSTRUCTION SHALL BE REPLACED AND REINSTALLED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER UNLESS SHOWN TO BE REMOVED ON CONSTRUCTION PLANS.
5. LIMITS OF PROPOSED ROADWAY OVERLAY SHOWN ARE APPROXIMATE. CONTRACTOR SHALL OVERLAY ALL DISTURBED AREAS OF ACCESS ROAD AS PART OF THIS PROJECT.
6. CONTRACTOR SHALL RESTORE ALL IRRIGATION SYSTEM COMPONENTS TO PRE-CONSTRUCTION CONDITIONS.
7. THE CONTRACTOR SHALL ADJUST EXISTING MANHOLE FRAMES AND COVERS TO MATCH FINAL GRADE.
8. ALL DISTURBED GRASS AREAS SHALL BE RESTORED WITH SOLID SOD IN LIKE KIND UNLESS OTHERWISE DIRECTED BY OWNER.

SIDEWALK NOTES

1. ALL SIDEWALKS SHALL BE CONSTRUCTED WITH 4 INCH THICK 3000 PSI CLASS I CONCRETE REINFORCED WITH 6X6 NO. 10 MESH.
2. SIDEWALKS SHALL BE CONSTRUCTED TO THE SPECIFICATIONS OF THE MANATEE COUNTY DEVELOPMENT STANDARDS AND A MINIMUM OF FIVE (5) FEET WIDE.
3. THE CONCRETE SHALL BE GIVEN A BROOM FINISH. THE SURFACE VARIATIONS SHALL NOT BE MORE THAN 1/2 INCH UNDER A TEN-FOOT STRAIGHTEDGE, NOR MORE THAN 1/8 INCH ON A FIVE-FOOT TRAVERSE SECTION. THE EDGE OF THE SIDEWALK SHALL BE CAREFULLY FINISHED WITH AN EDGING TOOL HAVING A RADIUS OF 1/2 INCH.
4. EXPANSION JOINT. EXPANSION JOINTS BETWEEN THE SIDEWALK AND DRIVEWAYS OR AT FIXED OBJECTS AND SIDEWALK INTERSECTIONS SHALL BE 1/2 INCH JOINTS.
5. CONTRACTION JOINTS. FIXED OPEN-TYPE CONTRACTION JOINTS SHALL BE FORMED BY STAKING A METAL BULKHEAD IN PLACE AND DEPOSITING THE CONCRETE ON BOTH SIDES. AFTER THE CONCRETE HAS SET SUFFICIENTLY TO PRESERVE THE WIDTH AND SHAPE OF THE JOINT, THE BULKHEAD SHALL BE REMOVED. AFTER THE SIDEWALK HAS BEEN FINISHED OVER THE JOINT, THE SLOT SHALL BE EDGED WITH A TOOL HAVING A 1/2 INCH RADIUS. SAWED JOINTS: A SLOT APPROXIMATELY 3/16 INCH WIDE AND NOT LESS THAN 1-1/2 INCHES DEEP SHALL BE CUT WITH A CONCRETE SAW AFTER THE CONCRETE HAS SET.

APPROVED
STATE of FLORIDA
JAN 27 2011
DEPARTMENT of
ENVIRONMENTAL PROTECTION

11-24-10

TRAVIS N. TERPSTRA
LICENSE
No 71412
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

NO.	REVISIONS	BY

PHILIP J. LOCAC, P.E. No. 57527

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EB0006681
www.mckimcreed.com

MANATEE COUNTY, FLORIDA

NWRF EXPANSION

GENERAL NOTES

DATE	NOVEMBER 2010
WEC PROJ. #	3005.0122
DRAWN	BTN
DESIGNED	P.A.
CHECKED	JS
PROJ. MGR.	P.A.

SCALE: HORIZONTAL AS NOTED, VERTICAL N/A

DRAWING NUMBER: G-0.3

STATUS: ISSUE FOR CONSTRUCTION

PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES, ALL SOIL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE IN PLACE AND MAINTAINED THROUGHOUT CONSTRUCTION.

CONTRACTOR SHALL FOLLOW BEST MANAGEMENT PRACTICES DURING CONSTRUCTION.

CONTRACTOR SHALL PREPARE AND SUBMIT A STORMWATER POLLUTION PREVENTION PLAN (SWPPP) FOR REVIEW AND APPROVAL PRIOR TO ANY CONSTRUCTION ACTIVITIES.

SEE SPECIFICATIONS FOR DETAILS.

CARE SHALL BE EXERCISED TO PREVENT DISTURBANCE OF NATURAL VEGETATION IN AREAS NOT PROPOSED FOR IMMEDIATE CONSTRUCTION.

ALL CUT AND FILL SLOPES AND DISTURBED AREAS SHALL BE SEEDED AND MULCHED TO PREVENT EROSION.

CONTRACTOR SHALL SUBMIT A DEWATERING PLAN INCLUDING BEST MANAGEMENT PRACTICES FOR REVIEW AND APPROVAL.

CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING PERMITS FOR ANY OFF-SITE DISPOSAL AREAS.

ADDITIONAL SILT FENCE IN FRONT OF ANY STORM INLETS PRESUMED TO DRAIN INTO THE PLANT.

CONTRACTOR SHALL PROTECT EXISTING PLANT PROCESS

DEPARTMENT of ENVIRONMENTAL PROTECTION

JUN 2

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MANATEE COUNTY, FLORIDA

NWRF EXPANSION PHASE 1

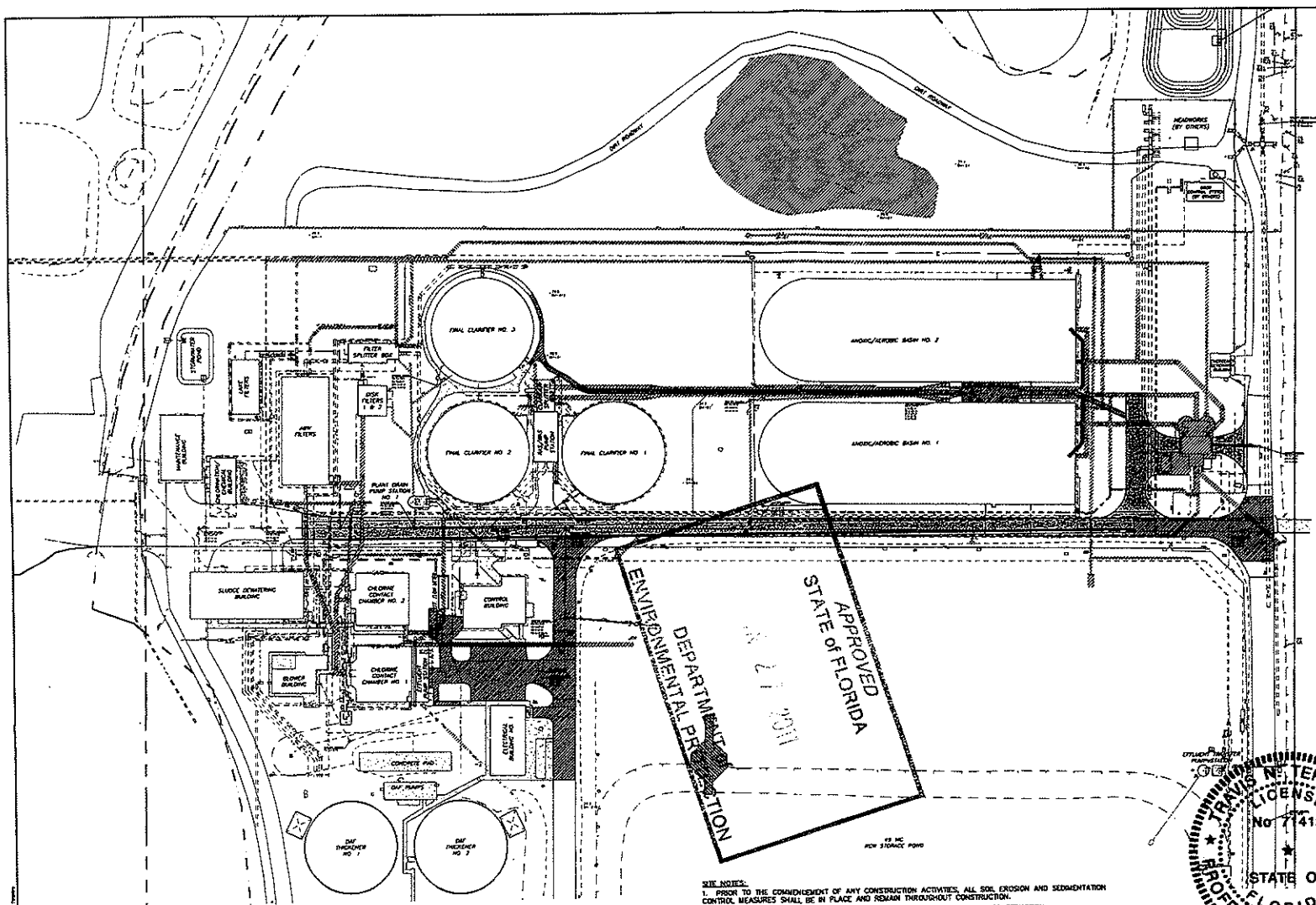
SOIL EROSION AND SEDIMENTATION CONTROL PLAN

DATE: APRIL 2021
NOR PROJ. # 1022-2050
DRAWN BPT
DESIGNED DCM
CHECKED JC
FINAL APPR. DCM

SCALE
HORIZONTAL: 1" = 100'
VERTICAL: N/A

G-0.5

STATUS: ISSUED FOR PERMIT
REVISION



Dept. of Environmental Protection
FEB 11 2011
Southwest District

DEMOLITION NOTES

1. REMOVE HEADWORKS AND ODOR CONTROL SYSTEM
2. CORE DRILL HOLE IN CONCRETE WALL FOR 36" D.I.P.
3. REMOVE 42" CONCRETE PIPE
4. REMOVE INTERNAL RECYCLE PUMPS
5. FILL 24" INTERNAL RECYCLE PIPING WITH GROUT AND INSTALL CAP ON BOTH ENDS OF PIPING
6. REMOVE 24" D.I.P.
7. INSTALL 36" BLIND FLANGE
8. REMOVE 36" D.I.P.
9. REMOVE 36" D.I.P.
10. REMOVE 36" CONCRETE PIPE
11. REMOVE 16" D.I.P.
12. INSTALL 16" BLIND CAP
13. FILL 6" PVC PIPE WITH GROUT, CUT AND CAP BOTH ENDS
14. REMOVE 6" D.I.P.
15. REMOVE 20" FLOWMETER ASSEMBLY AND ACCESSORIES
16. REMOVE 20" D.I.P.
17. REMOVE 18" C.I.P.
18. REMOVE 6" PLANT DRAIN
19. REMOVE 6' CHAINLINK FENCE
20. REMOVE 12" D.I.P.
21. ABANDON 20" D.I.P. AND CAP
22. ABANDON 12" PVC AND PLUG BOTH ENDS
23. REMOVE 8" DIP
24. REMOVE SSMH
25. REMOVE 12" PD
26. REMOVE CHORWALL
27. SEE DETAIL "B" ON M-3.1
28. MODIFY EXISTING 20" PIPING AS SHOWN ON C-D.4.1 AND S-5.0
29. ABANDON 12" EFF AND CAP
30. REMOVE EXIST. DIRT PILE
31. REMOVE 8" PVC
32. REMOVE EXISTING DUCT BANK
33. RELOCATE FLOWMETER AND CONTROL VALVE
34. CORE DRILL HOLE IN CONCRETE WALL FOR 36" D.I.P.
35. RELOCATE 16" D.I.P., FITTINGS AND VALVES
36. REMOVE 4" PVC ROW
37. FILL WITH GROUT AND CAP
38. REMOVE CONCRETE SPILLWAY AND FILL WITH EARTH

ELECTRICAL DEMOLITION NOTES

1. REMOVE ALL POWER AND SIGNAL CABLES TO THE SOURCE.
2. EXISTING CIRCUITS FOR REMOVED MISCELLANEOUS DEVICES SUCH AS RECEPTACLES, LIGHT FIXTURES AND SWITCHES SHALL BE RECONNECTED TO ANY REMAINING DEVICES ON THE CIRCUIT.
3. REMOVE ALL EXPOSED (NON-EMBEDDED) CONDUIT THAT WILL BE ABANDONED.
4. PATCH ALL CONDUIT MOUNTING HOLES.
5. CUT ALL CONDUIT PENETRATIONS THROUGH WALL, FLOORS, SLABS, ETC. FLUSH AND PATCH ALL OPENINGS.

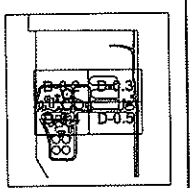
LEGEND

- REMOVE
- FILL WITH GROUT
- ASPHALT, BASE AND SUBBASE TO BE REMOVED
- ASPHALT/SIDEWALK TO BE REMOVED
- ABANDON IN PLACE AND CAP

SITE NOTES:

1. PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES, ALL SOIL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE IN PLACE AND REMAIN THROUGHOUT CONSTRUCTION.
2. CONTRACTOR SHALL FOLLOW BEST MANAGEMENT PRACTICES THROUGHOUT CONSTRUCTION.
3. CONTRACTOR SHALL PREPARE AND SUBMIT A STORM WATER POLLUTION PREVENTION PLAN (SWPPP) FOR REVIEW AND APPROVAL PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES.
4. CONTRACTOR SHALL PREPARE AND SUBMIT A DISPOSAL PLAN FOR EXCAVATION MATERIAL AND DISPOSAL OF THE EXISTING TOPSOIL PILE INCLUDING THE LOCATION OF DISPOSAL SITE(S) AND DISPOSAL PLANS SHOWING APPLICABLE BEST MANAGEMENT PRACTICES FOR REVIEW AND APPROVAL PRIOR TO ANY EARTHWORK ACTIVITIES.

TRAVIS N. TERPSTRA
LICENSE
No. 71412
STATE OF FLORIDA
PROFESSIONAL ENGINEER
2-10-11



DEMOLITION KEY

NO.	DESCRIPTION	DATE		
	NORMAN A. SCALLY, P.E. No. 61336			

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EB0008691
www.mckimcreed.com

MANATEE COUNTY, FLORIDA

NWRF EXPANSION

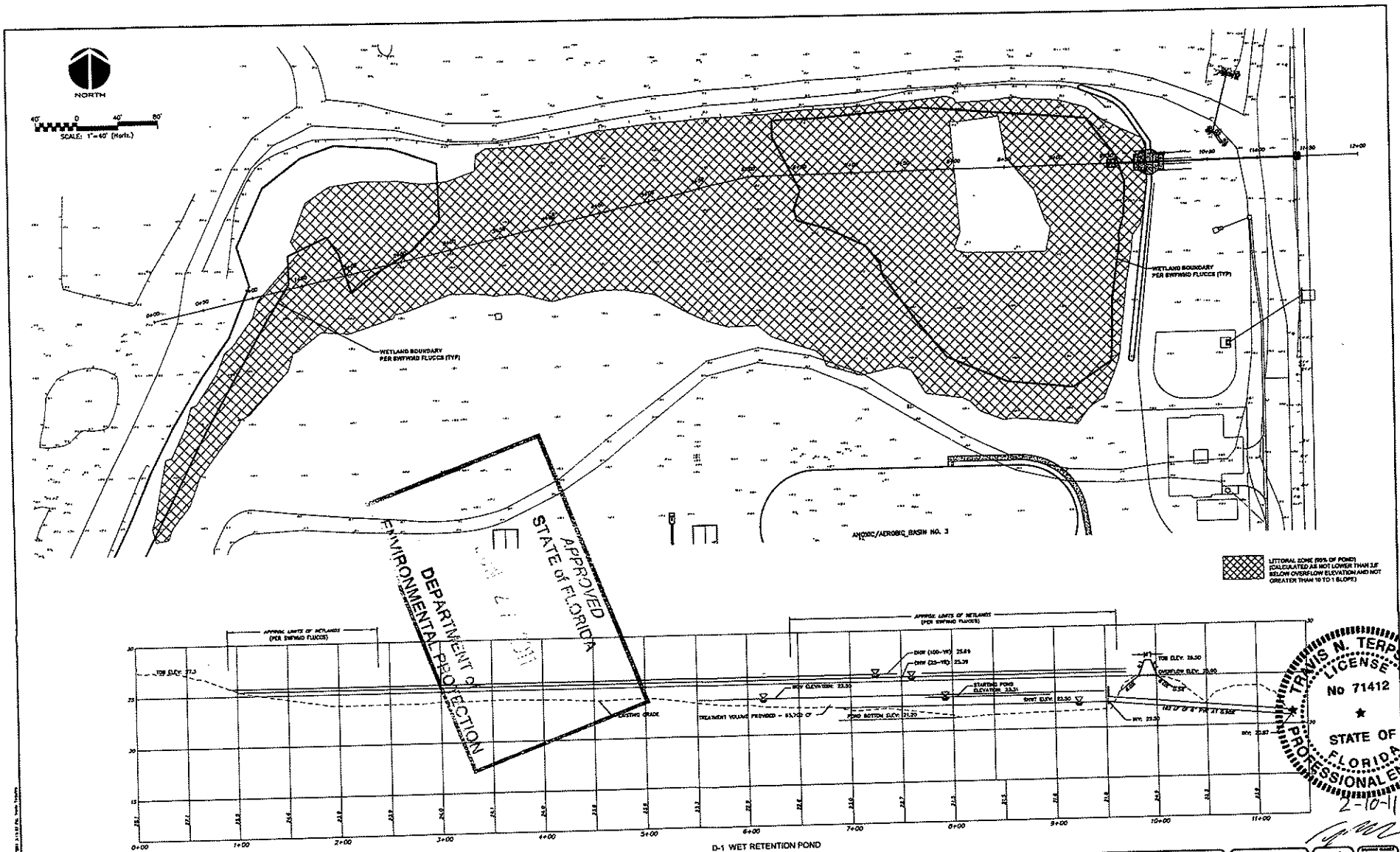
DEMOLITION SITE PLAN NOTES AND LEGEND

DATE:	FEBRUARY 2011
JOB NO.	1024-0032
DRAWN	BPK
DESIGNED	NJS
CHECKED	DCR
PROJ. MGR.	PJL

SCALE: HORIZONTAL 1" = 50' VERTICAL: NA

D-0.1

STATUS: ISSUE FOR CONSTRUCTION



D-1 WET RETENTION POND

TRAVIS N. TERPSTRA LICENSE No 71412 STATE OF FLORIDA PROFESSIONAL ENGINEER

2-10-11

REVISIONS	NO.	DATE

PHILIP J. LODYC, P.E. No. 37527

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MANATEE COUNTY, FLORIDA

NWRF EXPANSION

STORMWATER POND DETAILS

DATE:	FEBRUARY 2011
MC PROJ. #	1274-0122
DRAWN	DMP
DESIGNED	TNT
CHECKED	JPL
PROJ. MGR.	PJL

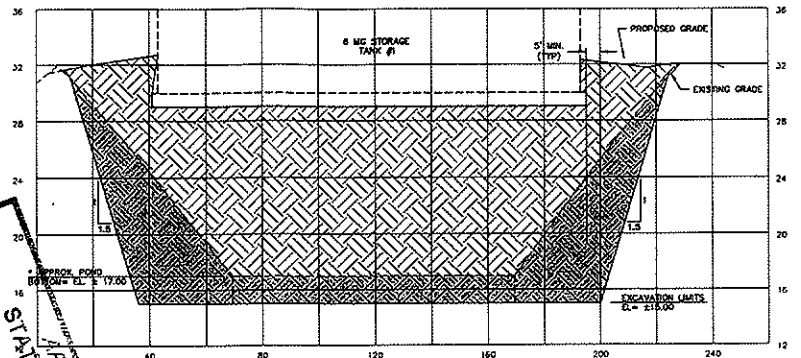
SCALE: HORIZONTAL 1"=40' VERTICAL: NA

C-0.3.11

STATUS: ISSUE FOR CONSTRUCTION

NOTES:

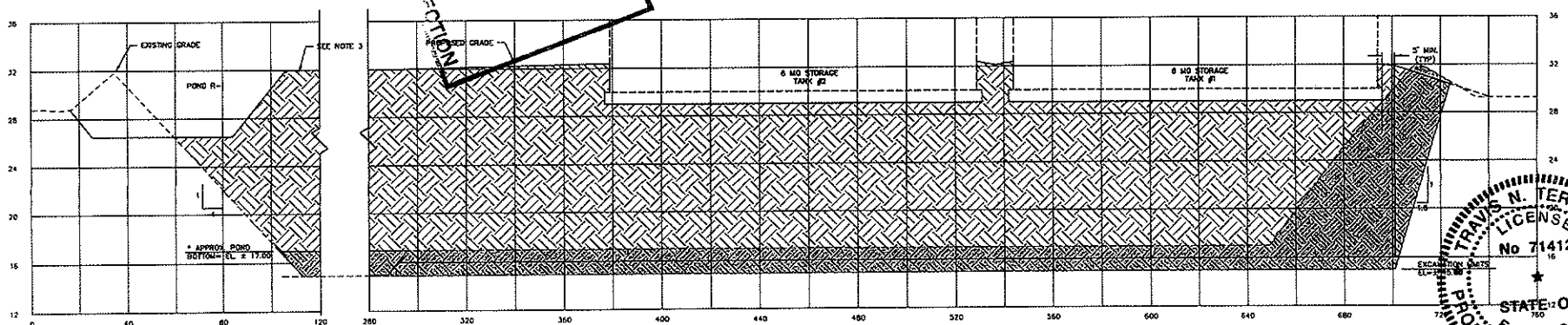
1. PREPARATION OF THE SUBGRADE PRIOR TO POND BACKFILLING WILL NECESSITATE REMOVAL AND REPLACEMENT OF POND BOTTOM SILTS AS WELL AS THE VERY LOOSE SILTY SOILS ON THE FLANKS OF THE POND (SEE THE GEOTECHNICAL REPORT FOR FURTHER REQUIREMENTS). THE ENTIRE TANK FOOTPRINT, PLUS A MARGIN OF AT LEAST 5 FEET OUTSIDE THE FOUNDATION PERIMETER SHOULD BE STRIPPED DOWN TO THE EXISTING POND BOTTOM ELEVATION INCLUDING OVER-EXCAVATION OF ANY ACCUMULATED SEDIMENTS, FOLLOWED BY PROOF-ROLLING WITH HEAVY VIBRATORY COMPACTION EQUIPMENT. THE CONTRACTOR SHOULD ANTICIPATE THE EXCAVATION WOULD EXTEND TO APPROXIMATE EL. +15 FEET. COMPACTION SHOULD CONSIST OF NO LESS THAN TEN (10) COMPLETE COVERAGES THROUGHOUT THE ENTIRE TANK AREA PLUS A MARGIN OF NOT LESS THAN 5 FEET BEYOND THE TANK PERIMETERS. THE PERIMETER FOUNDATION AREA FOR THE TANK STRUCTURES SHOULD BE DENSIFIED AT THE BOTTOM OF FOOTING ELEVATION. COMPACTION SHOULD CONTINUE SO AS TO DEVELOP A UNIFORM DENSITY OF NOT LESS THAN 95% OF THE MODIFIED PROCTOR MAXIMUM DRY DENSITY PER ASTM D-1557. COMPACTION TESTS SHOULD BE CONDUCTED AT INTERVALS OF NO LESS THAN ONE (1) TEST FOR EACH 2500 SQUARE FEET AND EACH 50 FOOT OF FOUNDATION PERIMETER AT A DEPTH OF 1 FOOT AND AT THE COMPACTED SUBGRADE ELEVATION.
2. FILL OR BACKFILL REQUIRED TO ESTABLISH THE FINISHED GRADE SHOULD CONSIST OF CLEAN CONSOLIDATED FILL COMPRISING THE SP TO SP-SM UNIFIED SOIL CLASSIFICATION OR AASHTO A-3 CLASSIFICATION. EACH LIFT, WHICH SHOULD NOT EXCEED 12 INCHES, SHOULD BE UNIFORMLY COMPACTED TO NOT LESS THAN 95% OF THE MODIFIED PROCTOR MAXIMUM DRY DENSITY.
3. THE WESTERN PORTION OF THE EXISTING REJECT POND IS NOT TO BE FILLED IN UNTIL THE NEW REJECT STORAGE TANKS AND ALL RELATED MECHANICAL, ELECTRICAL, AND CONTROLS SYSTEMS (INCLUDING REDUNDANT POWER SOURCES) ARE IN PLACE AND OPERATING TO THE SATISFACTION OF THE OWNER.



SECTION A/C-0.3.4

SCALE:HORIZ. 1" = 30' VERT. 1"= 4'

* = PER AUGUST 1997 NORTH REGIONAL WWTP EFFLUENT TRANSFER PUMP STATIONS AND STORAGE POND IMPROVEMENTS, RECORD DRAWINGS.



SECTION B/C-0.3.4

SCALE:HORIZ. 1" = 30' VERT. 1"= 4'

-TO REMOVE

-STRUCTURAL COMPACT FILL

APPROVED
STATE of FLORIDA
DEPARTMENT of TRANSPORTATION
NOV 21 2011

TRAVIS N. TERPSTRA
LICENSE
No 71412
STATE OF FLORIDA
PROFESSIONAL ENGINEER

11-24-10

REVISIONS	BY	DATE

PHILIP J. LOCKE, P.E. No. 57257

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MANATEE COUNTY, FLORIDA

NWRF EXPANSION

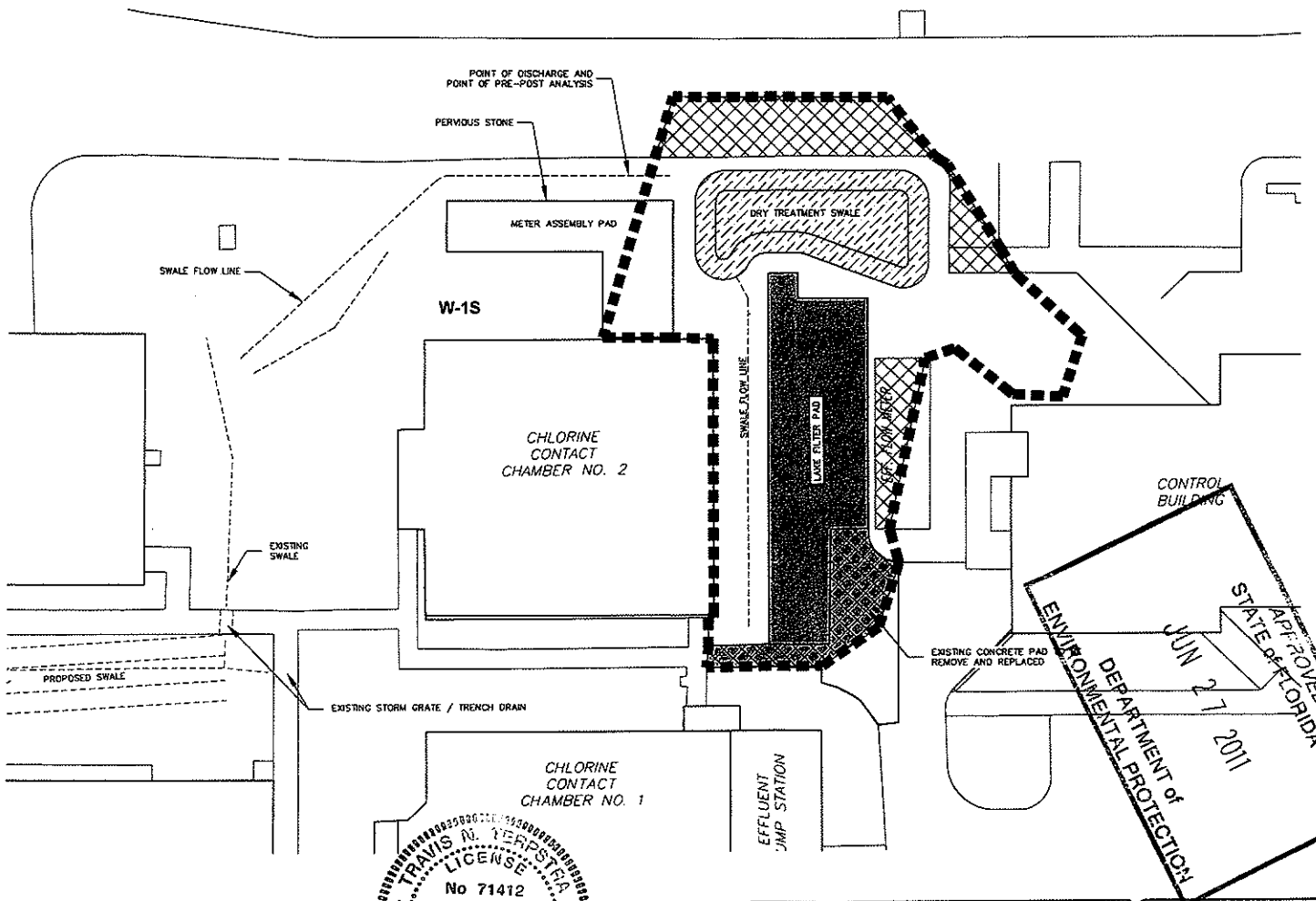
REJECT POND
INITIAL FILL SECTIONS

DATE: NOVEMBER 2010
MCE PROJ. # 1074-0122
DRAWN: BEV
DESIGNED: TT
CHECKED: JS
PROJ. MGR.: P.L.

SCALE
HORIZONTAL: 1"=30'
VERTICAL: 1"=4'

DRAWING NUMBER
C-0.3.8

STATUS: ISSUE FOR CONSTRUCTION



N

10' 0 10' 20'

SCALE: 1"=10' (Horiz.)

DRAINAGE BASIN W-1S IS A SMALL PORTION OF THE PROJECT SITE, LOCATED ENTIRELY WITHIN DRAINAGE BASIN W-1. SUB BASIN W-1S CONTAINS A 1,195 SQUARE FOOT CONCRETE PAD FOR A FILTER ASSEMBLY. RUNOFF FROM THE CONCRETE PAD FLOWS VIA SHEET FLOW AND SHALLOW CONCENTRATED FLOW INTO A DRY TREATMENT SWALE. THE SWALE PROVIDES PRE-POST PEAK DISCHARGE ATTENUATION FOR SUB BASIN W-1S AND ALLOWS THE TREATMENT VOLUME FOR THE NEW IMPERVIOUS AREAS TO INFILTRATE INTO THE NATIVE SOILS. THE DRY TREATMENT SWALE SYSTEM DISCHARGES OVER A STABILIZED OVERFLOW STRUCTURE THROUGH A PROPOSED GRASSED SWALE AND INTO AN EXISTING SWALE SYSTEM.

IMPROVEMENTS WITHIN SUB BASIN W-1S WILL BE CONSTRUCTED AND PLACED INTO OPERATION PRIOR TO THE REST OF THE PROJECT.

APPROXIMATELY 637 SF OF EXISTING IMPERVIOUS SURFACE IS PROPOSED TO BE DEMOLISHED AND REMOVED (SHOWN ON SHEET D-0.1). APPROXIMATELY 1,195 SF OF NEW IMPERVIOUS SURFACE IS PROPOSED FOR A NET INCREASE OF 558 SF OF IMPERVIOUS SURFACE.

STORMWATER TREATMENT IS PROVIDED FOR ALL IMPERVIOUS SURFACES DRAINING TO/THROUGH THE SWALE SYSTEM (NEGLECTING DEMOLITION) INCLUDING 1,310 SF OF EXISTING IMPERVIOUS SURFACES. THEREFORE, THE TOTAL AREA TO BE TREATED IS 2,505 SF.

Existing Conditions

	W-1s (sf)	W-1s (ac)
Impervious	1,310	0.03
Pervious	4,568	0.10
Pond	-	-
Total	5,878	0.13
Curve Number, CN	87	87

Proposed Conditions

	W-1s (sf)	W-1s (ac)
Impervious	2,505	0.06
Pervious	2,488	0.06
Pond	885	0.02
Total	5,878	0.13
Curve Number, CN	92	92

Required Treatment Volume (1/2" Over Impervious Surface)
104 cubic feet

Treatment Pond / Swale Volume Provided
Per Hydroflow pond report, the storage area below the overflow elevation of 27.60 is 467 cubic feet

Treatment Volume Recovery

	M-1
Infiltration Rate(in/hr)	0.25
Area of Pond Bottom (sf)	413
Infiltration through pond bottom only (cf/hr)	8.6
Time to Recover Treatment Volume (hr)	56.6

PROPOSED IMPERVIOUS
PROPOSED OPEN TANKAGE
EXISTING IMPERVIOUS
EXISTING OPEN TANKAGE
POND

TRAVIS N. TERPSTRA LICENSE No 71412 STATE OF FLORIDA PROFESSIONAL ENGINEER

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1365 Hamlet Avenue
Clearwater, Florida 33756
Phone: (727)442-7196, Fax: (727)461-3627
EB0006691
www.mckimcreed.com

MANATEE COUNTY, FLORIDA

NWRF EXPANSION PHASE 1

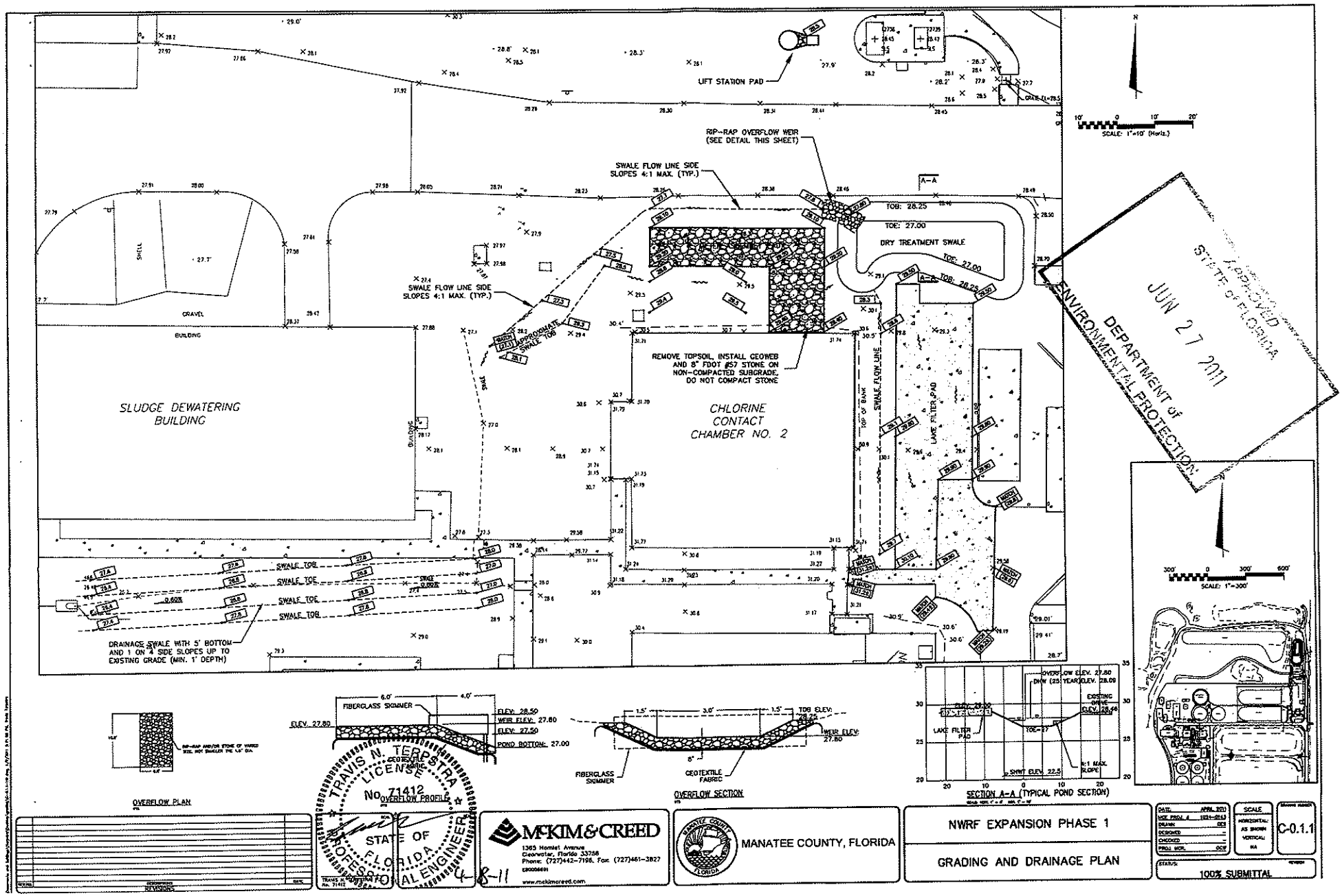
PROPOSED DRAINAGE MAP
W-1s, FILTER SUBBASIN IN DETAIL

DATE: APRIL 2011
MCF PROJ. # 1024-0143
DRAWN: TNT
DESIGNED: TNT
CHECKED: MS
PROJ. MGR.: DCW

SCALE: HORIZONTAL 1" = 40' VERTICAL: NA

FIG. 6c

STATUS: 100% SUBMITTAL



OVERFLOW PLAN

OVERFLOW PROFILE

OVERFLOW SECTION

SECTION A-A (TYPICAL POND SECTION)

TRAVIS N. TERSTRA
LICENSE
No. 71412
STATE OF FLORIDA
PROFESSIONAL ENGINEER
4-8-11

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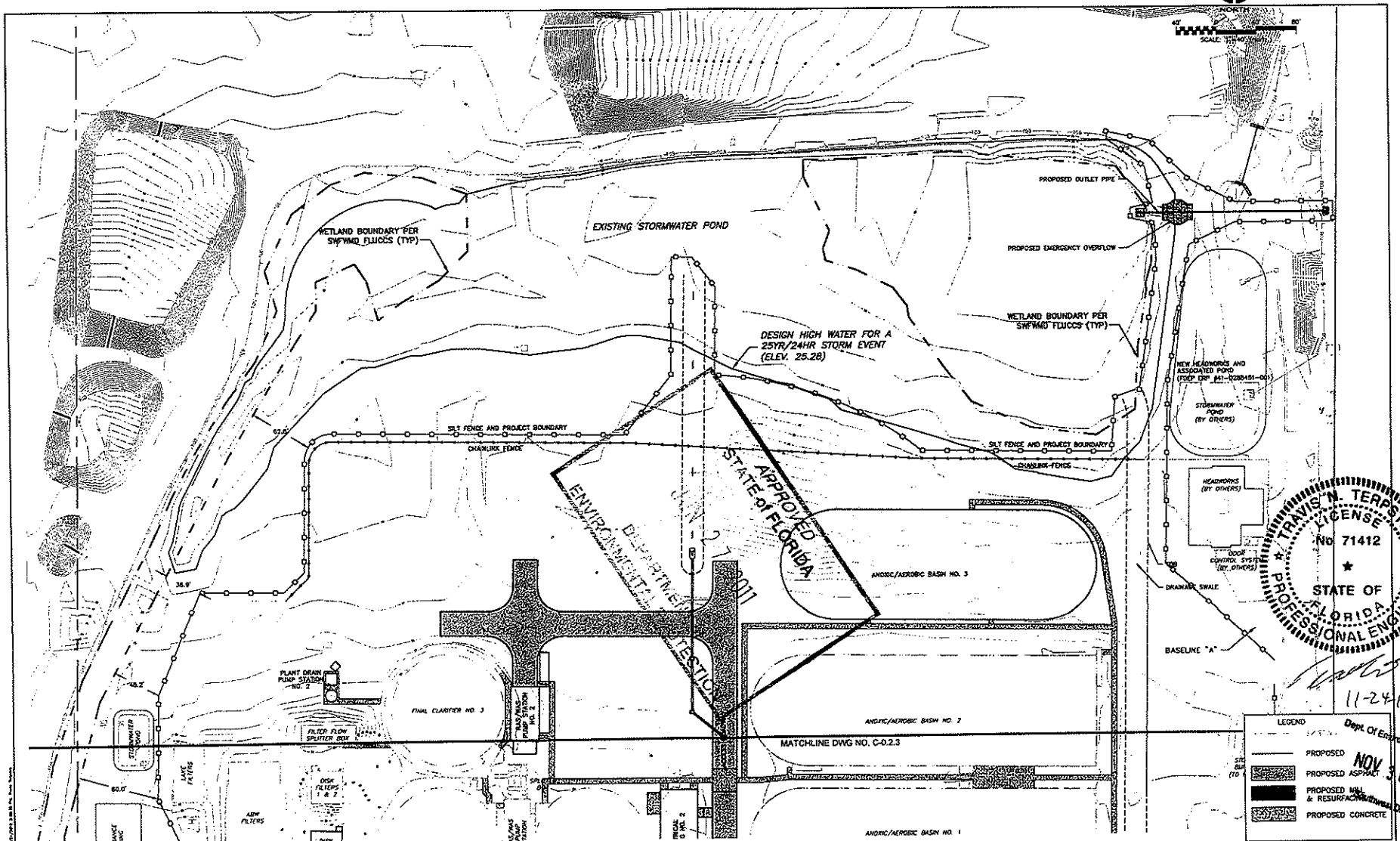
MANATEE COUNTY, FLORIDA

NWRF EXPANSION PHASE 1

GRADING AND DRAINAGE PLAN

DATE	APRIL 2011
MCE PROJ. #	1021-0143
DRAWN	DCS
DESIGNED	-
CHECKED	-
PROJ. MGR.	DCW
SCALE	HORIZONTAL: AS SHOWN VERTICAL: NA
DRAWING NUMBER	C-0.1.1
STATUS	100% SUBMITTAL
REVISION	



TRAVIS M. TERASTRA
LICENSE
No. 71412
STATE OF FLORIDA
PROFESSIONAL ENGINEER

11-24-10

Dept. Of Environmental Protection
NOV 30 2010
Southwest District

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Clearwater, Florida 33756
Phone: (727)442-7196, Fax: (727)461-3627
CA0000491
www.mckimcreed.com

MANATEE COUNTY, FLORIDA

NWRF EXPANSION

PROPOSED SITE PLAN – NORTH

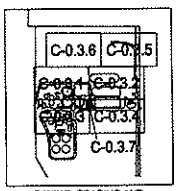
DATE	NOV/DEC 2010
MCK PROJ. #	1021-0132
DRAWN	BTK
DESIGNED	BTK
CHECKED	JB
PROJ. MGR.	PJL
STATUS	ISSUE FOR CONSTRUCTION

SCALE: HORIZONTAL: 1" = 40' VERTICAL: N.A.

DRAWING NUMBER: C-0.2.0

REVISIONS

PHILIP J. LOOKE, P.E. No. 51527



PAVING, GRADING AND DRAINAGE KEY

NORTH

CONNECT ROOF LEADERS TO INLET STRUCTURE WITH 6" SMOOTH INTERIOR WALL CORRUGATED HDPE @ 1% MINIMUM SLOPE

SEE DETAIL SHEET C-0.2.3

ELECTRICAL VAULT RIM ELEVATION RAISED TO ELEV. 29.45

ELECTRICAL BUILDING NO. 2

CLARIFIER NO. 1

HIGH POINT

PROPOSED 24' WIDE ASPHALT ACCESS DRIVE (SEE ASPHALT SECTION ON SHEET C-0.2.3)

FDOT TYPE F CURB AND GUTTER MODIFIED TO "SPILL OUT"

FFE = 29.80

R35.00

R15.00

R12.00

205+00

PROTECT EX POWER POLE AND MAINTAIN SURROUNDING GRADE (TYP)

APPROVED STATE of FLORIDA JUN 27 2011 DEPARTMENT of TRANSPORTATION

TRAVIS N. TERPSTRA LICENSE No 71412 STATE OF FLORIDA PROFESSIONAL ENGINEER

6-24-10

REVISIONS

PHILIP J. LOOKE, P.E. No. 57537

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MANATEE COUNTY, FLORIDA

NWRF EXPANSION

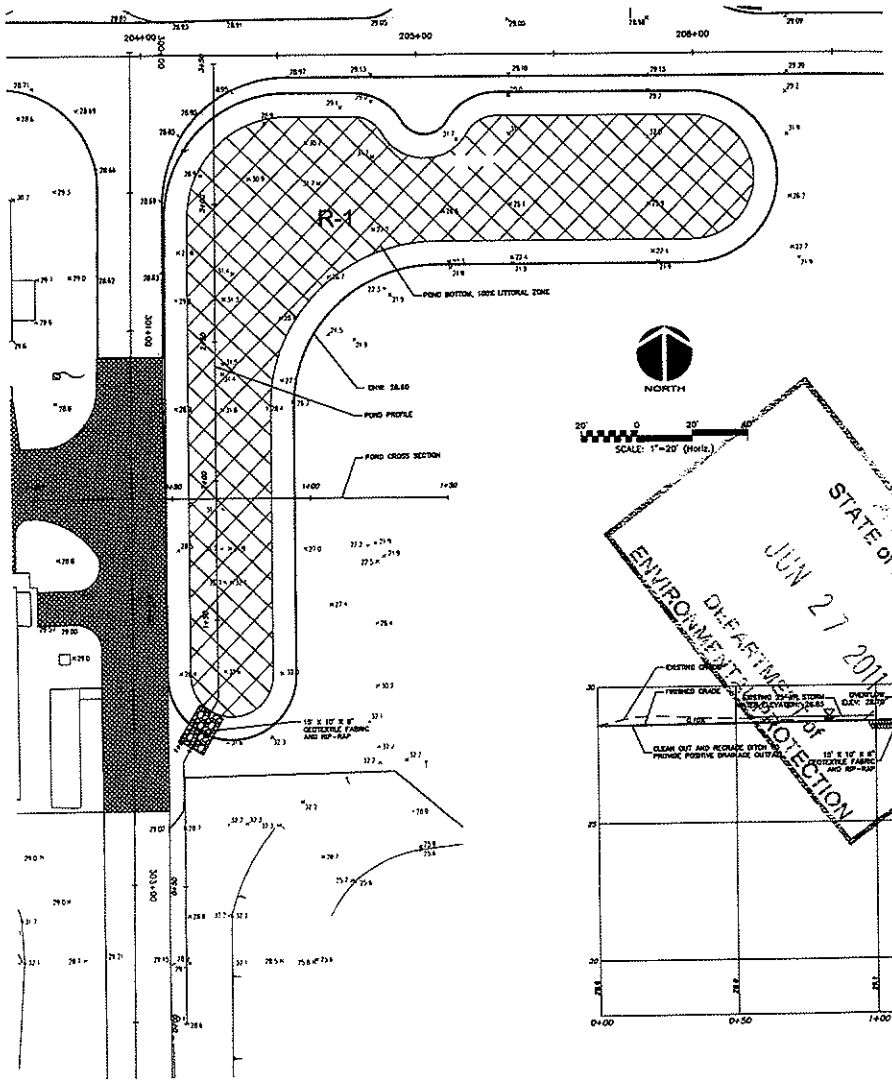
PAVING, GRADING AND DRAINAGE PLAN NO. 7

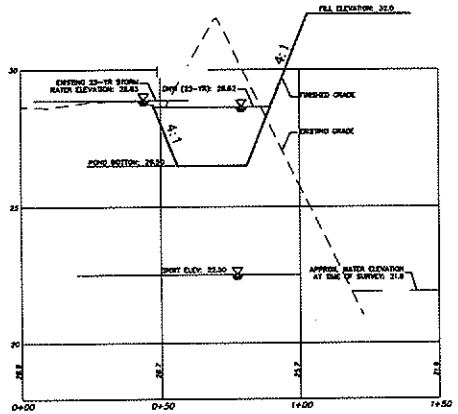
DATE: NOVEMBER 2010
MSE PROJ. # 1074-0122
DRAWN: BPT
DESIGNED: TT
CHECKED: JDL
PROJ. MGR.: PJL

SCALE
HORIZONTAL: 1"=10'
VERTICAL: NA

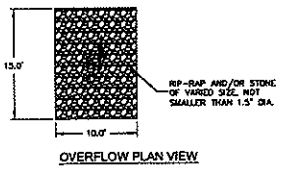
C-0.3.7

STATUS: ISSUE FOR CONSTRUCTION

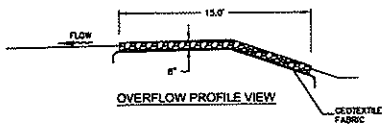




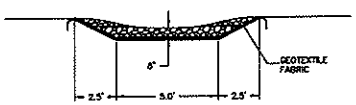
R-1: DRY DETENTION POND - CROSS SECTION VIEW



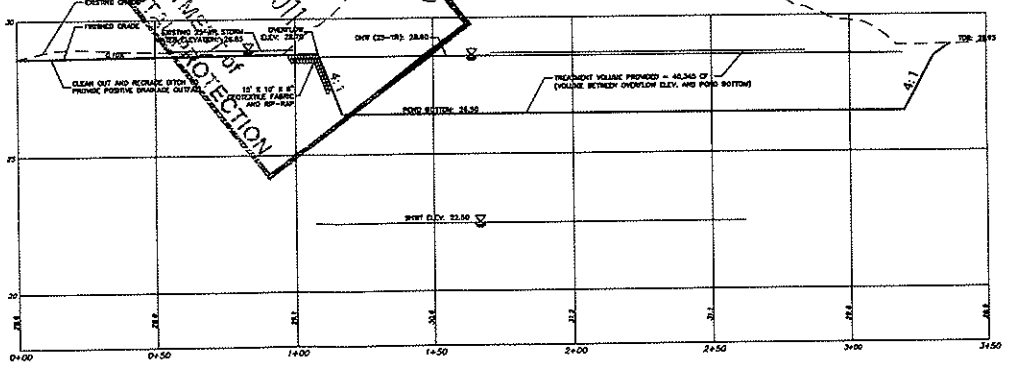
OVERFLOW PLAN VIEW



OVERFLOW PROFILE VIEW



OVERFLOW CROSS SECTION

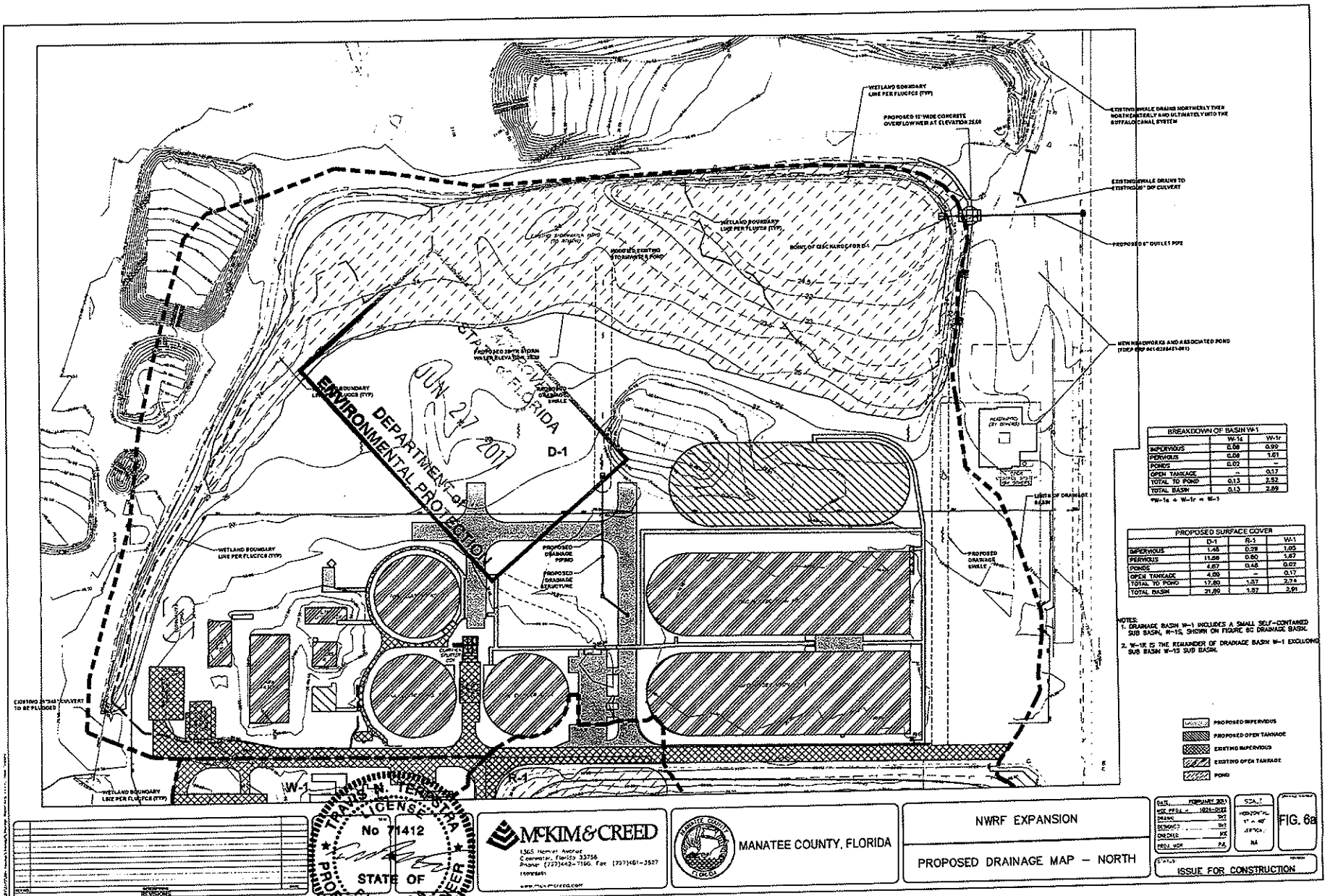


R-1: DRY DETENTION POND - PROFILE VIEW

APPROVED
STATE of FLORIDA
JUN 27 2011
DEPARTMENT OF
ENVIRONMENTAL PROTECTION

TRAVIS N. TERPSTRA
LICENSE
No 71412
STATE OF
FLORIDA
PROFESSIONAL ENGINEER
2-10-11

REVISIONS	PHILLIP J. LOCKE, P.E. No. 57827		McKIM&CREED 1365 Hamlet Avenue Clearwater, Florida 33756 Phone: (727)442-7196, Fax: (727)461-3827 EB0000691 www.mckimcreed.com	MANATEE COUNTY, FLORIDA	NWRF EXPANSION STORMWATER POND DETAILS	DATE: FEBRUARY 2011 DESIGNED: TT CHECKED: JBL STATUS: ISSUE FOR CONSTRUCTION SCALE: HORIZONTAL 1"=20' VERTICAL: N/A C-0.3.10



BREAKDOWN OF BASIN W-1		
	W-1a	W-1r
IMPERVIOUS	0.08	0.99
PERVIOUS	0.08	1.01
PONDS	0.02	--
OPEN TANKAGE	--	0.17
TOTAL TO POND	0.13	2.52
TOTAL BASIN	0.13	2.69

W-1a + W-1r = W-1

PROPOSED SURFACE COVER			
	D-1	R-1	W-1
IMPERVIOUS	1.48	0.28	1.05
PERVIOUS	11.88	0.80	1.87
PONDS	4.87	0.48	0.07
OPEN TANKAGE	4.00	--	0.17
TOTAL TO POND	17.80	1.57	2.74
TOTAL BASIN	21.80	1.57	2.91

NOTES:
1. DRAINAGE BASIN W-1 INCLUDES A SMALL SELF-CONTAINED SUB BASIN, W-1S, SHOWN ON FIGURE 6C DRAINAGE BASIN.
2. W-1R IS THE REMAINDER OF DRAINAGE BASIN W-1 EXCLUDING SUB BASIN W-1S SUB BASIN.

PROPOSED IMPERVIOUS
PROPOSED OPEN TANKAGE
EXISTING IMPERVIOUS
EXISTING OPEN TANKAGE
POND

TRAVIS N. TERRASTRA
LICENSE
No 71412
STATE OF FLORIDA
PROFESSIONAL ENGINEER
4-15-11

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1000681
www.mckimcreed.com

MANATEE COUNTY, FLORIDA

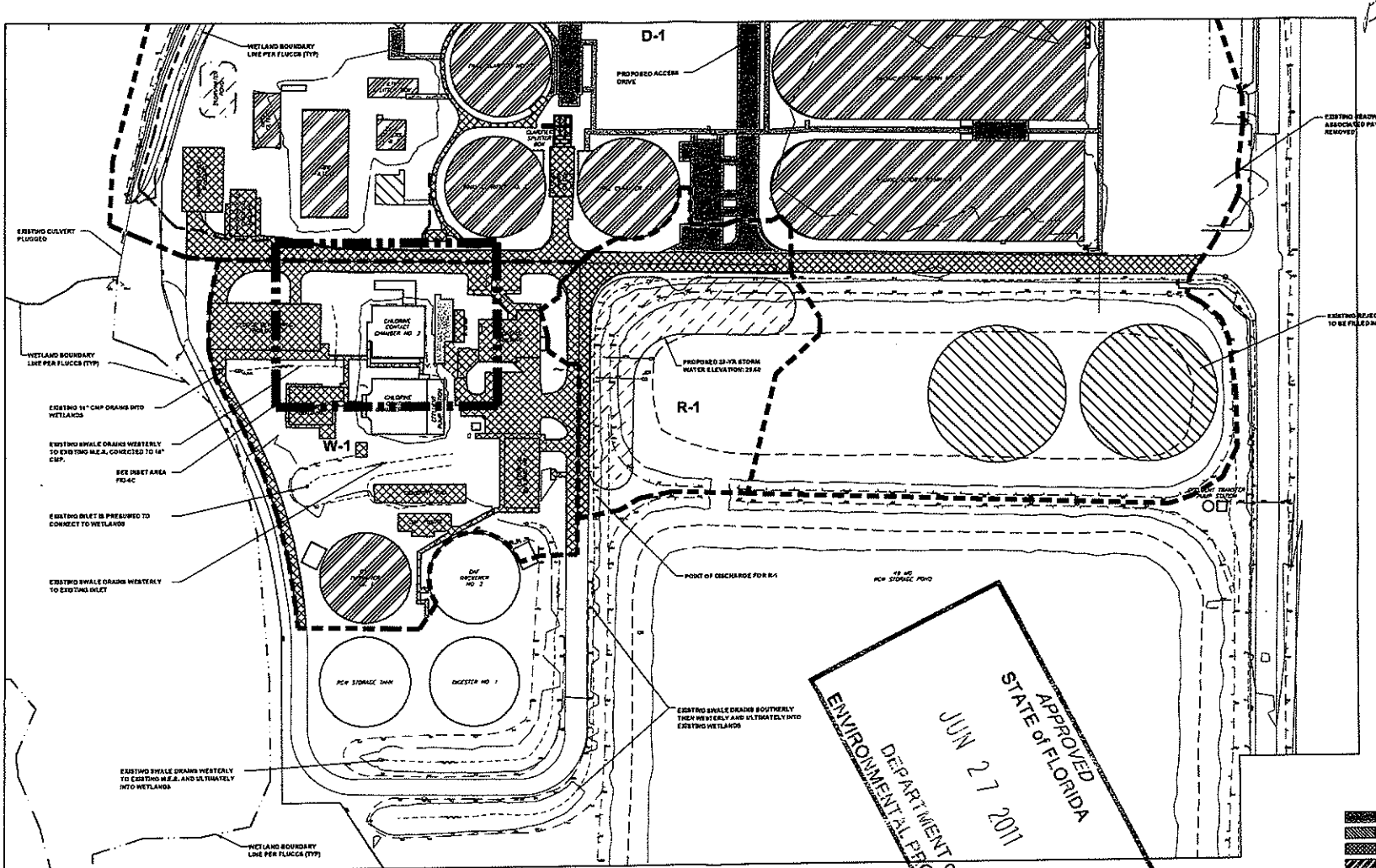
NWRF EXPANSION

PROPOSED DRAINAGE MAP – NORTH

DATE: FEBRUARY 2011
NWF PROJ. # 1024-0022
DRAWN: DKT
DESIGNED: SMT
CHECKED: MS
PROJ. MGR.: PA
SCALE: HORIZONTAL 1" = 40' VERTICAL NA

STATUS: ISSUE FOR CONSTRUCTION

FIG. 6B



APPROVED
STATE of FLORIDA
DEPARTMENT of ENVIRONMENTAL PROTECTION
JUN 27 2011

TRAVIS N. TERPSTRA
LICENSE
No 71412
STATE OF FLORIDA
PROFESSIONAL ENGINEER

4-8-11

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(80006691
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MANATEE COUNTY, FLORIDA

NWRF EXPANSION

PROPOSED DRAINAGE MAP – SOUTH

DATE: FEBRUARY 2011
HDR PROJ. #: 1024-0123
DRAWN: TNT
DESIGNED: TNT
CHECKED: MF
PROJ. MGR.: PS
SCALE: HORIZONTAL: 1" = 60' VERTICAL: NA

FIG. 6b

STATUS: ISSUE FOR CONSTRUCTION

REVISIONS
NO. DESCRIPTION DATE

Operation and Maintenance Instructions
for the
Manatee County North Water Reclamation Facility
Surface Water Management System
Permit No.: 41-02883451-002

The following normal maintenance items, including cleaning or replacement of the various elements of the system, will be required for the surface water management system to continue to operate as designed.

General Maintenance

1. All surface water management system pipes, swales, ditch blocks, inlets, catch basins, manholes, flumes, pond inflow and outfall structures (including oil skimmers), and discharge pipes should be inspected on a regular basis (monthly or quarterly) and following significant storm events. They should be maintained by removing built- up debris and vegetation and repairing deteriorating structures.

2. Chemicals, oils, greases or similar wastes are NOT to be disposed of in the surface water management system or through storm sewers. Treatment ponds are designed to treat normal road, parking lot, roof and yard runoff only. Some chemicals may interfere with a treatment pond's functions or kill vegetation and wildlife. Dispose of these potentially dangerous materials properly by taking them to recycling facilities or to collection locations sponsored by many local governments.

   Also, do not dispose of grass clippings in a surface water management system. Grass clippings pose problems by smothering desirable vegetation, clogging outfall structures and, when they decompose, may cause unsightly algae blooms that can kill fish.

3. Accumulated pond sediments may contain heavy metals such as lead, cadmium and mercury, as well as other potentially hazardous materials. Therefore, sediments removed from surface water management system inlets, pipes and ponds should be disposed of at an approved facility (check with your county Solid Waste Department or the Florida Department of Environmental Protection for disposal facilities approved to accept treatment pond sediment).

4. During any repair or maintenance activity, use care to avoid causing erosion or siltation to adjacent or off-site areas.

5. Alterations (filling, enlarging, etc.) of any part of the surface water management system are not permitted without prior approval from the Department and all other applicable governing agencies.

6. It is usually more cost-effective to monitor and perform routine maintenance on a surface water management system rather than let it fail and have to reconstruct the entire system.

7. Mosquito growth can be minimized in a surface water management system by the following measures:

   • Do not dump grass clippings or other organic debris into a surface water management system — decaying grass clippings and other decomposing vegetation create ideal conditions for breeding mosquitoes.

   • Clean out any obstructions that get into the system. Debris can obstruct flow and harbor mosquito eggs and larvae.

   • Remove water lettuce and water hyacinth, which nourish and shelter mosquito larvae.

   • Stock ponds with predatory "mosquito fish" – Gambusia minnows, which may be collected from other ponds and ditches and introduced into your SWMS.

8. Notify the Department at (813) 632-7600 within twenty-four hours of observation of sinkhole development in the surface water management system.

Wet Detention Pond

1. The side slopes of the detention pond and adjoining swale shall be inspected for bare spots, damage or erosion. Bare areas shall be sodded or seeded to replace the grass cover. In the case of erosion, replace the missing soil and bring the affected areas back to grade.

2. Maintain, rather than remove, wetland vegetation that becomes established in the littoral zone. Do not cut, mow, use herbicide or grass carp to remove any of the vegetation in the littoral zone.

3. On a quarterly basis and following significant storm events, inspect the area in front of the outfall control structure to for built-up sediments, vegetation and debris that impair the operation of the structure. Remove sediments, vegetation, trash and debris to an approved disposal site.

4. When littoral zone vegetation and sediment accumulate to such an extent that water depth decreases, the littoral zone may need to be re-graded and re-vegetated. When it appears that the pond has reached this state, contact the Department prior top large scale maintenance.

5. Notify the Department at (813) 632-7600 within twenty-four hours of observation of sinkhole development in the surface water management system. Reference Permit Number 53-0298504-001.

Dry Retention Pond

1. On a quarterly basis and following a storm event, the entity responsible for maintenance shall inspect the retention pond and outfall structure to ensure that the system is operating properly. If standing water persists longer than 72 hours after a normal summer rain event, or if wetland vegetation such as cattails grow in the retention areas, the surface water management system may be in need of repair. Repairs may be as simple as scarifying or raking the pond bottom, or may consist of removing the bottom sediment (approximately the top foot of soil) and replacing the soil with clean sand.

2. The retention areas shall be kept grassed and mowed frequently enough to prevent thatch buildup. Clippings and debris will be removed after mowing. Limit fertilizer use around the retention areas and do not fertilize the retention area bottoms.

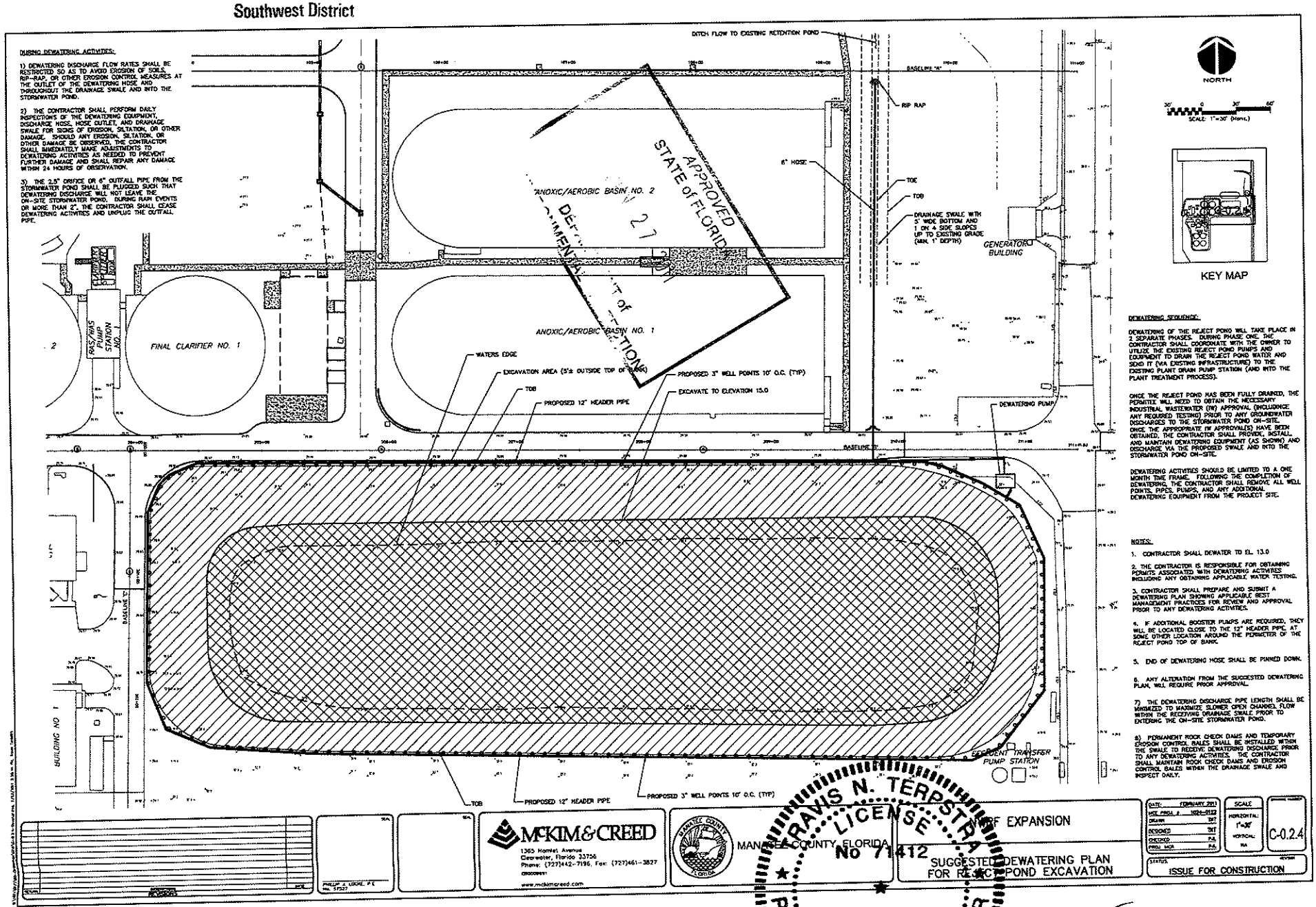
3. Re-sod any of the retention areas (sides or bottom) where grass or sod has been removed or eroded.

4. Notify the Department within 24 hours of observation of sinkhole development within any of the retention areas of the surface water management system.

Dept. of Environmental Protection

MAR 0 7 2011

Southwest District



STATEMENT OF NO BID

If you do not intend to bid please complete and return this form immediately to:

Manatee County Purchasing
1112 Manatee Avenue West, Suite 803
Bradenton, Florida 34205

We, the undersigned, have declined to bid on Bid No.: 11-2872DC NWRF Expansion Phase 1 for the following reason(s):

____Specifications too restrictive, i.e., geared toward one brand or manufacturer.
____Insufficient time to respond
____We do not offer this product or service
____Our schedule would not permit us to perform
____Unable to meet specifications
____Unable to meet Bond requirement
____Specifications unclear (explain below)
____Unable to meet insurance requirements
____Remove us from your "Bidders List"
____Other (specify below)

REMARKS:

_____

_____

_____

We understand that if we do not submit a Bid and this Statement of No Bid is not executed and returned, our company may not be contacted by you for this commodity or service.

Company Name: _____

Company Address: _____

Telephone: _____ Fax: _____

Date: _____

Signature: _____

_____
(Print or type name and title of above signer)

email address: _____